CORRESPONDENCE

TROPICAL WEATHERING AND LANDFORMS : A CORRECTION

SIR,—In the introduction to a review of Oahu Valley Sculpture in the *Geological Magazine* (vol. lxxx, pp. 237–243, 1943), I have allowed myself to speculate dangerously as to the possible imperfection, or even absence, of adjustment to structure in the landforms of mountainous parts of New Guinea and those other hot and wet regions in which chemical weathering is intensely active and breaks down all rocks with little or no regard to their original nature. In doing so I was not voicing only my own opinion. Behrmann [1] has failed to find any structural control of landforms in the Sepik Valley region of northern New Guinea, and has, indeed, picked out its absence as a most remarkable thing about the erosion features of tropical mountains in general. He claims that differences in the nature of the unaltered rocks can effect only the rapidity of vertical corrasion (linear erosion, so-called) in such streams as are for the time trenching their beds vigorously and so have cut down through the zone affected by weathering.

Differential, or selective, erosion works, however, in mysterious ways ; and the actual fact in New Guinea, as recorded by Carey, whose comprehensive study of the geomorphology of that region I had overlooked, is that prominent strike ridges have emerged in the sculpture of extensive terrains of young sedimentary strata. In New Britain also the presence of volcanic tuffs and lavas interbedded with the sedimentary series " has resulted in considerable differential resistance among the stratiform layers with a marked effect on the topography ".[2]

Mr. M. Ongley, of the New Zealand Geological Survey, who has personal experience of the New Guinea landscape and who first drew my attention to the misleading nature of my slip, has reminded me also that in that region, as elsewhere, the landforms as they appear in vertical air photographs are betraying many of the details of the structure of the terrain to photo-geologists. In a forested region, where minor details of outcrops can less readily be detected by their form, it is chiefly the main strike ridges that can be relied on to reveal a structural pattern. It seems out of the question to suggest that there is any general method of isolating strike outcrops as ridges other than the well understood process of headward nibbling of subsequent valleys, and this must take place along belts in which the formations are either inherently less resistant than those with which they are in contact at the sides or else are particularly susceptible to progressive weakening by contemporaneous weathering processes.

The fact that selective weathering is affected by climatic conditions is well recognized by workers in semi-arid regions, who are in the habit of describing certain formations as resistant to erosion *under the prevailing conditions of climate*. Whether the selective activity of chemical weathering works along quite the same lines in hot rain-forest regions as it would on

[1] W. Behrmann, Der Sepik und sein Stromgebiet, *Mitt. aus deutsch. Schutzgebieten*, Ergänzungsheft 12; quoted extensively by K. Sapper, *Geomorphologie der feuchten Tropen* (see p. 37), 1935.

[2] S. W. Carey, The Morphology of New Guinea, *Australian Geographer*, vol. 3, No. 5, pp. 3–31 (see pp. 9, 10, 16, 17, 25), 1938.

similar patterns of strata in the moist-temperate belts is a question that offers itself for investigation. Which, that is to say, will be the escarpment-forming members of a heterogeneous series under different condition of weathering? According to Carey, sandstone beds at any rate are escarpment-makers and pelitic beds are weak in New Guinea, as they generally are in temperate regions. In some parts of northern New Guinea, I am informed, there are ridges bounded by great escarpments formed or capped by Tertiary limestone strata.[1] It thus appears that, in spite of the obvious rapidity of its destruction by solution, limestone remains a relatively resistant rock in that region.

Malaya lacks a cover of young sedimentary strata such as yield the prominent strike ridges of New Guinea.[2] On the older formations, and especially on the granite areas, Malayan weathering is rather sporadic and inconsequent in its selectivity. Quartz, for example, appears *sometimes* to be more susceptible to chemical attack than is feldspar. Though quartz is soluble to some considerable extent, granite is weathered much more rapidly than quartzite, however. So also are shales and schists. Instances quoted by Scrivenor show that erosion is much less far advanced (in the same cycle) on quartzite than on other terrains associated with it. Thus long continued erosion must leave quartzite areas in relief as residual ranges or ridges.

On reflection it becomes apparent that the peculiarity of Oahu valley sculpture depends but little on an indifference, if such there be, of tropical erosion to structure, for the domes of basalt thus dissected are, or have become, practically structureless. Oahu valleys are developed, so far as is known, only under two very special conditions, and a similar pattern of erosion is not to be expected except where these are fulfilled. The conditions are: (1) An initially rather steep slope of the surface on the flank of a dome, on which consequent drainage has developed; and (2) the essentially homogeneous nature of a pile of dome-building basalt flows. These are not only chemically homogeneous throughout (or sufficiently so to prevent selective weathering being very effective under any conditions), but also are almost without interbedded ash or scoria beds of " Vulcanian " origin such as make up much of the cones of other volcanoes and offer a much smaller resistance to erosion than lava flows as long, at least, as these remain fresh.

WELLINGTON, NEW ZEALAND. C. A. COTTON.
27*th March*, 1944.

RESTORATION OF DISTORTED SPECIMENS

SIR,—In my recent paper upon this subject, *Geological Magazine*, lxxx, 1943, p. 139, I did not give the proof of the photographic method which I described because it was too long and did not seem suitable for this journal. The proof will be found in *The British Journal of Photography* for 14th April, 1944, xci, p. 129.

CAMBRIDGE, PHILIP LAKE.
20*th April*, 1944.

[1] M. Ongley, oral communication.
[2] J. B. Scrivenor, *The Geology of Malaya*, 1931.