PHOTOGRAPHIC SURVEYING, INCLUDING THE ELEMENTS OF DESCRIPTIVE GEOMETRY AND PERSPECTIVE

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TOPOGRAPHER and ASSISTANT,
Showing mode of carrying instruments.

PHOTOGRAPHIC SURVEYING

INCLUDING THE ELEMENTS OF

DESCRIPTIVE GEOMETRY

AND

PERSPECTIVE

BY

E. DEVILLE
Surveyor General of Dominion Lands

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PREFACE

The first edition of this book was issued in 1889. It was prepared solely for the use of the surveyors employed by the Department of the Interior on photographic surveys; the edition of fifty copies was lithographed in the surveys office. Some copies found their way outside, and, owing to the favourable comments which they received, the whole edition was exhausted in less than a year. Photographic surveys have since been undertaken for many purposes which were not contemplated at their inception, and a new edition of the book has become necessary for the guidance of the surveyors engaged in the work.

The photographic method is known by many names: photogrammetry, metrophotography, topophotography, iconometry, etc.

It seems that iconometry is the most appropriate name, because it expresses the principle of the method, which is to measure by means of perspectives. Whether the perspectives are photographs, or whether they are produced otherwise, is immaterial so far as the method is concerned. Neither this term nor any other has yet been generally adopted.

The conception of this method is due to Laussedat: his first experiments were made in 1849, the perspectives being drawn with a camera lucida. His paper on the subject, written in 1850, was published in 1854. Shortly after, he substituted photography for the camera lucida. He gave a full exposition of the method in various papers, and his work was so complete that little has been added to it since. Wherever photographic surveys are now made, they are executed by the application of the principles laid down by Laussedat.

In Germany, Meydenbauer was the first to give his attention to the new method. His investigations, commenced in 1865 or thereabouts, were continued by Jordan, Hauck, Koppe and many others.

In Italy, the celebrated engineer Porro, who was acquainted with Laussedat and knew his work, proposed for surveying purposes, a

camera built to receive spherical plates. The idea was not practical and was never carried out. In 1875 and 1876, some experiments were made by Lieutenant Manzi Michele, but they were not favourably received. To Major General Annibale Ferrero, Director of the Geographical Military Institute, is due the credit of initiating the ordnance photographic surveys of the present day. Their execution was entrusted to engineer L. Pio Paganini with a staff of able assistants. The work of the institute is very remarkable and deserves careful study.

In Austria, the first important surveys were made by Mr. Vincenz Pollack, chief engineer of the state railways. Some beautiful mountain maps have lately been printed by Giesecke and Devrient, of Leipzig, for the German and Austrian Alpine club. They are the work of S. Simon. He made use of the original ordnance survey, filling in the topographical details from photographs. These maps represent one of the most successful applications of photographic surveying. Schiffner's and Steiner's writings on the subject are among the best, and the Austrian instrument makers, such as R. Lechner or Starke and Kammerer, have surveying cameras of many patterns to select from.

It is in Canada that the method has received its most extensive application; it was first employed when the surveys of Dominion lands were extended to the Rocky Mountains. In the prairies, our operations are limited to defining the boundaries of townships and sections; these lines form a network over the land by means of which the topographical features, always scarce in the prairies, are sufficiently well located for general purposes.

In passing to the mountains, the conditions are entirely different. The topographical features are well marked and numerous; the survey of the section lines is always difficult, often impossible, and in most cases useless. The proper administration of the country required a tolerably accurate map, and means had to be found to execute it rapidly and at a moderate cost. The ordinary methods of topographical surveying were too slow and expensive for the purpose; rapid surveys, based on triangulations and sketches, were tried and proved ineffectual; then photography was resorted to.

Up to 1892, the photographic surveys were confined to the Rocky Mountains, in the vicinity of the Canadian Pacific Railway; at the

end of that year, they covered about 2,000 square miles. In the same year, an International Boundary Commission was appointed to examine the country along the boundary between Canada and the United States Territory of Alaska. The Canadian Commissioner, Mr. W. F. King, decided to carry out his share of the work by photography. In 1893 and 1894, his parties surveyed about 14,000 square miles.

Irrigation surveys were commenced last year in the south-westerly part of the North-west Territories, where the rainfall is not quite sufficient for agricultural purposes. In addition to the gauging of streams, the establishment of bench marks, etc., it is necessary to ascertain the catchment areas and to define the sites best adapted for reservoirs. For this purpose photography has again been resorted to in the foot hills and on the eastern slope of the mountains. It has, in this case, a peculiar advantage. Whether or not a site is a favourable one for a reservoir cannot be known until the plan has been partly plotted. It must be possible to bring water to the proposed place and to run it off; the capacity must also be adequate. If favourable, a detailed survey of the site is required. With the ordinary surveying instruments, a preliminary survey has to be made; if, after plotting it, the site is found favourable, the topographer has to go over the ground a second time to make a detailed survey. Or, the whole of the work may be executed at once, with the contingency that the detailed survey may turn out useless. With the camera, the plan may be plotted so far, and so far only, as required; the photographs which furnish a general plan, can be made to give all the detail wanted without going again into the field. Whether the site is a good one or not, there is no labour wasted.

Notwithstanding the many publications on photographic surveying, the great advantages assigned to it and the numerous experimental surveys executed, it has not yet come into general use; in many quarters there is still an adverse feeling against it. There is such a fascinating simplicity about the method that it is at first difficult to understand the reasons which prevent its adoption. Can anything more convenient be conceived than a method which enables a topographer to gather rapidly on the ground the material for his maps and to construct them afterwards at leisure in his office? In the first edition of this book, I endeavoured to explain this anomaly. The large scales of

European surveys were given as one of the reasons. Col. Laussedat took very strong exception to this explanation, contending that photography can be used to advantage whenever views can be had covering a large space of ground. His contention is no doubt correct; but the advantages are not so great then as with small scales. This can be illustrated by comparing a plane-table-stadia survey in a dry climate with a photographic survey. When the scale is so large, and the points fixed are so close together, that the topographer takes as much time to plot one point as the rodman takes to move from this point to the next one, then there is not a very great difference in the cost of the two surveys. The advantage of the photographic method is that the plotting being done in the office, the field expenditure of the topographer and the cost of his party during the construction of the map, are dispensed with. Against this, there is the disadvantage that the plotting by intersections is more laborious than the plane table plotting by directions and distances. It may be that the camera still has the advantage, but not to such an extent as with a small scale survey. All this, of course, rests on the assumption that the climate permits of outside work every day with the plane table.

The experience of eight years has modified my views on the causes which have prevented the adoption of the method. I am now inclined to believe that they are simply to be found in the failure of those who tried it. I soon discovered that the apparent simplicity of photographic surveying is a delusion, and, that under no circumstances has a topographer to display more skill and ability than when using the camera. He requires not only experience, but a combination of the faculties which make an accomplished topographer. Unlike other methods, it presents nothing before his eyes to show the progress of the work or the gaps that may exist in it. His undeveloped plates are his only records. Every time he exposes one, he must have present in his mind what it will give, what amount of information he can extract from it, what constructions he will apply, what further views are necessary and how they will combine. These acquirements are not the lot of every topographer, and unless a man is well qualified, his attempts at photographic surveying cannot be successful. All this, however, is only the beginning of the surveyor's troubles; it is in the purely photographic part of the work that he finds the most frequent cause of failure. The kind of views wanted, if they include distance, are the