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Map Reading

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MAP READING

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THE introductory quotation in a recent number of this Journal¹ emphasized the study of maps. It is worth reviewing.

"In geography we are constantly using maps; and upon them must be based a necessarily large part of our work in geography. So proper education in geography must include a careful training in the making and interpretation of maps. More and more a map is coming to be a shorthand representation of a mass of geographical information, and more than ever a good geographer is able to read a chapter from a map. A pupil needs to learn the language of maps, then to memorize some of the essays and sketches set forth in the map's language. To do this is an exercise of attention and retention, and, studied in this way, the continents become as easy as so many letters in the alphabet—learned once, learned forever." We are slowly outgrowing the practice that involved the learning of a long list of unrelated names of capitals of states or countries, names of rivers and mountains, bays, capes and the like. Many teachers may insist that the old order has entirely passed away, nevertheless, it is essentially and persistently retained in much of the teaching, especially when the subject matter of instruction concerns lands other than our own. The misuse or too frequent use of the text book makes the teaching forced and uninteresting. The development of home geography within recent years enables us to take a long stride forward. The study of home geography should not be confined to the limits of any one or two grades but by constant field exercises it should be made to enrich all the later work in the subject. Many studies have to be cut into portions to suit the mental capacity of the pupils of the different grades. In this way, the continuity of a subject is apt to be broken. If the home geography is relegated to a certain grade, and if in a succeeding grade the study of one of the grand divisions, as Eurasia, occupies all of the time to the

¹J. P. Goode, *Jour. of Geog.* III, 2, opp. p. 35.

neglect of out-door observation, the work must largely be done in the old way and without much aid from home geography. The pupil will not be in intimate touch with the subject as presented in earlier grades, and little use is made of the instruction of these grades. Yet a study of Eurasia can hardly be considered anything but visionary, if the concepts gained from the study of home geography are slightly considered. The object of the insistence upon the study of types has this thing in view, namely, to furnish the mind with some units of measurement which are to be the standards for future judgments. Such articles as "A Temporary Sahara" probably finds its inspiration in this idea. Some work of this nature is done, as for instance, the determination of the rainfall under the control of wind direction and topography. In most cases, however, the rational treatment is incidental, and forms no part of the working plan. The opportunity for an increase of the rational or development plan is obvious. With a wealth of data derived from the study of home conditions many features of another country may be approximated in vision. Such work will mean a distinct gain in clearness and accuracy of thought because of the foundation on which it is built. Not to apply the lessons of the home study to other lands is to isolate, make fictitious, the distant places. The present paper is a continuation of a previous article by the author¹ and an elaboration of a scheme of map work that has stood the test of trial. The outline of this article is not a course to be followed as narrated. It is rather a somewhat severe expression of an idea that should yield suggestions for the different stages of the work of map reading. In each case the application of the principles of home study is the agent. If each of the grand divisions is studied with some reference to a plan of this nature, the repetition involved will be found to be excellent drill work.

The maps which accompany this paper are ten in number and are briefly catalogued as follows:

1. Outline map, with parallels and meridians. The map may be on any projection. However, it is advisable to shun the Mercator projection and its modifications for the sake of emphasis on direction, and in order that early practice may be gained in treating north and south directions as coincident with meridians, and east and west with parallels.
2. Topographic map, showing three degrees of elevation.
3. Wind chart for July.
4. Wind chart for January. These wind charts mark the average extreme of the seasons and the average limits of the migration of the wind belts.

¹Jour. of School Geog. IV, 171.

²Map Making and Map Reading. Jour. of Geog. III, 65.

5. Rainfall map.
6. Soil map. Under this head is included minerals. This map offers a great variety of materials from which to choose. Its use must depend more largely than the preceding maps upon individual conditions of mind and time. Here it will be employed very fully, if indeed, its use is not carried too far.
7. Map of vegetation. This map may also be expanded according to

Fig. I. Outline map.

desire. Maps of different products may be used. In this instance the map shows the degrees of luxuriance rather than kinds of vegetation.

8. Map of Animals, showing the range of domestic animals.
9. Map of Commerce. A map of degrees of commercial development and indicating future possibilities in this direction, with important railroads and sailing routes.
10. Map of Population, showing density.

These maps may be made easily from a stencil or by sketching upon heavy paper, and mounted for wall use. If a crayon pencil is used for drawing the lines and for coloring the maps they may be read in all parts of a school room. A legend should be added to each map and care should be taken to make this legend as legible as the map itself.

The Specific case. South America.

1. Given an outline map (Fig. I) of South America, with the parallels

Fig. 11. Topography map. ■ Highlands, above 2000 feet.
 --- Uplands. □ Lowlands. (After Redway and Hinman).

and the meridians. The position of the country may be decided. As an aid to the location the meridian of the home, in this case, Worcester, approximately 71 degrees west longitude, may be entered on the map. The proportion of South America to the east of this meridian is noted and the fact furnishes a basis for a few simple problems in longitude and time. When it is noon in Worcester (75th meridian time), what is the time (local) at Cape St. Roque? The parallels may be used: A. In reference

to location. What portion of South America is within the tropics? What place in North America corresponds in latitude with the southern extremity of South America? B. In reference to the position of the sun. At noon on the days of the equinoxes what is the position of the sun to an observer at the southern extremity of the country? On the day of the summer solstice? On the day of the winter solstice? C. In reference to climate. The consideration is merely latitudinal control or sun insolation. The statements

Fig. III. Wind map for July. Arrows fly with the wind. Dotted areas show ascending currents. (After Davis).

must be very general and be of such a nature that a modification under the other climatic controls can be made easily and without a sense of the futility of the general statement. Here also may be emphasized the large percentage of the country under the direct rays of the sun in sharp contrast with North America.

A journey in fact or fancy taken along a meridian in North America discloses the idea of increasing luxuriance of vegetation as one goes south-

ward and a diminishing amount as one journeys to the north. Thus low latitudes may be inferred to foster the luxuriant growths and high latitudes a lesser and lesser amount. A first general consideration along this line paves the way to a fundamental conception of the vegetation of South America. So in like manner a heavier rainfall may be expected in the low latitudes than in the places more distant from the equator.

From the outline of the country two questions are suggested. The first

Fig. IV. Wind map for January. Arrows fly with the wind. Dotted areas show ascending currents. (After Davis).

has to do with harbors, population and commerce. The very limited harborage of the western coast and the few along the Atlantic coast may mean little commerce, or the concentration of commerce at few localities. Under the latter consideration the commerce is light or congested. A statement left undecided or an alternative to be settled by subsequent knowledge, with judicious handling, often incites the pupil to an eager anticipation of future lessons. A second question arises concerning the southwestern coast

line. A likeness to the irregular coast line of Maine is suggested, and a similarity of origin may be inferred.

2. Add to the data of map I, the topographical map (Fig. II). The study of the home conditions has shown the effect of altitude upon climate. We may now strengthen certain points left in suspense while studying map I. The continually changing aspect of the work may seem at first glance an

Fig. V. Rainfall map. ■ Over 80 in. //// Over 40 in. |||| Over 30 in. _ _ _ _ Over 20 in. □ Under 10 in. (After Mill).
::: Over 10 in.

objection to the scheme, but it is nothing more than the evolutionary process experienced in all our growth. To present South America with all its features, topography, drainage, wind, rainfall and culture, is to confuse with the multiplicity of new ideas. The advantage in a developing set of maps of a continent is not alone the emphasis on special features, but better still the interdependence of physical conditions and the consequent modification of the different controls which shape the continental life.

The very general statement concerning climate obtained from the consideration of latitude circles may now be modified. The height of the Andes, and of the Brazilian and Guiana highlands in the equatorial regions suggest a more temperate climate in those parts, while the culminating portions of these ranges of mountains may be thought of as having a cold cli-

Fig. VI. Soil and Mineral map. . Recent alluvium. ooo Diluvium.
 :::: Sand. === Loam and Loess. Diamond. • Iron.
 + Gold. C Silver.

mate. The change from the highest equatorial Andes to the Southern Andean heights may be paralleled in kind in North America.

If any connection has been made between altitude and rainfall an approximation of the conditions of rainfall may be attempted, and even the wind charts will introduce a new feature. The vegetation is now confined to a smaller area inasmuch as the highest portions of the mountains, like high latitudes, are not localities of much vegetation.

It is necessary to step aside at this point to show that inasmuch as vegetation depends largely on rainfall and since the rainfall has been considered, the statement for vegetation might be further modified. Such a step, however, would defeat the purpose in view. The map under consideration, the topographic map, is to be followed and the modifications due to topography considered. The rainfall was discussed from the standpoint of altitude and

Fig. VII. Vegetation map. Chief condition of vegetation.
 Tropical and Subtropical. //// Grassy plains. === Forest and Cultivable lands.
 Temperate. ' ' ' Prevailing fir and pine trees. --- Grassland cultivable. Part needs irrigation.
 :::: Desert Regions. (After Adams).

the vegetation must be considered in like manner. To discuss the vegetation from the viewpoint of the rainfall hypothecated from the topographical map is to base our reasoning on a portion of the truth and not the entire truth. Such a step would be dangerous.

The division of South America by the Andes into a narrow western por-

tion and a broader eastern portion offers some basis for the consideration of the distribution of population. In this instance as in the others the plan is to gain our conclusion from the discussion of the map in hand and the previous data, independent of what may be the final decision when all the data is at hand. In a way an analysis of the controls is made. Whereas it is not only possible but most convenient for population to collect in spots favored by harborage and open by easy journeys to large areas, yet when the

Fig. VIII. Animal map. Range of Domestic animals. \\\\. Horse.
 — — — Llama and Alpaca. — — — Southern limit of sheep.
 Southern limit of cattle. (After Adams).

last thing has been said it will be found that the gratification of the desires of mankind may dictate a habitation in localities in spite of their many disqualifying physical features. It is claimed that a weighing of the convenient and the usual will bring into strong relief man's departure from easy paths when such cases are discovered. We may note in passing that the presence of the mountains in the southern part of the grand division may strengthen

the contention in regard to glaciation deduced from the irregular southwestern coast line.

3. To the data already presented add the wind maps (Figs. III and IV), showing the distribution of the winds for January and July.

The process of elimination and reasoning continues. Where the winds blow from water over the land the expectation is a modified climate. If the wind strikes against a mountain slope and is forced to rise rainfall results.

Fig. IX. Commercial map. □ Deserts or unproductive regions.
 Regions commercially undeveloped. === Regions of
 important commerce. ■ Regions of largest commerce.
 (After Adams).
 - - - - - Steamer lines. ——— Rivers
 navigable for river steamers. + + + + + Railroad.

The winds that blow across the country without coming in contact with great slopes carry with them more moderate conditions, so that it is the experience that climates otherwise oppressive because of the latitudinal and topographic controls, become more bearable. The ascending air columns are regions of low barometer because of the increment of motion upwards.

As the ascending air column, because of cooling, increases in relative humidity rain is the usual result. Where the prevailing wind blows from water across the land a region of continual rainfall is the experience. If two regions as in southern Chile and Guiana, in different latitudes, are under this control, it may be expected that the latitudinal control will yield the de-

Fig. X. Population map. Density of population. □ Less than 1 per sq. mile. 1-25 per sq. mile. — 25-125 per sq. mile. ■ 125-500 per sq. mile. • Cities of over 100,000. (After Tarr and McMurtry).

cision as to which shall have the greater quantity of rainfall. On the other hand when the winds blow over the land, or from the land to the water the conditions for aridity are obtained. Thus we may approximately locate the Atacama desert region. Furthermore, if the mountains are high enough to intercept a prevailing wind the leeward side of the range will in all probability be under varying degrees of aridity, as is the case with much of Argentina. A comparison of the two maps, III and IV, easily leads one to see the migration belts. The South American country may be divided into two

regions, one under a prevailing wind throughout the year and the other under one wind for a part of the year and under another for the remainder of the year. The seasons under the influence of this migration may be much more nearly approximated from a diagrammatic chart of wind direction than from the sweeping statement that South America has "a wet and dry season." The process of acquiring this idea is the educational function which far outweighs in value the crude fact. The rational process is too often missing from a geography lesson; it is easier to cram with data which are asserted as true, than to labor through a process of reasoning, especially if the teacher is not quite sure that the reasoning process will not contradict her list of facts, which are her eternal verities.

4. The data has so accumulated that a very near approach to a rainfall map may be drawn. The map (Fig. V) is the next one to be presented and the variations from the anticipated may be noted and perhaps considered. Many queries arise. In regard to vegetation: Where are the localities of luxuriant growth? of more comfortable growth? of scanty vegetation? The conditions of living in regions of luxuriant vegetation are so marked that a discussion will lead to the density and to some degree to the state of civilization.

Nothing has been said up to this time about rivers. Rivers as the carvers, to a large degree, of land forms would perhaps naturally precede the consideration of topography. For the needs of this discussion the logical historical order cannot be followed. In the earlier years of instruction we must study the land surface as we find it. So with the topography and the rainfall a consideration of rivers is possible. It will be obvious to the pupils that on the western slopes the streams must be short and in the region of the drying winds a scarcity of rivers may be expected. The larger rivers of the eastern continental slope and the smaller streams of the secondary highlands follow as a natural consequence. The more arid regions of Argentina will furnish the cue to the rivers of that locality. The ordinary physical wall map, showing the rivers may now be presented for verification.

5. Enough data have been given so that the remaining maps may be constructed, and the true map displayed at the end of the exercise rather than at the beginning. The reasons for the errors in the constructed map may serve as a quest which will reveal new information. So we are to construct the soil map. From the topography and rivers locate the alluvial lands. From the wind charts locate the sandy regions. From the winds and rainfall locate loess. From the rainfall map locate salt. From the outline and topography locate diluvium. Under the soil map is included minerals. There may be added by conventional signs as large a variety of these

as suits the individual judgment. There is some connection between mountains and mining so that a first statement might locate the possible localities for minerals from the topographical map. The soil map (Fig. VI) may now be displayed and the deductions verified.

6. The topography, rainfall and soil maps have already furnished considerable data for the discussion of vegetation. If the result is expressed upon a map and then the vegetation map (Fig. VII) (showing luxuriance) is displayed and the same process of comparison used, the experiment should yield something of value.

Another side of the vegetation story may be introduced. If for instance we know the conditions under which rice grows, then the rice yielding portions of South America may be considered. On the other hand, the story may be approached from the following point of view: Rice requires 60 to 80 degrees for ripening and is grown on irrigable land. What localities in South America satisfy the above conditions? After a decision is reached the facts in the case should be made known. The judgment may be faulty because there has been an error in the pupil's mind concerning the climate; because the land has been given over to another product; because of the unsettled condition of the government; or for some other cause discoverable or otherwise. So in like manner a number of staples may be used. Sugar cane requires rich, moist soil, practically no frost, even in winter, prefers the vicinity of the sea. Cotton requires a long warm summer, some rain, rather fertile soil. Wheat requires a mean summer temperature of 57 degrees, plenty of sun. This list may be expanded easily.

7. It is not easy to locate within limits native animals because of the migratory habits. At the same time certain definite conditions control much of the animal life. The influence of man is so marked upon this life that he must be counted the most important modifying influence. In a way the native animal life may be approached in the same fashion as the vegetable life. In many cases one of the requirements will be the absence of civilization. The vegetation, the soil, the topography and the climate furnish a starting point. The home study may yield a basal notion which, though crude, is acceptable as perhaps one of the best available. The life of a swamp is known to differ from the soil of a hillside. The swamp life is apt to be largely reptilian. If trees abound in a large swamp any life not of the swamp itself must be arboreal. So we question what sort of life may be expected on the plains, in the forest tracts and on the mountain heights.

Following the same method used under vegetation, certain type species may be selected and their conditions of living noted. Similar conditions may

be found in the country studied. The text-book may properly be used for correction when the conclusions have been drawn.

For the domesticated animals the process is a little more definite. Grazing is often carried on in uplands, among mountains and on plains where the rainfall is insufficient for agriculture. Certain localities in South America may be selected as suitable for grazing. It is not supposable that the truth will be reached from a reasoning process at every stage. The object in each step is twofold. In this instance, if we are sure of the right conditions under which grazing thrives then the discussion puts upon trial the previous judgment concerning climate, topography, etc., while there has been located the grazing regions through the same processes that caused them to develop.

8. Commerce and population are interrelated to such an extent that it is not easy to place one before the other in discussion. The decision in this paper is to consider the commercial map before the map of population, although one implies the other, and finally to sum up under both the topics that are not easily separated. The regions of densest commerce and the regions of commercial possibilities may be approximated and a very near approach to a commercial map constructed. What statements concerning commerce could be made from a study of a soil map? How would a study of the rainfall map modify these statements? Would the topographic map give any hint concerning commerce? How far might the outline map indicate centers of commercial activity? Under what conditions and where in South America do the outline and the winds hinder commercial development? Under what conditions and where is it aided by these controls? Questions which relate to vegetation and animal life may follow and then later the commercial map (Fig. VIII) may be presented and considered.

In any discussion of population, the consideration is based on the desires of mankind and presupposes that people will live where there is something to live for more or less independent of risks. It may assume a slight knowledge of the climatic effects upon life. Why were the native mountain tribes—the Incas—more highly developed than the valley tribes—the Caribs, for instance? What effects will climate (the resultant of the first four maps), have upon the state of civilization? How far will any one map, as the soil map, explain the Spanish conquest? The commercial map is almost the population map. The outline map may aid in locating cities.

The centers of population and commerce, the cities, may now be considered. Explain Rio Janeiro. Using each of the preceding maps does any one or ones above the others indicate a reason for its growth? Work out a similar scheme for Buenos Aires. Iquique offers a new situation. The

outline map suggests nothing and the winds are not favorable to the location of a city at this place. There is the conclusion that places may develop in spite of harborage and in the face of unfavorable winds.

The above plan of map reading is carried out in detail under some headings while under others suggestions only are made. There is scarcely a limit to the expansion of such an idea. In part the article will offer nothing new. The study of maps and the extent of map work is largely the outcome of the individual decision of the teacher. It cannot be done safely by a teacher who approaches the task in uncertainty. Much more than is here presented may be done by a teacher sure of her steps and careful of her decisions. Some of it should certainly be woven here and there into the study of the grand divisions.

FIELD WORK IN GEOGRAPHY

BY ARTHUR P. IRVING

Buckingham School, Springfield, Mass.

THESE trips by classes of the Springfield, Mass., schools have been found very attractive and profitable. No attempt is here made to designate the schools that took the trips.

A ninth grade class walked a mile or more after school one day to the Connecticut River. There was an unusual amount of snow on the ground and the ice was just beginning to soften. Everything indicated a freshet in a few days. The pupils observed the conditions and got all the preliminary data for a study of the annual rush of water. For several days the newspapers were watched to learn of the progress of the river and a new interest was awakened. Unfortunately for this study the snow melted gradually and the river never made so little fuss over its spring duty.

At another season a ninth grade left the school at 3 o'clock. The street railway allowed half fare so the class of forty pupils went to the lower end of the city. The river had begun to drop from its high water mark. A special study was made of the muddy current and of deposit. Fertile fields along the river were shown as a result of this deposit. A long bridge over the river at this point offered a fine opportunity for observation. This trip took about two hours and cost five cents apiece.

One Saturday in June the class of eighty or more had a geographical picnic. A ride of twelve miles on the electrics brought us to the foot of a range of hills known as the Wilbraham Mountains. The walk from there up to the top of the range, 900 feet high, was merry with the joy of being out in the free country. The day was spent in a large grove of chestnut trees. A great variety of flowers were picked and the woods were thor-