

R. RUHE: "Climatic geomorphology and fully developed slopes: a discussion"

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SUMMARY

RUHE (1975) has attempted to show that "fully developed slopes" of similar form occur in different regions despite climatic variation. He has however failed to support this suggestion with adequate evidence. Some comments to this effect already provided by COX (1977) have been too rapidly dismissed by RUHE (1977).

RUHE (1975) has recently attempted to show that "fully developed slopes" occur under a range of climatic conditions apparently without change in basic form.

A recent discussion of this work (COX 1977) attempted to clarify some of the issues involved, but drew only a tongue-in-cheek reply (RUHE 1977). COX (1977) raises issues of importance which deserve attention. It is the purpose of this continuing discussion to further emphasise the need for additional examination of RUHE's original work in order that its contribution may be correctly assessed.

RUHE (1975) attempted to show the similarity of slope forms in various climatic regions through the use of

- 1) Assertion that the similarity of slope form is "pictorially self-evident" (RUHE 1975, 318)
- 2) log-linear plots of unspecified sections of slope profiles through which straight lines are fitted.

The first line of evidence is clearly of little validity. As COX (1977) has pointed out, some of the photographs presented by RUHE show little more than a concavity, with no sign of a "fully developed slope". To analyse the similarity of form of these features would require details of their dimensions, degree of curvature, and so on. RUHE provides no such details. If the point being made by RUHE in presenting these photographs is merely that concave slopes may be found in all climates, then there is no ground for dispute, other than the need for his paper.

If RUHE (1975) is arguing for similarity of form at a more precise level, then details of the slope form are required. Further, such an analysis would depend upon an adequate discussion of the sampling program, and of such factors as the location of the sampled slopes within drainage basins, of their stage of development, and of their three-dimensional setting, all of which are known to affect slope form (CARTER & CHORLEY 1961, WALTZ 1971). It is entirely possible that one could select slopes at varying stages of evolution, at varying locations with respect to active stream channels, and so on, and show similarity of form; however, this would reveal nothing of the form which might be displayed by such slopes at some later stage of their evolution, or in the absence of the particular local controls involved.

With respect to the second of RUHE's supporting arguments, relying on the log-linear graphs, one can only re-iterate the comments of COX (1977). Equations of

the form

$$y = ae^{bx}$$

as used by RUHE can only represent smooth curves; they cannot be an adequate description of a slope containing all the elements of a "fully developed slope". This indicates three possibilities:

- 1) The slopes observed by RUHE did not possess a waxing segment.
- 2) RUHE has fitted an inappropriate model to the slope profiles.
- 3) RUHE has graphed only the slope segments below the waxing slope.

If the slopes did not possess a waxing segment, then RUHE is only describing a convexity, and not a "fully developed slope".

If RUHE fitted an inappropriate model, then his argument fails and alternative models must be fitted.

If RUHE has only plotted the slope segments below the waxing slope, a possibility suggested by RUHE (1977), then it is not possible to judge the overall form of these slopes. It would be necessary to know the form of the waxing slope, and its dimensions in relation to the remainder of the slope.

RUHE (1975) has thus presented no sound support for his central thesis, which must remain no more than a suggestion (made so long ago by WOOD 1942) awaiting investigation. His criticism of geomorphology for overlooking the "fact" of ubiquitous "fully developed slopes" in favour of "more erudite matters" is unfortunate.

The issue of the climatic control on slope form is a difficult one to investigate, and yet is of fundamental interest and importance. The details are certainly not self-evident, as recent work (TOY 1977, DUNKERLEY, in press) indicates.

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