Review: Surveying

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Source: *The Geographical Journal*, Vol. 26, No. 5 (Nov., 1905), pp. 550-552

Published by: geographicalj

Stable URL: <http://www.jstor.org/stable/1776364>

Accessed: 28-06-2016 05:57 UTC

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as well as by that wonderful waterway, the Casiquiari canal, which connects the Amazon and Orinoco river systems. His plan includes the removal or avoidance of the obstructions existing in the Rio Negro at San Gabriel and Camanaos in the 25-mile stretch of the river. He even proposes to open a commercial *route* from Manaos to Bogotá, and, as a result of his personal explorations, he states that "a natural, open, continuous detritic formation, or macadam, of 900 feet average width and uniform level, separates the Meta and Vichada rivers, and descends from San Martin, on the eastern slope of the cordillera of Sumapaz to the river Orinoco."

Since 1860, a treaty has been in existence between Brazil and Venezuela, which fosters a transit commerce between the two countries; but the obstacles to navigation have prevented the development of any important trade. No doubt, if they could be removed or avoided at a moderate expenditure, the upper valleys of the Orinoco and Rio Negro, which are very rich in indiarubber, might find an outlet *viâ* the river Amazon, and thus avoid the dangerous falls and rapids of the middle Orinoco. The Rio Negro is navigable for light-draft craft the entire year, except at the short stretch of rapids above named.

The production of indiarubber in the Casiquiari district is already considerable, and is stated to be about one hundred tons yearly.

In colonial times the border-land between the Amazon territory of Portugal and that of Spain in the Orinoco valley was held to be of much value by the respective contestants for its possession, and many small forts were built at strategic points. Among others, the fortresses of San Felipe, Marabitaná, and St. Gabriel were built between 1754 and 1763, and, on the confines of the Rio Branco branch of the Rio Negro, several points were fortified during the last half of the eighteenth century to also protect the district from advances up the Essequibo river, the portage across the water-divide being very easy, and only a mile long. Nearly all of the above-named forts were abandoned by 1788.

The Casiquiari canal was discovered in 1744 by the Jesuit father, Manuel Roman, and became the ordinary route between the Catholic missions of the Orinoco and Rio Negro.

Many writers have called attention to the possibility of connecting the Plata river system with that of the Orinoco by a navigable water route through the heart of the continent; but, so far as the upper Paraguay, the Guaporé, and river Madeira are concerned, it is a scheme impracticable of realization, owing to hundreds of miles of rapids and falls; but a project looking to the removal of the obstacles which exist between the Amazon and upper Orinoco, *viâ* the Rio Negro, and the establishment of a valuable avenue for traffic by steamers to develop the great resources of an immense area of country, seems to be worthy of careful, detailed study by the state of Amazonas.

G. E. C.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

SURVEYING.

Text-book of Topographical and Geographical Surveying.' By Major C. F. Close, C.M.G., R.E. London: Printed for H.M. Stationery Office by Harrison & Son; sold by Wyman & Sons. 1905. Price 3s. 6d.

Major Close has at last filled a gap in technical literature which has long wanted filling. For years past there has been a slow but very steady advance in English geographical schools, the tendency of which has been to place England more on a level with her continental neighbours in matters relating to the acquisition of map

knowledge of her widespread possessions beyond the seas, than was possible under the restrictions which necessarily distinguish Ordnance Survey methods. No standard work on topography, as applied to continents rather than counties, has previously existed in the English language, unless we make an exception of Mr. Wilson's 'Topographic Surveying,' which is certainly a valuable summary of the principles of the art from the American point of view. Major Close leaves nothing to the imagination, although he wisely confines himself to the strict limits of his subject, declining to enter into the tempting field of geodetic discussion (on which science there is already an ample literature), and dealing only with those practical issues which bear directly on the final attainment of sound topographical maps. For the first time, too, we have all those branches clearly defined, and the relative value of the map results properly co-ordinated with the object they are meant to serve. The place of topography in the wider field of geography is well maintained, and the principle that it is just as scientific to make approximately accurate mapping (so long as it will always fill its own place in the world's geography without error and without distortion) as to labour through all the preliminaries of geodetic arc measurements, and thus be left hopelessly behindhand in the practical results of useful map-making, is clearly intimated. In short, it is a practical work all through—as a text-book should be—and it is to be earnestly hoped that it will form the basis of topographical instruction in all the geographical schools in England.

So full and so complete is the work in the matter of forms, tables, and illustrations, that it would take a long time to refer to all those features of it which deserve special recognition. The illustrations are excellent, and if any criticism can be applied to them it is that they are almost too good. One or two specimens of the very roughest and readiest form of topographical art, as applied by highly trained Indian explorers to districts over which they may have to carry a reconnaissance at the rate of hundreds of square miles per diem, would not have been out of place in a work of this sort.

From the commencement of the book we note that Major Close insists on the importance of a preliminary basis of triangulation, or traverse, for topography, and rightly maintains the advantage of such a basis over any form, or combination of forms, of astronomical observation. His remarks on the preliminary base measurement include a reference to those newer methods which have been introduced by French experts, which render the process of rapid measurement so much more accurate than was formerly possible. It is for this reason, perhaps, that he does not insist forcibly on the necessity for a constant repetition of linear measurements during the extension of the reconnaissance (or "geographical topography"), which was adopted till lately as the best means of compensating error. All the most useful methods of carrying out what we may term irregular triangulation are well explained, but we may, perhaps, note that it has been found in practice *always* necessary to introduce an azimuth value derived from astronomical observation with the computations for interpolating a position by triangulation, whether from three or more points or from two. Whilst Major Close very rightly insists on the uncertainty which attends latitude checks owing to inconstant level deflection, he perhaps depreciates the value of such checks a little too far. The uncertainty must always exist, but in practice it has not been found to invalidate their usefulness to any great extent.

The chapter on the use of subense instruments for traversing purposes is most useful. It is an essential detail in topographical surveying which is often overlooked. The use of the plane-table is advocated by an expert at the process. One small detail may perhaps be emphasized even further than by the italics which

Major Close gives it. *Pins should never be used* to assist the plane-table to align his ruler. It is a slovenly expedient which is too often made use of. I have seen a plane-table that looked like a pin-cushion in a military school lately.

The chapter on "Surveys on Active Service" is altogether good. There is a point about map-reproduction in the field which is perhaps worth more discussion. The sun-printing processes (blue prints and the like) can be made use of with far greater facility than either lithography or zincography. The latter may be superior in their results, but the advantage of illustrating the first despatches after an action by a sketch-map made during its progress, and reproduced with the utmost rapidity, are not to be overlooked. It might very well happen that at the close of an extended action covering 8 or 10 miles of front, the position of every brigade could be indicated to the general commanding by means of a series of sketch-maps made during the course of the action, traced and printed within an hour or two, given that light was available. This would hardly be possible by any other means than sun-printing. On the subject of map projections Major Close is perhaps the best authority in England, and he treats the subject liberally. The story of British mapping might possibly be considered as hardly appropriate to a text-book; but the moral of it is far too important to allow of its omission. That moral is best given in Major Close's own words, "No system of sketching, no combination of sketches, and no compilation of previously unconnected material, whether sketches, isolated surveys, or from plans, will result in a trustworthy topographical map." The grand ruling principle of working from the whole to a part, and not *vice versa*, is the keynote of the whole book—the golden rule which must surely govern all English surveys in the great future before them.

The subject of astronomy as an adjunct to topography is well and fully illustrated. Due value is given to the various methods of determining longitude, and Major Close gives expression to the opinions of all experienced topographical and geographical surveyors in his summary of this subject. It might be expressed as follows: "Never take an observation for an abstract value of longitude if you can obtain that value differentially by telegraph; never use the telegraph if you can get a differential value by triangulation."

Taking it for all in all, it is the best book on topography that has yet appeared in the English language, and will certainly serve as a standard guide for all the many geographical schools in the country.

T. H. H.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

OCEAN COMMERCE.

'The Organization of Ocean Commerce.' By J. Russell Smith, PH.D., Instructor in Commerce, University of Pennsylvania, No. 17 of the series in Political Economy and Public Law of the Publications of that university. Philadelphia: 1905.

This is an excellent work, which must prove indispensable to all who are interested in commercial geography. The nature of the work is exactly indicated by its title. The volume develops systematically, with respect to ocean transport, the corollaries that flow from the great facts relating to transport—that commodities are always carried most economically in the largest vehicles, provided only that the vehicles can always be filled; that the cost of carriage is more or less enhanced where goods cannot be conveyed directly to their ultimate destination, but have to undergo one or more handlings and changes in the mode or the means of conveyance; that the loss of time in carriage is serious, especially in the case of certain commodities; and that losses are also involved in uncertainty as to the time of