

THE NATURE AND THE METHOD OF ACTION OF THE QUATERNARY CLIMATIC CHANGES OF EASTERN PERSIA.

If we admit that the terraces of Eastern Persia are due to climatic changes, we are at once confronted by the question of the nature of the changes and the method of their action. It seems reasonable to suppose that the nature of the changes was the same as that of the changes which took place in glaciated countries at the same time, although differing in degree. Till recently it has generally been assumed that the glacial period was characterized by increased precipitation accompanied by greater cold. Penck and Bruckner have shown, however, that certain phenomena in the Alps can only be explained on the supposition that the precipitation remained nearly constant, while the degree of cold increased and evaporation therefor diminished to such an extent that glaciers and inclosed lakes expanded greatly. Our knowledge of Persia is too slight to justify any conclusion as to whether the climate of the fluvial and lacustral epochs was characterized chiefly by greater cold or by greater precipitation. The question can not be wholly neglected in this report, however, for if, as seems probable, the last of the fluvial epochs occurred since the occupation of the country by man, the character of the change must have had an important bearing on human development.

A little light may be shed on the question by considering the conditions which must have prevailed during the formation of the terraces. The most important and universal condition for the production of climatic terraces seems to be that during an interfluvial epoch like the present the slopes of the mountains shall be ungraded, and during a fluvial epoch graded. A general view of Western Asia from Chinese Turkestan to Turkey shows that terraces are well developed among young mountains such as the Tian Shan range in Turkestan and the eastern part of the Taurus range in Turkey, where ungraded slopes are the rule. They are also numerous among mature mountains, provided the region is so arid that ungraded slopes are characteristic of maturity. Such a condition, as we have seen, is well illustrated in Eastern Persia. Among mountains which have reached the stage of maturity, and are not so arid as to remain ungraded, on the contrary, terraces are poorly developed, as is shown among many of the lower mountains of Turkey and to a less extent of Turkestan. The cause of the prevalence of terraces in regions where the slopes are to-day ungraded seems to be that in such regions a change of climate is able to produce marked effects upon the character of the slopes, either by causing more rapid weathering or by causing the slopes to assume a graded condition.

Another condition of terrace formation is that terraces do not occur to any great extent in regions of deposition such as fans. When found upon fans they almost always soon die out downstream, showing that they owe their origin to impulses derived from farther upstream among the mountains. Accordingly, in considering the process of terrace-making we may confine our attention to the mountains and to those parts of the mountains where erosion is actively at work upon ungraded slopes.

It is difficult to estimate the effect which an increased degree of cold with unchanged precipitation would produce upon ungraded slopes; for among the mountains as they stand to-day the colder, more elevated portions are also subject to