THE PHYSIOGRAPHIC FEATURES OF MARYLAND

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HEAD OF CHESAPEAKE BAY FROM ELK NECK.

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THE PHYSIOGRAPHIC FEATURES OF MARYLAND*

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The State of Maryland extends from, approximately, the 75th meridian to west longitude 79° 30′. It thus embraces within its boundaries portions of the Atlantic Coastal Plain, the Piedmont Plateau, and the Appalachian Ranges and Plateau, the three geologic and geographic provinces of the Atlantic slope of North America. The state may, therefore, be said to present in its own varied topography, an epitome of the surface features of the whole Atlantic slope.

Of these three provinces, the Piedmont plateau is the oldest. This is shown both by comparing its highly metamorphosed crystalline and sedimentary rocks with the relatively unaltered strata of the other provinces, and by the character of its topography. From the Piedmont, in early geologic time, were obtained the materials which are now found built into the folded and faulted strata of the Appalachian regions. From both Piedmont and Appalachian districts a great volume of sand, gravel, clay and boulders, has been washed during the later periods of geological time. These materials are now found forming the youngest of Maryland's topographic provinces, namely, the Coastal Plain. These three provinces, with their several subdivisions, are shown on the accompanying map. (Fig. 1.) In the following pages the characteristics and the development of the chief surface features of these provinces will be briefly discussed.

THE PIEDMONT PLATEAU

Topography.—The oldest province, the Piedmont plateau, is divided into an eastern and a western portion by the crest-line of the divide between those streams which flow eastward by direct courses into Chesapeake bay and those which flow westward into the Monocacy. This divide is a rather flat-topped ridge which

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runs in a northeasterly direction across the state from the Potomac to a point beyond Mason and Dixon's line. It has an average elevation of nine hundred feet, rising gradually from its southern end, where it has an elevation of about six hundred feet to a maximum of nearly one thousand feet near the northern boundary of the state.

FIG. 2. THE PATAPSCO VALLEY IN THE PIEDMONT PLATEAU, BALTIMORE CO.*

From this divide, called Parr's Ridge, the general surface of the eastern division of the Piedmont slopes gently southeastward to an elevation of about six hundred feet at its eastern boundary where it seems to pass beneath the western fringe of Coastal Plain sediments. The general appearance of this portion of the Plateau is that of a gently rolling plain traversed from northwest to southeast by a few broad, shallow valleys. Near its eastern limit a few hills and ridges are seen to rise very slightly above the general

* Illustrations in this article are furnished thru the courtesy of the Maryland Geological Survey.

surface. On looking closer it is seen that the streams have cut trenches or gorges below the general upland surface. These gorges increase in depth as they proceed eastward, and at the same time their channel profiles change from the normal concave-upward type to the less usual convex-upward type. In the excellent view of one of these stream valleys, forming Fig. 2, the foreground illustrates the character of the valley slopes as they lead down to the narrow flood plain over which the stream is now flowing. In the background the crests of the rounded hills neighboring the stream, together with other more distant elevations, are seen to merge into the even and almost level horizon line, which is characteristic of any general landscape view in this district.

Several of the smaller streams of the eastern Piedmont occupy valleys which do not belong, strictly speaking, to the tree-like branching system of most of the streams. These streams are found to be located along bands of soluble limestone whose directions are at variance with the stream-branching usually found here. Deposits of Coastal Plain sediments have been found in these peculiar, subsequent valleys, whose age is therefore fixed as intermediate between the date of formation of the general upland and that of the earlier Coastal Plain deposits.

Turning to that portion of the Piedmont Plateau situated west of Parr's Ridge, the first character of general importance that catches the eye of the observer is the change in slope of the upland surface. Instead of declining gradually and uniformly, as does the eastern upland, to the line of lowest levels, along the Monocacy, the descent is comparatively rapid for the first portion of the distance. The reason for this is clear. In the first place the total change in elevation from the divide to the lowest levels on either side is the same, approximately 500 feet; but on the east this descent is accomplished only after traversing a horizontal distance of over forty miles, while on the west the decline is made within less than half that distance. In the second place, areas of yielding brown sandstones and shales which occupy the central portion of the western division, have further narrowed the horizontal distance within which the decline takes place by extending the low levels found near the Monocacy, for several miles toward the divide.

The streams which flow westward across the more steeply sloping portion of the plateau are characterized, for a short

distance from the ridge, by somewhat narrower valleys than are found belonging to the eastward flowing streams. These valleys widen rapidly, however, as they approach and enter the sandstone areas adjacent to the Monocacy. At the same time the general surface of the plateau loses its steeper slope. It becomes almost horizontal for a distance of about eight miles, maintaining an average elevation of 500 feet above sea-level. Then the surface declines rapidly to a lower level of 450 feet where a broad terrace may generally be traced out. Along the present entrenched channel of the Monocacy runs a second and narrower terrace at a level of about 350 feet. Both the terraces and the general upland surface rise gently as they extend northward, and all are now more or less dissected by stream channels cutting across them down to the Monocacy. The channel profiles of all the streams of this district show the normal concave-upward slopes produced by uninterrupted stream growth. The grades, however, are much steeper near the heads of the streams referred to, than they are at corresponding points in the channels of the eastern division streams.

The Rocks and Structure.—The rocks of the Piedmont plateau province include fragmental and igneous rocks, in both metamorphosed and non-metamorphosed conditions. The eastern division is largely composed of altered igneous rocks which have pinched in with them bands of phyllite, slate, quartzite and marble that undoubtedly represent originally stratified rocks. On the west the rocks are largely phyllites, with included marble and limestone lenses, upon which unaltered red sandstones, shales, and limestone were deposited. These sandstones, etc., are now much faulted.

The dynamical metamorphism which the present crystalline rocks have undergone, has arranged their mineral constituents in long parallel lines and planes which bear no necessary relation to the stratification planes of the originally elastic rocks. From the east and the west the foliation planes dip steeply down towards an axial line. This line, called the axis of foliation, crosses the Potomac near Great Falls, proceeds northward past Gaithersberg and Westminster and on into Pennsylvania. On the western side the strike of the foliation and of the infolded marble lenses is northward, parallel with the axis. On the east after keeping a northeastward course as far north as Westminster, the foliation of

the gneiss and its infolded bands of marble, quartzite, etc., makes a sudden turn to the east, follows the new direction for some miles, then again turns northeastward.

Relation of Topography to Structure.—The relation between topographic forms and geologic structure is not a close one in this province. All the larger streams, including the Monocacy except for a short distance, seem to have located their courses quite independently of the arrangement of the bands of yielding and resistant rocks described above. This feature is more strikingly illustrated in the eastern division where the Gunpowder, Patuxent and Patapsco rivers are the best examples. In the western division the Monocacy shows some independence of yielding and of resistant rocks in portions of its course below Frederick, while many of its tributaries from the east are quite indifferent to the foliation and the variations in the phyllites which they cross.

The general indifference to structure shown by the courses of the Piedmont streams, coupled with their peculiarly characteristic tree-like branching patterns have led to the conclusion that the streams did not originate upon the plateau surface as now exposed. Their characters indicate that they developed their present patterns when flowing across an almost smooth and gently sloping surface such as would belong to a series of nearly horizontal marine beds deposited across the beveled edges of the present eroded crystallines of the eastern division. On the west the covering on which such courses could have been developed seems to have been the now partially removed and much faulted red sandstones of the Newark formation. On the east the cover was probably formed by a westward extension of the deposits of the Coastal Plain.

The streams have cut their channels down thru these coverings and into the formerly buried crystalline rocks, then forming the foundations. The streams were thus able to so fix their courses in the crystallines that subsequent elevation and erosion, resulting in rather widespread removal of portions of the cover, have but served to confirm them the more in their discordant positions. The majority of the present stream courses of the Piedmont are thus seen to be at variance with the existing rock arrangement or structure because they have been inherited from courses developed when those structures were quite hidden beneath a blanket of younger sediments.