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PRACTICAL EXERCISES ON TOPOGRAPHIC MAPS

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THE EDUCATIONAL VALUE OF TOPOGRAPHIC MAPS

THE topographic maps now published by the United States Geological Survey are already widely used in schools and colleges as the basis of practical exercises in physical geography; but in some cases that have come to my attention, it has seemed as if the exercises based on the maps were not well planned, and in no case did they nearly exhaust the valuable lessons that such maps may teach. The construction of transverse profiles by platting the heights, taken from map contours, on cross section paper, is a time-consuming exercise, perhaps helpful once or twice but likely to be carried too far. The study of land and water forms on these or on any similar maps is certainly useful, but it is often too unsystematic to be of disciplinary value, because it does not begin with carefully selected simple forms, clearly isolated, and well defined, and advance gradually to forms of greater complication. The study of land forms on maps of actual regions should, indeed, always be preceded by the study of artificially simplified maps of type examples. The use of maps of actual land areas in their natural complication as a means of illustrating idealized types to beginners in physical geography is a good deal like the use of pages from the account books of a large mercantile establishment as a means of illustrating the simple processes of addition, subtraction, multiplication, and division to beginners in arithmetic.

It was with a view of providing a graded introductory series of ideal types that I included a number of simple, invented maps of imagined forms in my *Practical Exercises in Physical Geography* several years ago. However, for those who have not time or inclination for so systematic an approach to the subject, much can still be done by beginning with maps of actual regions. In the most elementary exercises suggested below, it is assumed that the student is advancing through the elementary stage in which acquaintance is made by some means or other with different kinds of land forms, and that he supplements his text book with exercises intended to give facility in reading maps on which selected kinds of forms are illustrated, in order that he may

later be proficient in describing actual landscapes. The more advanced exercises may be profitably added to college courses.

The prevailing lack of proficiency in geographical description must impress every critical reader of articles upon exploration, such as appear in the leading geographical journals of the world. The authors of such articles, after traversing certain little known regions, naturally wish to give some account of them to others; and as one of the many readers thus addressed I have often made a faithful effort to visualize the landscapes described, but as a rule with small success. Part of the failure has doubtless been on my side, but the larger part is on the side of the authors, who for some reason or other omit various details that are essential to intelligibility. Perhaps the authors were less interested in the forms of the regions traversed than in the people who occupied them; perhaps they were interested enough in the land forms, but had never had adequate training in geographical descriptions; perhaps they were interested and trained in landscape description, but did not have assiduity enough to make written record while the facts were still before them: the result is the same, their descriptions do not suffice to portray the regions described to their readers. I believe that all three deficiencies may be lessened by preparatory exercises in the description of landscapes. The best preparatory exercises must be conducted out doors on carefully selected districts; but it is a very difficult matter to conduct such exercises as part of school work. It is with the object of suggesting similar exercises, based on topographic maps and adapted to the limitations of indoor teaching, that these pages are written.

NARRATIVE DESCRIPTION

Let it be assumed that a chapter on "plains and plateaus" has been studied: the teacher may then place a map representing a characteristic part of the Atlantic coastal plain or the Appalachian plateau before each member of the class, and assign the following exercises: Select a route for a walk or a drive of a day or two across the quadrangle, and write a two, three, or four page account of what you would see. A teacher who has not yet made trial of such an exercise, will, I believe, be surprised at its useful and disciplinary possibilities. A simple description should suffice for young beginners, who need tell little more than directions, distances, heights, and local names; much more may be demanded from advanced students in a college course, who should give details concerning hill and valley forms, describe general views from hill tops, and introduce imagined personal experiences appropriate to the district traversed. The

composition thus produced evidently deserves consideration for its English as well as for its geography. The essence of its narrative form is that it presents the successive elements of the district traversed in the order in which they are encountered along the route that is followed. It thus serves as an introduction to the narrative record which a traveler might make in his journal, day after day, in his passage across an unknown country.

Narrative reports may vary not only in grade, as above intimated, but also in scale and in principle. Practice in writing on different scales, which corresponds to mapping on different scales, may be secured by requiring that the most important points of a three or four page report shall be reduced first to one page, and then to ten lines. This is of high practical value. It teaches a young writer how to tell the gist of his experiences, while excluding the less important details. Condensed narration must be well written, in order not to be dry; and nothing contributes so much toward the training needed in the preparation of a well written condensed report as practical exercises that result in producing it at the end of successive steps of approach.

Narrative reports may be varied in principle by specifying that some students shall avoid all explanatory terms and phrases such as account for valleys by erosion, for river directions by relation to initial land-slopes, for the location of villages by waterfalls or harbors, and so on; while other students shall use explanatory terms and phrases as far as possible. In other words, the first group is limited to the statement of visible matters of fact in empirical terms and phrases, from which all inferences as to past conditions, unseen processes, and supposed influences are ruled out; while the other group is urged to make use of pertinent theories in giving explanatory description to land forms and of reasonable inferences in accounting for the location of roads and villages, but it is at the same time cautioned to express any doubts that may be felt regarding inferences and explanations by some appropriate phrases, such as "it seems to be" or "it looks as if", and so on. In no other way can the contrasts between the empirical and the rational treatment of geographical problems be so well emphasized; in no other way can students be given so good ground for making choice between the two methods of treatment, one of which is so clearly an old fashioned, obsolescent method, that was unconsciously developed in an era when geographical facts were regarded as merely existing, while the other is as clearly a consciously planned, advancing method, by no means perfected as yet, but already characteristic of an era in which the evolutionary philosophy has

shown that geographical facts, like all other facts, are full of meaning, and that the discovery and announcement of their origin and development and meaning goes a long way in emphasizing their mere occurrence. Is it not plain, then, that with variations of grade, of scale, and of principle, narrative reports may give abundant and valuable exercise in geographical study?

INDUCTIVE REPORTS

Let it now be assumed that, after a few exercises in narrative reports on plains and plateaus have been performed, the class advances to the study of a chapter on mountains, concerning which a series of inductive reports are to be prepared. Here a number of maps from the Appalachian or other mountains should be brought forward; the various features, topographic as well as physiographic, represented on a quadrangle, are then to be grouped together according to their kinds, and their kinds are to be arranged or classified in some systematic order. Here again the reports may range from elementary to advanced, from condensed to detailed, from empirical to explanatory; but now, instead of travelling along a single route and presenting the facts there found in the accidental order of their encounter, it may be assumed that all the facts of an entire quadrangle, having become known by observation on many routes, are to be described in groups following some order that the young geographer may select or devise. Among the kinds or groups of things are ridges, valleys, streams, roads, villages; and these groups are not only to be separated from each other, they are also to be subdivided. Ridges may be subdivided according to height, length, direction or other features; streams, according to their direction, or to the relation of their direction to that of adjacent ridges; villages, according to their location on low ground or high, on streams or divides, and so on. It should be regarded as "fair play" to ask the teacher for needed information, not contained on the maps when it is needed in forming or in subdividing groups. For advanced classes, the topographic map may be supplemented by the other maps and the text of a geological folio.

The essence of this kind of a report is that it first brings things of a kind together, independent of the order in which they are discovered; it then arranges the various kinds of things according to some consistent plan; it next describes or defines each of the kinds according to some systematic method of geographical treatment; and it finally subdivides each kind into its varieties. While a narrative report corresponds to a traveller's story, such as geographical journals usually publish, an inductive re-

port corresponds to a text book. A narrative report describes each thing of whatever kind separately and for itself; an inductive report describes many things of a kind all together by generalizing them; that is, by selecting the essential features in which all the things of a kind agree, and omitting the individual features in which few or no things of a kind agree. Thus the idea of "type" is developed. True, this idea has been employed in the previous narrative reports, for everything then mentioned must have been named in terms of some previously acquired type, but at that time the idea of type was unconsciously accepted and employed, now it is consciously analyzed and developed. Definitions of groups or types framed by different students may be profitably compared; and when modified and improved by discussions, the definitions thus based upon the study of geographical features on maps may be advantageously compared with corresponding definitions in different text books; much wholesome discussion may be thus provoked; pupils may be even led to learn that a text-book is not necessarily final or infallible.

Furthermore, the principal of "classification" will be developed as the different members of unlike groups are subdivided. When classification is first attempted, it may be so little understood that valleys, for example, may be classed by placing all the long valleys in one category, all the wide valleys in a second, and all the deep valleys in a third, without perceiving that the features by which these categories are characterized are not mutually exclusive. The teacher may have to aid some pupils by explaining that the true idea of classification involves the separation of groups of things into subgroups according to the variation in the value of some feature that all the things possess. All valleys have lengths; hence valleys may be classified as long, medium, and short; all valleys, of whatever length, have breadth; hence all valleys, first grouped according to their length, may then be subdivided according to their breadth; and the three subdivisions thus formed may be again divided as to depth, making 27 subgroups or varieties in all. A very little of this sort of thing will be enough for beginners; for advanced students, there can hardly be too much of it if they wish to advance still farther.

However naturally a number of ridges or of valleys, or of roads, or of villages, may fall into groups and sub-groups and thus, as it were, assemble themselves around their ideal type, they will still show some individual variations and such variations are ordinarily indicated by the use of adjectives to qualify

the type noun. Care should be taken to select adjectives that best indicate the observed departures from type. In view of the variations of a group of things discovered on a single quadrangle, it is to be expected that a greater range of variations will be discovered when the field of observation is enlarged; and this will suggest that some adjectives should be held in reserve for future need. Here we encounter a process that may be called systematization, which I have treated at some length in an essay on the "Principles of Geographical Description" (*Annals Assoc. Amer. Geogr.*, V, 1915, 61-105; see p. 77-85), but which cannot be considered here, farther than to indicate briefly that through this process the student may greatly enlarge his equipment with types and varieties of types—his "mental outfit" as it may be called—in preparation for future observational work. Suppose, for instance, that several *cuestas*, represented on different topographic maps, are reported for comparison; one may be low and narrow but well defined; another may be broader and higher, yet so much dissected as to be ill defined; one may be so flat-topped as to resemble a plateau; another so steep on both sides as almost to merit the name of ridge. As soon as these differences are apprehended, let the class be asked to imagine other values of the differences than those represented by the maps, to draw diagrams for their illustrations, and to select adjectives for their description.

Again, as further exercise in systematization, let all the elements of form in all these *cuestas* be searched out and defined, not as an abstract exercise, but as the most practical means yet invented for the quick observational detection and the accurate and intelligible description of any and every kind of *cuesta*, wherever and whenever met. Can anyone doubt that from a class whose mental outfit is thus enlarged, there will be a good chance for the emergence of a successful geographer!

REGIONAL DESCRIPTION

A long step in advance of inductive treatment is made when regional description is attempted. Let it be supposed that the chapter on sea-coasts has now been reached in the text book, and that maps of a mountainous coast are selected for description. The effort here is not to set forth the features along a single route in narrative form, following the accidental linear order of encounter on a journey, nor to group the features inductively according to their kind, and arrange the various kinds of features according to some adopted system; but to present them all in their natural grouping in such a manner as shall give the best possible understanding of the region as a whole. The method

that will best accomplish this object is not yet agreed upon among geographers; there are presumably many "best" methods, each one to be preferred in view of special considerations. But it should be clear that, whatever method is best, it can be best reached by gradual approach through preliminary exercises on narrative and inductive reports; for regional description is the most difficult branch of geography, the goal of geographical endeavor.

Regional description, like the other forms of presentation already considered, may vary in grade, scale, and principle. Variations in grade will naturally accompany progress in geographical study through several years of increasing proficiency; variations of scale will be determined by the specifications of the teacher during school and college years, and by the exigencies of opportunity afterwards; variations in principle are not likely to be practised after a choice of principle has been made, for success in whatever principle is then adopted will demand devoted attention for it. Choice of principle should therefore be delayed long enough for it to be made intelligently, but not so long that no chance for later practice in applying it is allowed.

In the practical accomplishment of a regional description, its grade, scale, and principle having been decided upon, the chief difficulty lies in determining the order in which different features shall be mentioned; for although the object is areal, the means are linear; however many things occur together simultaneously in a given region, they must be mentioned one after the other. The systematic order of classification, appropriate for inductive reports is not appropriate here; the first things to be mentioned should not be the easiest to understand or the simplest to describe, but the dominant features of the region, after which the subordinate elements should follow according to their relative importance. Evidently the inorganic features of land forms should precede all the organic features that occur upon them; and in a full description, such as is based on outdoor observation instead of on map study, climatic factors should be introduced between the land forms and their inhabitants; and the inhabitants should include plants and animals as well as man, and the correlations of all these factors should be clearly brought out; but exercises based on maps are limited to land forms and items of human culture, with the addition of plant assemblages such as forests and swamps when they are represented. Regional descriptions based on maps are therefore by no means complete, but they are valuable as introductions to more complete descriptions.

A few words may be allowed to emphasize the importance of exercises on different scales. Regional description is difficult under any conditions; but it is most difficult under the condition of limited space, when choice has to be made between what may be included and what must be omitted. Exercises on this topic should always proceed from detailed through medium to condensed statements. It is not to be expected that students should agree with one another as to the contents of condensed description, for agreement on so difficult a matter has not yet been reached even by professional geographers; but in any case, whether a condensed regional description is written by a tyro or by an expert, it will be better done if its limited contents have been carefully selected from an abundance of knowledge, than if they are hastily thrown together from a scanty store of information. Hence a full statement of facts should be written out first; and condensation should be progressive through two or three degrees. It is much easier to prepare a good condensed account in this gradual manner than in a single stride. Try it and see.

The evident difficulty that stands in the way of students gaining proficiency in geographical description through narrative, inductive, and regional exercises of different grades and scales and principles is the lack of time. There are, more is the pity, few schools or colleges in which geography is studied so seriously as to warrant the assignment of hours and years enough for this purpose; but I am convinced that if time can be found for some such exercises as are here outlined, the results gained will be repaying. Yet, as in all exercises, specified by one person and carried out by another, they will be almost worse than useless if they are in charge of a teacher little informed and less interested in geographical science. The enforced performance of these exercises under unfavorable conditions would be as dull and spiritless as their willing performance under favorable conditions may be lively and profitable.

There is an indirect advantage that will follow from map exercises, to which allusion has not yet been made: they will familiarize the youth of the nation with the value of good maps and thus make their value greater still. It was but a generation ago when, apart from the charts of the U. S. Coast Survey and from a few maps of specially surveyed areas, our people had practically no opportunity of knowing what a good map is. They saw the simplified maps of school atlases, the land-office outlines of western states, the rough state and county maps that serve the needs of commercial travellers, express companies and the like, and the caricatures that too often take the place of maps in railway folders, but they had no means of seeing topographic

maps on which the slopes of mountain sides, the breadth of valley bottoms, the fall of streams and many other facts are shown. Topographic maps for 40% of the area of the United States have been published in the last 35 years; many of the earlier sheets are deficient in accuracy, but all the later ones are excellent examples of topographic art; even the existence of these maps is unknown to vast numbers of our people. Surveyors, foresters, highway engineers, irrigation companies, and many other professional men use the maps abundantly and know their value; but few of them know that, at the present rate of progress in mapping, about a century will be needed to complete the topographic map of the United States. Progress is slower now than it was 30 years ago because better work is exacted. About half a million dollars has been spent on this work every year for ten years past, but if at that rate a hundred years will be needed to survey the whole country, it is plain that larger appropriations must be made in order to expedite the completion of the map.

Teachers who recognize the value of good topographic maps in their own work, and their technical value in many other directions may well take a hand in urging more rapid progress; and for this purpose the meetings of state branches of the National Council of Geography Teachers offer good opportunity for united action. But even with increased appropriations, scores of years must pass before the maps are completed, and in the meantime, the young pupils of today will grow up. Let us see to it that they grow up with a well founded understanding of what good maps are, and of their many uses in practical affairs. Then they will, in their turn, see to it that work upon the maps is continued and expedited.

SWINE FEEDING FROM OAK FORESTS IN SPAIN

In western Spain certain lands covered with oaks are utilized by sending pigs into them to feed on the acorns. Toward the middle of autumn when the pastures begin to be poor and the acorns on the evergreen oaks which are earlier than the cork oaks, begin to ripen, the feeding begins. The process follows a certain order and is aided by knocking the acorns down with poles. The forest is usually divided into four parts and the acorns knocked from the trees in the low-lying quarter first; then the second after about two weeks, and so on. The pigs indicate their hunger for the acorns and the workmen do not begin until that time to knock them off.—[From the *Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, August, 1913.]