METHODS AND MODELS IN GEOGRAPHIC TEACHING.[1]

IT is important in teaching the physical geography of the land that the forms of the earth's surface which are to be considered should be selected and arranged in accordance with some natural and if possible genetic system of classification, and that they should be so clearly illustrated as to impress their essential features vividly on the minds of the students. While continental relief and outline should have brief elementary attention, more deliberate study must be devoted to the small rather than to the large areas of the land, the boundary of each area being determined by the extent of a single kind of structure. A single structural area may be called a geographic "individual;" and all the individuals of one kind are to be idealized in a type. The types of the land-forms are then to be classified, first, according to their structure; and, second, according to the degree of advance that they have made in their destructive development, that is, according to their age. Any individual form may be imagined to pass through a cycle of life, beginning when its surface is presented to the destructive forces of the atmosphere, and ending when these forces have reduced the mass to the level of drainage discharge, that is, to the base-level of erosion. The sequence of forms assumed in this cycle of life is highly characteristic, and justifies the use of such terms as "youth," "adolescence," "maturity," and "old age," to indicate the degree of development that the individual has reached.

Models are employed to impress on the class the essential features of the various types. The models are of a size large enough to be seen by a class of fifty or a hundred students. They are made of paper, colored to indicate certain features, and arranged in nests of two, three, or four, for easy packing. Each nest or group of models represents the successive forms assumed by a single individual as it passes from youth to age. In order to give concrete illustration of their use, the group of forms that may be included under the heading of plains, plateaus, and their derivatives,[2] is described at some length.

A very young plain, like that of the Red River of the North, still retains its embryonic or pre-natal constructional features. It is level; its drainage is poorly developed; and the few streams that have as yet cut their channels in its surface have only incipient valleys, narrow and shallow. The future of such a surface would find it traversed by deeper and wider valleys, and broken by more numerous side-streams, and the originally smooth inter-stream surface becomes broken and diversified. While we cannot wait to see this change in the plains of the Red River, we may elsewhere find it already reached in the more advanced or adolescent stage of other plains, born longer ago, such as the coastal plains of the Carolinas. A still later form is found in the sub-mountainous country of West Virginia, where all resemblance to the initial smooth surface is long ago lost, but where the horizontal structure of the bedded rocks assures us that in its youth this surface was as smooth as the Red River plains are to-day. West Virginia is in its maturity, for here we have the greatest variety and strength of topographic expression. The drainage is most perfectly developed. The streams are most numerous, and carry at this time the greatest share of land-waste to the sea. Central Kentucky is still further advanced. Here the intensity of relief has diminished; for, while the hill-tops have lost some of their initial elevation, the valley-bottoms have not correspondingly gained in depth, having already at or before maturity reached close to base-level, below which they cannot cut. Maturity is passed when topographic expression thus begins to fade. Further advance still more reduces the relief of the surface, until in old age the region is a broad low land, whose monotony is only here and there relieved by low hills, while idle streams wander on the faintest gradients to the sea. The plains about the upper waters of the Missouri in eastern Montana illustrate this stage, — a broad, gently rolling expanse, overlooked by an occasional lava-capped mesa, where erosion has been resisted. When the lava of the cap was poured out from some neighboring vent, it ran down hill to the lowest place that it could find, and there accumulated: the mesas are therefore witnesses to the greater height to which the whole surface once rose. And in the denudation of the original mass to its present ultimate form, it must have passed through all the stages represented by the examples already quoted; it must have had an initial level surface. This was trenched by young and growing valleys, shallow and few in number at first; deeper, wider, and more numerous later on; until in maturity there must have been in this now monotonous country a wilderness of rugged hills and a labyrinth of branching valleys. But as the hills wasted away, the land standing relatively quiet all the while, the relief was lessened, and finally the gently rolling plains of the present time were evolved.

Interruptions in a simple cycle of growth are seen on a closer examination of some of the examples given. The old plains of eastern Montana are no longer lowlands: they are now of considerable elevation above base-level; their rivers are swift, and flow in deep, narrow valleys, even where the rocks are soft and weak, and are interrupted by falls even where the volume of water is large. Manifestly, then, the whole region has lately been uplifted; that is, it has entered a new cycle of life, in which it has only reached early youth, and in which, if it is not interrupted, it will pass through another sequence of forms. The region of the high plateaus of Utah, as described by Dutton, is a wonderful example of the double control of form that appears in individuals not far advanced in a second cycle of growth. The general upland surface had entered maturity while standing at a lower level; it was then raised several thousand feet, and, thus rejuvenated, is now advanced a little way in its second cycle. The great cañons are only in their youth, though so profound: their depth is a sign of precocity, not of great age.

Variations in intensity of development characterize different individuals according as they stand at a great or small elevation above base-level. The coastal plains of the Atlantic slope cannot have deep valleys and strong relief, because their valleys are not allowed any considerable depth of cutting; while the cañons just mentioned give us the climax of intense expression by reason of the great height of the general upland surface over the base-level of the region.

Inasmuch as the association of topographic features at the several stages of development is strongly characteristic, it seems advisable to recognize this association in the manner ordinarily followed; that is, by the use of technical names, of which geography stands in so great need. In the same way, the types of different classes of individuals manifest throughout their life a characteristic succession of forms, such as is well known in those organic forms that undergo metamorphosis. Here again well-defined names applicable to the individuals throughout their whole life may be introduced to great advantage.

The history of a river may also be illustrated by the series of models, showing the first establishment of stream-courses on the lowest lines offered to the rainfall, the later adjustments and changes of streams by their mutual interaction, the accidents to which streams are liable from climatic change and otherwise. The shifting of streams by the mature adjustments of their drainage areas is regarded as a point of much importance in the development of the drainage of a region.

[1] Abstract of a paper read before the Johns Hopkins University Scientific Association, Feb. 13, 1889, by Professor William M. Davis of Harvard College.

[2] See an article on this subject in the Proceedings of the American Association, 1884.

D. C. HEATH & CO. will publish at once "The Laws of Health in Relation to School Life," by Arthur Newsholme, M.D., diplomate in public health, University of London. It is a compend of sanitary science, useful to those who are erecting new school-buildings or modifying those already existing. It is of importance to all who are charged with the responsibility of watching over the mental and physical well-being of pupils of both sexes, in public or private schools or in boarding-schools. It is a book already in use in English training-schools. It has been carefully revised to adapt it to our climate and the needs of American schools. The London *Athenæum* says of it, "It is wholly meritorious and altogether free from any blemishes that we can find. There is nothing to be said of it but that it is excellent." *Nature* says, "Dr. Newsholme has studied his subject thoroughly, and his conclusions are all the more valuable because they have been to a large extent suggested by his experience as a medical officer of health and as a medicinal referee for various schools and training-colleges."