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PART I

I

CARTOGRAPHY: ELEMENTARY IDEAS.

BEFORE dealing with this subject itself in detail, it is desirable to give an elementary notion of the objects of cartography—of map-drawing—and, perhaps, in this connection, it should be made clear that I am here dealing with *geographical* maps alone; thus excluding star-maps, maps of the moon, and possibly some other extensions of cartography beyond the actual surface of the earth on which we dwell.

The natural development of the map is the desire which necessity, or curiosity, imposes on mankind to explore the earth's surface, and to move from one part of that surface to another—working from the known to the unknown—on the path of experience and enquiry.

Thus we have the elements of direction and distance; the main object of cartography being to give graphic expression and permanency to these elements. The result is a map—of course in its most rudimentary form.

What is the first point? It is clearly *direction*, and the savage man who desires to move—prompted by the observations he may have made as to natural phenomena (the flow of water in rivers, the ridges and ranges of mountains within his view), the information he may receive from others as to fertility, or the presence of means of existence at a distance—has first to deal with this problem. His standard of direction is, in the main, the sun in its regular risings and settings, in a less degree may be established by well-recognized stars, and, in detail, is associated with water boundaries, the direction of water flow, and these factors he can communicate by word of mouth or by the drawing of maps.

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Distance is a secondary factor in the case. We are none of us competent, in practice, even to-day in our highly civilized state, as individuals, without the aid of instruments of precision, to determine weight and measurement, or to compute time or space. In fact we are singularly deficient in these appreciations. The savage does not measure distance except in terms of time. Even to-day, in mountainous districts, in climbing the cross-country travel, no one thinks in terms of miles or kilomètres. So many hours is the measure. In climbing in the Alps, for instance, one never gets into one's mind any idea of kilometric distance. The guides give the times which a particular journey across the mountains, or a particular ascent, will take according to the circumstances—mainly of the weather.

We come back to this, that a rudimentary map is a route-map, a travel-map, a road-map—in *one* direction—with the gradual development of collateral details.

Similarly, sea-charts were built up in early times by point to point observation of the coast-line, no mariner in those days facing the open sea, without the pressure of great necessity, or except to a very limited extent.

These are the natural and fundamental ideas upon which maps have been built up, and it is well to keep these ideas of origin well and permanently in mind, especially in regard to teaching.

II

THE TECHNICAL BASIS.

The object of the cartographer—the map-maker—is to lay down on a flat surface—in modern times of paper—a pictorial representation of a portion of the earth's surface.

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For this purpose it is obvious that certain conventional arrangements must be arrived at. The building up of these conventions has, of course, its own history. Art and convenience have gradually reached what we now universally accept to-day in this respect. While maps are drawn to scale, as regards general dimensions, and the distances between points of importance, the indication of details is universally pictorial. A town is represented by a dot, a road or river by a broad line which is perhaps fifty or a hundred times wider than the object represented, if drawn on the true scale of the map. Variations from a plane surface are similarly treated in a highly technical manner. Elevations and depth in water are represented by forms of shading, or the drawing, upon a system, of horizontal lines, or by colours. In the adaptation of all this method and convention, the objects of the particular map must be, of course, specially considered. The cartographer in most cases aims at giving pictorial value to the dominant features of the district, or country represented, in particular to natural features, such as the flow of water in rivers, coast-lines, the character and altitude of high plateaux and mountain ranges, and to such artificial features as the location of populations and of centres of industry and commerce, the means of travel and communication—which may in some cases mean the map of a road or railway with marginal details—and, finally, to special features, geological features for example and others, possibly, relating to climatic conditions, and questions of population and race, and broad features of marsh land, ice, sandy wastes, and so on. The map-maker must, in all cases, just as the landscape or portrait painter must, settle his mind on the limits and objects of his particular composition before he begins his work.

We may also have special maps, as, for instance, of the

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roads, or of the rivers, of a country, of which the French maps of Nicolas Sanson of 1632 and 1641 respectively are good early examples.

A map is pictorial—as it represents a surface as a conventional picture; it is scriptorial—in respect of the written details and explanations. The limits of both must be settled. At one time a number of maps of the English Counties were published, almost covered with descriptive text. An example of this eccentricity is found in the *Atlas Anglicanus*, by Emanuel and Thomas Bowen, published about 1770. The practice has not been followed and is not to be commended. Even the writing of the necessary names on a map is a subject of much art and ingenuity if the pictorial clearness of the map is not to be obscured. The maps of Sanson and of other cartographers of the seventeenth century, and even earlier, are sometimes curious in consequence of the practice adopted of writing the names of countries and provinces in single letters distributed about the map in the places the most free from detail, and in some cases it is quite a hunt to pick up the whole of a title. I may instance a map of the *Isle de France* in the *Cartes Générales de Toutes les Parties du Monde*, Paris, 1658.

To sum up these observations—a map lies in character between a book and a picture, and combines the features of both. The classification and the bibliographical description of maps are thus difficult, and require a good deal of attention[1].

The decorative art in relation to maps was very prominent in the early stages of map-making. It disappeared when the geographical accuracy and scientific representation of surface became the dominant object (as it now is) of the carto-

[1] A discussion of this matter will be found in a paper I communicated to the Bibliographical Society some years back, which is reprinted in my *Studies in Carto-Bibliography*, Oxford, 1914.

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grapher. The illuminated maps of the Jaillots of the end of the eighteenth century, and two very beautiful sheets of the neighbourhood of Naples of 1793 and 1794, drawn by Rizzi-Zannoni, are, I believe, the finest specimens extant of this decorative art.

Simplicity is an important object of the cartographer; its combination with graphic detail is an essentially difficult problem; when colour, in outline, or super-imposed over the whole area, is introduced, this problem becomes more difficult still. A critical comparison of the official maps of half-a-dozen European Countries would establish at once to the eye the truth of this observation. Rizzi-Zannoni had an almost marvellous success in treating his map-surface in the most elaborate detail without destroying the pictorial effect of relief and of variety.

Maps are reproduced in various ways, but in general from engraved plates. The questions involved are not discussed here, and it is doubtful whether such a discussion is at all necessary to the completeness of my *exposé*, although, no doubt, it might be made of great artistic and professional interest when fully and adequately treated by experts.

III

THE TECHNICAL ELEMENTS OF A MAP.

To treat now of the technical elements of the map. Of these, three are absolutely essential.

There must be a *scale*. The scale is the measure of proportion between the picture and the area of the earth's surface represented. Without a scale a map is of no practical value; it is a vague sketch and conveys to the reader no concrete impression of size at all.

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There must be *orientation*, that is to say there must be some clear indication of direction. The common, and now well-established, practice is to arrange the map with the true north at the top. This is, of course, a purely conventional method, and, as regards plans on a large scale, is not always followed. But any variation from this arrangement is met by drawing on the map an arrow, or other indication of the directon of the points of the compass, so that the map can, if necessary, be placed in its true position relatively to the area it represents.

Location may not be necessary in plans, but it is certainly desirable in anything that can be called a map, and in all maps of large areas it must be regarded as essential. By location I mean indications which enable the reader to place the map correctly on the earth's surface, and relatively to other maps and sheets on the same or different scales.

For map-drawing, as I have already pointed out, technical and conventional methods are essential, and have come now to a stereotyped uniformity. This matter, with the others mentioned above, will be treated more fully later. I may, however, call attention in connection with the study of all these details, to the Army *Manual of Map Reading and Field Sketching*, 1912 (*Reprinted, with Additions*, 1914), which can be purchased for a shilling. It contains a mass of most valuable and suggestive material, admirably arranged, condensed and illustrated, and, although it is drawn up from a purely military point of view, has a general educational value from which every teacher of geography and every student of the practical use of maps can derive assistance. The following opening sentence in this handbook is worth quotation:

> An officer, or non-commissioned officer, may be said to be proficient in map reading when on examination a map conveys to him a clear impression of the ground features as represented

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by contours or shading, and of all the natural or artificial features exhibited on the map. Further, he should be able to identify his position on the ground quickly and to recognize all visible objects marked on the map.

This requires close study and constant practice, and is an important branch of military education.

The view I desire to impress upon teachers with regard to the proper treatment of maps as instruments of knowledge and study is in close harmony with this statement in its general bearings.

IV

TERMINOLOGY.

Before passing from the introductory part of this study it is as well to deal with Terminology, which has both an interest—mainly historical—of its own and an instructional value which should appeal to the teaching profession.

When, in the latter half of the sixteenth century, maps began to accumulate as the result of the general development in copper-plate engraving and printing, no name existed for the books into which they were collected. Ortelius, who published, in 1570, the first systematic collection of maps, which was printed at Antwerp, in the famous printing establishment of Christopher Plantin, gave it the title of *Theatrum* (or a display, or show). This was followed by John Speed in England (*Theatre of the Empire of Great Britaine*), by Maurice Bouguereau, the printer of Tours, in his *Théâtre François*, and by his successors Jean Le Clerc and Jean Boisseau, and also by Melchior Tavernier. In the meantime Gerhard Krämer, who is better known in the latinised form of his surname as *Mercator*, working on parallel lines to those of his friend Ortelius, had built up a collection of maps which, it is said, he withheld from publication in

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order to assist Ortelius in the sale of his venture. Mercator died before this collection was actually published, but he had chosen for it the symbolical and mythological title of *Atlas*. This is, in itself, a rather far-fetched adaptation of the Greek mythology, in which Atlas was known as the being who supported on his shoulders the pillars on which the sky rested, pillars which were thought to rest in the sea, immediately beyond the most western horizon. But, whatever the idea may have been in the choice of this name for a collection of maps in book form, its shortness seems to have given it favour, and it has survived all its rivals and is now well-established in cartographical nomenclature. Amongst other terms employed in the same sense were *Speculum* (*Speculum Orbis Terrarum*), Gerard de Jode (*c.* 1578), and *Speculum Britanniae*, used by John Norden in 1593; *Geographia*, *Cosmographia*, and *Chorographia*; but none of them had any success. For individual maps, the word *Map* itself came into use in the Middle Ages, the name *Mappamundi*, or *Mappemonde*, being explained as showing that maps were originally painted on cloth. We have restricted the use of this designation to land-maps, having adopted *Chart* for sea-maps, which was, as early as the fourteenth century, used in this sense (*carta nautica*) though it did not come into general use till two centuries later. The word *Type*, from the Greek, is sometimes found. The Romans called a map *Tabula*, and Mercator, in anticipation of his atlas, made use of the same term to describe a set of maps of France, which he issued in 1585 (*Galliae tabule geographicae*). We have beside the name *Portolano*, which was used in the Middle Ages to designate the charts of the Mediterranean. But, out of all this groping for suitable names, with us in England, *Atlas*, *Map* and *Chart* remain in exclusive possession.

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V

HISTORICAL CLASSIFICATION.

In the historical classification of maps there is, as in the study of books, the great natural division between the period anterior to the discovery of the art of printing and of impression, and that of easy multiplication of examples by the latter method.

In a broad way the dividing line may be taken at 1500; but the earliest dated printed map is of 1460, and it must be remembered that the *Theatrum* of Ortelius appeared in 1570. This intermediate century may be regarded as a period of transition.

Bearing in mind this division, I go back to the early history of cartography as it is known to us in Europe and the more or less approximate arrears of Asia and Africa.

VI

HISTORY OF MAP PRODUCTION.

(*a*) PERIOD OF MANUSCRIPT.

Adopting this geographical limitation for the moment, it is amongst the Egyptians that we find the earliest recorded examples of cartographic representation, many of them mural; maps and plans have actually been discovered on old Egyptian papyrus rolls.

To the Babylonians is attributed the high distinction of having originated the division of the ecliptic into twelve signs, and, later, into 360 degrees. The division of the circle into this number of degrees, and the further divisions of 60 minutes and 60 seconds, as well as the corresponding division of the day into 24 hours, were the outcome of their sexagesimal system of numeration.

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Adopted by the Greeks, and by Ptolemy, the scientific elements necessary for the astronomical determination of geographical position became available, and cartography at once advanced to the certainty of a science.

It does not fall within the plan of this treatise to review the progress of cartography amongst the Greeks prior to the time of Ptolemy, but it may be well to mention the world-map of Hecataeus of Miletus, of about 500 B.C., and to notice the great advance for which we are indebted to the famous astronomer and geographer, Eratosthenes of Cyrene, the keeper of the Alexandrian library (276–196 B.C.). He recognized the spherical form of the earth, and was the first to make a rational geodetic measurement for the purpose of determining its size. This work is stated to have been approximately correct, but, unfortunately, a later astronomer, Posidonius (about 130–50 B.C.) reviewed the conclusions of Eratosthenes, diminishing his arc of the meridian by one-third, and from this error, adopted by Ptolemy, there resulted an exaggeration of the longer axis of the Mediterranean by a third, and a distortion of all the Mediterranean countries, which, although the error was corrected in the compass-charts of that sea of the Middle Ages, was perpetuated in cartography until as late as 1700.

When Columbus set out to discover—not a *new* world but the eastern shores of the Indies—he seems to have founded on the errors of Ptolemy and his immediate predecessors, which, in effect, ignored the space on the earth's surface occupied by both the American Continent and the Pacific Ocean. Had he accepted the working charts of the Mediterranean drawn by navigators, and from them deduced a reversion to the approximately correct calculations as to the dimensions of the earth of nearly 2000 years earlier, it may well be doubted whether the space to be travelled to

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