

ART. III.—A 'Blue Ridge' in New England;* by
RALPH H. BROWN.

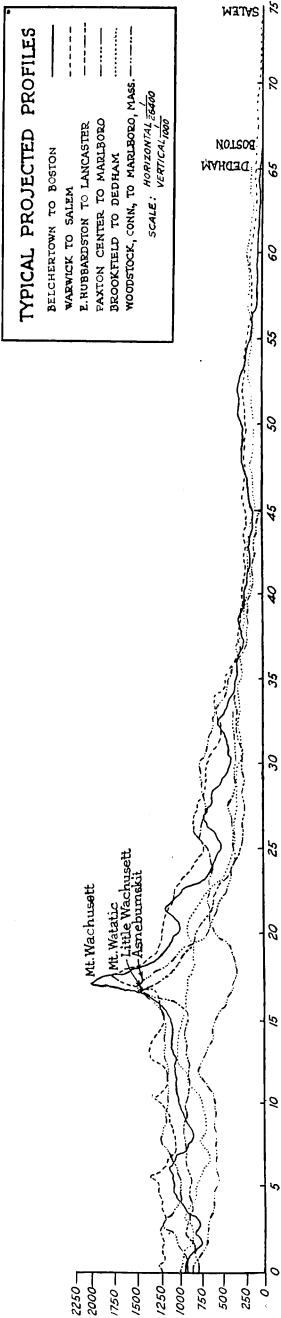
While engaged in an investigation of erosion surfaces in southern New England, the writer's attention was drawn to certain, as yet unexplained, features, associated with its monadnocks and the peneplain above which they rise. After studying the region in greater detail it was felt that the problem was of sufficient moment and importance to justify presenting the results to others through the pages of this journal. It is hoped that the following discussion will throw further light upon the mode of origin of residuals on a peneplain; that it will be a contribution, however slight, toward deciphering the physical history of southern New England; and that, lastly, it may be of some use and value in substantiating one of the explanations which has been put forward concerning the origin of the Blue Ridge of the southern Appalachians. The need is felt, also, of studies which will aid in giving greater definiteness to an aspect of physiography which has suffered too much from vague generalities.

Projected profiles,¹ running east and west, were drawn at frequent intervals across southern New England (fig. 1). When these profiles were superposed, one upon the other, it was found that in all cases, a residual rose above the peneplain, and that all were situated in the same position. It was found, in short, that a residual frequently stands on the divide between eastward- and westward-flowing streams, where there is a distinct break in the seaward slope of the New England peneplain. The result is a feature which appears to be a dissected escarpment facing to the east. This is clearly shown in the accompanying profiles. The following well-defined hills and mountains are members of this divide: Tatnuck Hill, Asnebumskit, Pine Hill, Wachusett, Little

*I wish to acknowledge my appreciation of the help given me by Dr. A. K. Lobeck, of the University of Wisconsin, in the preparation of this paper.

¹A discussion of projected profiles as a phase of map study in determining erosion surfaces may be found in the work of Professor Barrell, entitled "The Piedmont Terraces of the Northern Appalachians," this Journal, 49, 241-245, 1920. Examples of such profiles may be found in that article and in that published by Dr. Lobeck on the peneplain in New England, The Geographical Review, vol. 3, pp. 53-60, 1917.

Fig. 1.



Watatic, Watatic, Temple Mountain, Pack Monadnock, Crotched Mountain, and others scarcely less worthy of mention. Connecting these residuals is a rise of land, in many places forming a distinct ridge, across which no important streams flow. It is, in fact, the watershed between the Atlantic Ocean and the Connecticut River.

This has not entirely escaped the notice of others. In a foot-note, Bowman² remarks that "Mt. Monadnock—does not stand alone, but is one of a group of monadnocks which includes Wachusett, Watatic, Asnebumskit and others." That monadnocks may owe their preservation not only to superior hardness of composition, but also to position with respect to streams, is also a view that is quite generally held. Arthur Keith,³ writing in 1892, remarks that some unreduced areas on a peneplain owe their presence to "immunity due to distance from main drainage lines and to the ocean." Many writers since then have offered the same suggestion, but actual quantitative measurements seem to be lacking. Referring particularly to the area under discussion, J. H. Perry writes that "this mountain [Monadnock Mtn.] and the other monadnocks to the south on the Atlantic-Connecticut divide, probably owe their survival to their position rather than to the greater resistance of the rocks composing them."⁴

What seems to have escaped the notice of previous workers is the position of the peneplain on either side of this monadnock-divide. The profiles establish without question that the peneplain to the east is about eight hundred feet above sea-level, while directly to the west its elevation is a thousand feet. This is a distinct rise of two hundred feet in a horizontal distance of from two to five miles. There is, obviously, a relationship between the monadnock-divide, the peneplain on the west at an elevation of 1000 feet, and the peneplain which slopes off from the eastern face at an elevation of eight hundred feet.

The profiles showed such general agreement over a wide area, that it was distinctly not a local or special

² Bowman, Isaiah, *Forest Physiography*, 1911, p. 637.

³ *Geology of the Catskill Belt*, Part 2, U. S. G. S. 14th Annual Report, p. 377, 1892-93.

⁴ *Geology of Monadnock Mountain*, *Journal of Geology* vol. 12, p. 14, 1904.

feature but one of some importance and of general application. Inasmuch as the features presented were not unlike those which might result from marine occupation of a fluvial peneplain, it was at first thought it might possibly be a northward extension of the marine terraces so ably presented by Professor Barrell⁵ and by Miss Hatch,⁶ but for reasons to appear later, the more plausible explanation lies in another direction.

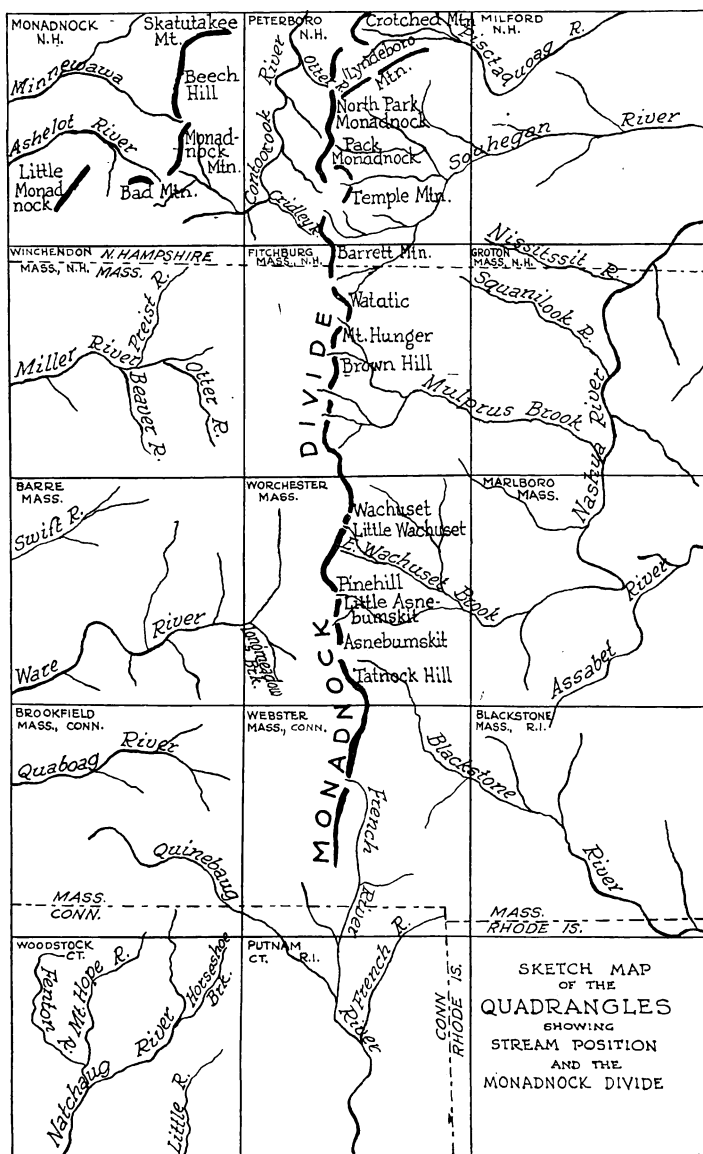
The map (fig. 2) shows the relationships between stream and monadnock position. The headwaters of eastward-flowing streams, such as the Blackstone, the Nashua, and the Souhegan, are much nearer the divide than are those of westward-flowing streams. It will be seen further that many streams whose courses are to the east, have actually penetrated the divide and are now flowing across it. Instances of imminent stream capture abound, for eastward-flowing streams, being lower in position, are at an advantage. This is particularly true in the Peterboro and Fitchburg sheets. The divide is preserved upon rocks of varying degrees of hardness, but there is nothing about them to indicate that the rocks of which it is composed are more resistant than the rocks of the surrounding upland. These monadnocks represent a divide which has itself become dissected by the streams which are attacking it from either side. At present it is being attacked with more vigor upon the east than upon the west, and, since the divide between the distinct monadnocks is being reduced, and not the residuals themselves, differences in elevation are becoming accentuated rather than lessened. Even in a region of homogeneous material, unreduced areas will remain near the sources of streams. The divide, in its westward migration, has now very nearly reached its permanent position. This is particularly true in the south.

Streams flowing to the east travel some forty or fifty miles before emptying their loads into the sea, while those flowing west travel some two hundred before so doing. Streams flowing to the east have fairly direct courses; those flowing west reach their destination in a more roundabout way. Consequently, the rivers flowing eastwardly have lowered the land more in the same

⁵ Barrell, Joseph, op. cit., plates 5 and 6.

⁶ Hatch, Laura, Marine Terraces in Southeastern Connecticut, this Journal, 44, 319-330, 1917

FIG. 2.



amount of time than have the streams flowing in the opposite direction, which may account for the lower altitude of the peneplain east of the monadnock-divide and the markedly higher elevation of the peneplain west of it.

This explanation is supported by evidence farther south. In southern Massachusetts and northern Connecticut, the monadnock-divide becomes fainter and fainter and is finally obliterated near Putnam, Connecticut. This, as might be expected, is fifty miles from the sea. Toward the south, also, the difference in elevation of the peneplain on either side of it decreases until, at the point where streams are no longer controlled by the divide and the region is open to attack from three directions—east, south and west, the elevation of the peneplain is equalized and slopes, without break, to the sea. The map shows the southward-flowing Quinnebaug to which is mainly attributable the disappearance of the divide. The final obliteration of the divide together with the merging of the peneplain as streams become equally spaced and as distances from the sea in three directions become the same, seems to justify this explanation. Since the difference in elevation is finally lost, the feature cannot be a marine terrace.

A similar explanation has been advanced for the origin of the Blue Ridge.⁷ There, the peneplain west of the Ridge is at a much greater elevation above the sea, than the peneplain east of it, but, nevertheless, is held, by some, to be of the same age. Streams flowing to the east have a comparatively short, direct route to the sea of some one hundred miles, while streams flowing west travel ten times that distance in a circuitous route by way of the Mississippi drainage basin. Towards the south the Blue Ridge becomes less and less distinct, until finally it dies out, as does the monadnock-divide of New England. Towards the south, also, in the southern Appalachians, the peneplain on either side comes to be more nearly of the same elevation until finally, simultaneously with the disappearance of the divide, the level becomes equalized. Stream positions with respect to

⁷ The idea owes its origin to W. M. Davis, "The Stream Contest along the Blue Ridge," *Bull. Geogr. Soc. Phila.*, 3, 1903, 203-244; and is referred to in D. W. Johnson's work on "Drainage Modifications in the Tallulah District," in the memoirs of the Boston Society of Natural History, vol. 33, p. 231, 1906-1907.

the Blue Ridge are the same as those shown for New England. Stream captures by eastward-flowing streams have added to their volume from time to time, and thus the divide has been pushed westward.

There seems much reason, therefore, for styling this monadnock-divide as "the Blue Ridge of New England." The Blue Ridge is, indeed, reproduced in miniature in Massachusetts, which curiously enough is said to be the Indian name for "blue hills." The ridge also extends into New Hampshire, and, if smaller in size and less magnificent than the real Blue Ridge, is, none the less, an imposing barrier. It is unfortunate that that part of New Hampshire just to the north is as yet unmapped by the Survey. It would be interesting and instructive to follow the monadnock-divide and to determine the altitude of the peneplain on either side of it if, indeed, it does not again become equalized as distances from the sea become comparable, and as the peneplain approaches and is finally replaced by the unakas of New England, known as the White Mountains.

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