

practical engineers, the study of hygiene and of scientific agriculture, and, last but not least, for the adequate equipment and endowment of that greatest of Oxford's academical institutions, the ancient and world-renowned library of Thomas Bodley's foundation.—*The London Times*.

CURRENT NOTES ON LAND FORMS

NARROW COASTAL PLAINS

WELL-DEFINED land forms have an importance in systematic physiography that is not yet fully enough recognized by travellers. Hence all the more satisfaction is felt when an article gives so definite an account of such a feature as a narrow coastal plain that it can be easily appreciated by the reader. Such is the case in the 'Notes on the Raised Beaches of Taltal (Northern Chile),' by O. H. Evans (*Quart. Journ. Geol. Soc.*, LXIII., 1907, 64-68).

The coastal plain at Taltal has a gently inclined surface, fringing the coastal ranges and extending up the broader valleys to a considerable altitude and distance from the present shore. There is local variation in the width of the plain, and in the altitude of its inner border (200 feet, back of Taltal) along the base of the mountains. The surface of the plain is thinly covered with angular fragments from the hills; but where sections reveal its structure, it is seen to consist of stratified sand and gravel, containing recent shells which are sometimes plentiful enough to form distinct beds. Here and there the subjacent rocks rise through the plain in curiously weathered remnants of former islets and stacks. Evidence of intermittent uplift is found in several terraces, three of which are relatively well defined at altitudes of about 15, 80 and 200 feet above sea-level; two more obscure terraces are seen at intermediate heights. Where the mountains approach the sea and the plain narrows, the terraces are replaced by lines of boulders; at other points a rock shelf and again a series of shallow caverns marks the former shore line. Sudden uplifts are inferred from the well-preserved condition of the shells. Although no explicit statement is made as to the relation of the larger in-

land valleys to the plain, it may be inferred from certain phrases that the valley floors are now well opened somewhat below the plain surface. Regarding the smaller ravines of the old-land hills, it is said that their beds "suddenly alter in inclination and become precipitous as they approach the sea. Were streams suddenly to start running in these old gorges, they would terminate in waterfalls." Whether this sudden steepening is at the former or at the present shore line, does not clearly appear.

Another narrow coastal plain is described by W. D. Smith as forming an interrupted rim around the mountainous island of Cebu, and containing nine tenths of its large population ('Contributions to the Physiography of the Philippine Islands: I., Cebu Island,' *Philippine Journ. Sci.*, I., 1906, 1043-1059). The basis of the plain is of coral rock, over which alluvial deposits have been spread by the streams and rivers from the interior valleys.

Brief description of what appears to be a small and undissected coastal plain on which Sidon is situated on the Mediterranean border of Palestine, is given by Libbey and Hoskins in their account of a journey to 'The Jordan valley and Petra' (2 vols., New York, Putnam's, 1905). Its low and well-watered surface has a 'carpet of green' in strong contrast to the gray foot-hills which rise from its inner border. A similar coastal or littoral plain extends southward from the hills by Beirut (see p. 66, frontispiece, and plate on p. 41).

I. B. AND W. M. D.

GLACIAL TROUGHS AND HANGING LATERAL VALLEYS

IN view of the ever-increasing volume of evidence to the effect that every glaciated mountain range in the world thus far studied shows a systematic association of peculiar features, such as valley-head cirques often holding rock-basin tarns, over-deepened main-valley troughs with floors of a considerable width, hanging lateral valleys, and Piedmont morainic amphitheatres, it is interesting to scrutinize the statements of certain geologists who still maintain that glaciers are ineffect-

ive eroding agents. Among these is W. Kilian, of Grenoble, whose studies have made him intimately familiar with many valleys of the French Alps, which most physiographers would regard as overdeepened by intense glacial erosion, but which Kilian explains otherwise ('L'érosion glaciare et la formation des terrasses,' *La Géogr.*, XIV., 1906, 261-274). These trough-like or broad U-shaped valleys, sharply incised beneath the gentler upper slopes ('paliers') which steepen somewhat in ascending to the peaks, he regards as the result of retrogressive torrential erosion during a late interglacial epoch, with slight modification by ice action during the last glacial epoch; the torrential action thus appealed to being itself explained as the result of an assumed change in the attitude of the land-mass with respect to base-level, and the hanging lateral valleys being accounted for as a result of the preponderance of erosion by the main stream.

It would certainly seem appropriate that those who adopt this hypothesis should, in the interests of thorough investigation, themselves be the first to give it an impartial test by looking to see if it applies in non-glaciated regions, where independent and acceptable evidence of change of base-level may be found, and where the disputed element of glacial erosion is ruled out of the case. Curiously enough, Kilian does not do this; nor does Heim, nor Garwood, nor Fairchild, who all, like Kilian, deny the efficiency of glacial erosion. It is true that reference is made by Kilian to recent articles by J. Brunhes, of Fribourg ('Sur les contradictions de l'érosion glaciare' and 'Sur une explication nouvelle de l'érosion glaciare,' *C. R. Acad. Sci.*, Paris, CXLII., 1906, 1234-1235; 1299-1301), to show that U-shaped valleys occur in non-glaciated districts; but Brunhes's articles are brief and general, and give little aid in solving the problem at issue.

Kilian himself states that U-shaped valleys may be produced by stream erosion in certain structures, and on this simple point there need be no dissent; but the peculiarity of glaciated valleys is that the U-shape prevails in all sorts of structures; thus indicating that glaciation

and not structure is the determining factor. The Allegheny plateau, south of the glaciated area in the eastern United States, contains a good number of open U-shaped valleys, especially where relatively weak underlying strata are capped by stronger overlying strata; but all such open main valleys receive their lateral valleys at accordant grade, and thus differ most significantly from glaciated U-shaped valleys. It is singular that the non-glacialists do not themselves discover and accept this suggestive fact. As to the working hypothesis that retrogressive torrential erosion, excited by favorable change of base-level, may in time produce great trough-like valleys, certainly no one should, on *a priori* grounds, object to its due consideration; but this hypothesis normally requires the development of lateral valleys accordant with their main valley by the time that the main valley has gained an open floor; and as soon as the inquirer sees that the open Alpine troughs are constantly associated with discordant or hanging lateral valleys, it would seem to be incumbent upon him to set the working hypothesis aside as invalidated, and to look for another of greater competence.

Kilian and Brunhes both emphasize the importance of subglacial torrents, as Frech has done even more strongly ('Ueber das Antlitz der Tiroler Zentralalpen,' *Zft. Deut.-Oesterr. Alpenver.*, XXXIV., 1903, 1-31; see especially p. 22), in causing whatever erosion may have taken place during the glacial occupation of a valley; and it is to be presumed that no one would wish to minimize whatever aid may thus be given in a difficult problem; but it is inconsistent with all that is known of torrential action to think that, even under the constraint of subglacial flow, torrents can have accomplished the major part of the work that must be attributed to the general process of glacial erosion. Sharp-cleft gorges, such as that of the Aar in the rock-sill above Meiringen, and of various other Swiss rivers, may well be ascribed in large part to subglacial torrents; but the trough-like cross-section of a glaciated valley is not in the least what would be reasonably expected from the work of a high-pressure torrent. Indeed, the fact that

the lip of many hanging valleys is so little trenched is strongly suggestive of the relative inefficiency of sub-glacial torrents; for precisely in such positions of sharply increased descent should the torrents have been most effective.

W. M. D.

HANGING VALLEYS IN ENGLISH LAKELAND

AMONG the recent essays which explain hanging lateral valleys otherwise than by glacial overdeepening of the main valley is one by J. E. Marr, of Cambridge, England, on 'The Influence of the Geological Structure of English Lakeland upon its Present Features' (presidential address, *Quart. Journ. Geol. Soc.*, London, LXII., 1906, lxi-cxxviii; see p. cvii-). The greater depth of the open main valleys is here ascribed to normal erosion on weak structural features called 'shatter belts'; but under this explanation—glacial erosion being disregarded—it is difficult to understand why the lateral streams, which often mouth from 500 to 1,000 feet over an open main valley floor, have accomplished so little trenching of their hanging valleys during the long period in which the main valleys were well widened by the slow processes of general subaerial erosion. There are many cases in non-glaciated districts where wide longitudinal valleys on belts of weak rocks are joined by narrow lateral valleys whose small streams enter the main valley through belts of hard rocks; the Allegheny Mountains present hundreds of examples of this kind: but in practically all such cases, even when the contrast in resistance of the hard and weak rocks is strongly pronounced, the small lateral stream has been able to cut its narrow notch in the hard rocks down to accordant grade with the main valley floor that has been opened on the weaker rocks; for the widening of the main valley by general subaerial erosion has been a relatively long process even in its weak rocks. The streams in the hanging valleys of English Lakeland would then be exceptions to this rule, if their hanging position is not to be explained by the glacial overdeepening of the main valleys. A number of cases of stream capture and rearrangement are described by

Marr in this connection; but as glacial erosion is entirely omitted from the problem, the explanation by normal stream action alone must remain in the same measure of doubt as that which now obscures the explanation of the rearrangement of various branches of the Rhine in the neighborhood of Chur, Switzerland, by normal stream action, as stated a score of years ago by Heim. W. M. D.

HANGING VALLEYS IN GENERAL

SINCE the convincing report on the glaciers of Alaska by Gilbert (Harriman Alaska Expedition, III., 1904), additional accounts of main-valley troughs and hanging lateral valleys, regarded as the result of glacial erosion, are given for the mountains of Alaska by R. S. Tarr ('Glacial Erosion in Alaska,' *Pop. Sci. Monthly*, LXX., 1907, 99-119), and by R. S. Tarr and L. Martin ('Glaciers and Glaciation of Yakutat Bay, Alaska,' *Bull. Amer. Geogr. Soc.*, XXXVIII., 1906, 145-167; see p. 159, figs. 17 and 18); for Norway by A. P. Brigham ('The Fiords of Norway,' *ibid.*, XXXVIII., 1906¹); for the Tian Shan mountains by Friederichsen (see these 'Notes,' March 8, 1907); for the New Zealand Alps by E. O. Andrews ('Some interesting facts concerning the glaciation of southwestern New Zealand,' *Trans. Austral. Assoc. Adv. Sci.*, 1905, 189-205; good plates); for the Sierra Nevada by A. C. Lawson ('The Geomorphogeny of the Upper Kern Basin,' *Bull. Dept. Geol., Univ. Calif.*, III., 1904, 291-376; see p. 329); and for the Sawatch range of the Colorado Rocky Mountains by L. G. Westgate ('The Twin Lakes Glaciated Area,' *Journ. Geol.*, XIII., 1905, 285-312) and by the undersigned ('Glaciation of the Sawatch Range, Colorado,' *Bull. Mus. Comp. Zool., Harv. Coll.*, XLIX., 1905, 1-11).

¹ The pages of this article are not cited here, because the reprint from which this reference is made has been repaged, and consequently affords no sufficient indication of its original place. If editors of scientific periodicals still persist in the troublesome habit of repaging reprints, it is to be hoped that authors and reviewers will protest against it.

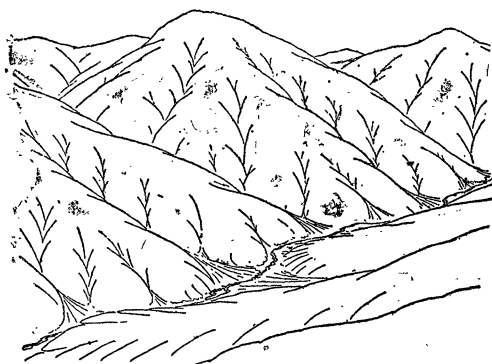


FIG. 1.—A normally eroded mountain mass, not affected by glacial erosion.

The three diagrams here presented are reproduced from an article by the undersigned on 'The sculpture of mountains by glaciers' (*Scot. Geogr. Mag.*, XXII, 1906, 76-89), in which evidence for glacial erosion is found in a comparison of glaciated and non-glaciated mountains, entirely independent of whether glaciers are known to be capable of eroding or not. In view of the inaccessibility of the

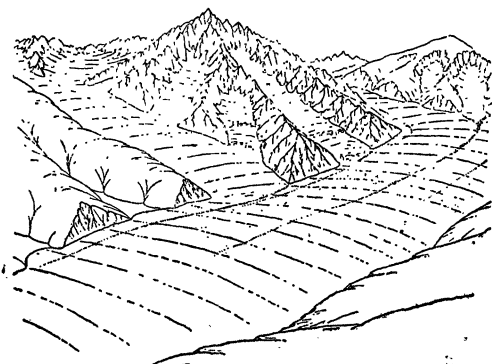


FIG. 2.—The same mountain mass as in Fig. 1, strongly affected by glaciers which still occupy its valleys.

bottom of a large Alpine glacier, it is believed that the best means of determining whether it acts as a sculpturing agent or not is to be found in a comparison of districts, otherwise similar, one of which has not been glaciated, while the other has been glaciated. The diagrams are not drawn from nature, although they summarize a variety of facts seen in various mountain ranges. The third one of the series may be taken as typical of La Plata peak, in the Sawatch range of Colorado, and of the overdeepened trough of Lake Creek

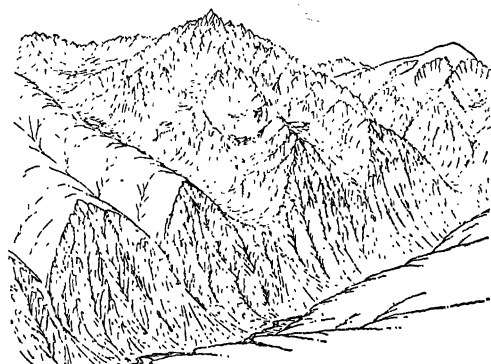


FIG. 3.—The same mountain mass as in Fig. 2, shortly after the glaciers have melted from its valleys.

beneath it, with a well-defined hanging lateral valley between the two.

It is of interest to note in this connection that a good explanation of hanging lateral valleys was given earlier than the date, 1898, usually assigned for this important advance in rational physiography; namely, in 1888, by La Noé and Margerie, in '*Les formes du terrain*' (Paris, *Service géographique de l'armée*, p. 177), where the cause of the discordance of hanging lateral valleys over their trough-like main valleys is very clearly set forth.

W. M. D.

THE WISTAR INSTITUTE OF ANATOMY

THE annual meeting of the advisory board of anatomists of the Wistar Institute was held on April 14 to 16. The members of the board present were Professors Barker, Donaldson, Gage, Huber, Huntington, Mall, McMurrich, Minot and Piersol; of the institute's staff, Drs. Greenman, Hatai, Stotsenburg and Streeter; of the institute's board of managers, Drs. Brown and Lewis.

The board held two sessions on Monday, April 15.

The general work of the year and the financial condition of the institute were explained by M. J. Greenman, the director.

The research in neurology was reviewed by Professor Henry H. Donaldson, chief of the neurological research of the institute. Professor Donaldson also reported upon the Vienna meeting of the International Brain Commission (May, 1906) and stated that an