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AERIAL PHOTOGRAPHIC INTERPRETATION

Principles and Applications

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President, Geotechnics and Resources, Incorporated

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AERIAL PHOTOGRAPHIC INTERPRETATION

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AERIAL PHOTOGRAPHIC INTERPRETATION

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PREFACE

This book is intended to be of use to a wide variety of readers who are, have been, or are going to be interested in the possibilities and applications of the *new natural science of aerial-photographic interpretation*. Until now, there has been no such general work to which such people could refer.

In the interest of usefulness, the book also devotes brief supplementary consideration to *photo analysis*, *photo reading*, and *photogrammetry*, particularly in terms of their relation to practical studies in the earth sciences.

In the first chapter of Part I, the reader will learn that interpretation is not the same subject that has gone by that name in military and scientific circles within the past few years, but that it is a new intellectual discipline, using induction and deduction, based upon wide knowledge, and that it treats the earth's surface as an integrated physical and ecological whole.

The remaining chapters of Part I, devoted to the elements of the photographic pattern together with their significance and interpretation, point out that the imperfect state of our present knowledge necessitates the completion of some honest and valid interpretations that are heavily qualified and even merely educated guesses. One will realize that interpretation as interpretation may be wrong and that its validity must remain a function of the knowledge and experience of the interpreter. In completing his perusal of Part I, the reader will be exposed to many of the uncertainties of interpretation and will become further convinced that reading alone will not "make" an interpreter.

Part II describes the formation of landforms composed of unconsolidated materials and their appearance as depicted in the aerial-photographic perspective. This will also provide an opportunity to practice the use and applicability of the principles presented in earlier chapters. Variations in pattern that are exhibited by rock types, as well as the reasons for their occurrence, may be studied.

In Part III, the reader may learn about the various ways in which the aerial-photographic techniques can contribute to the main terrain branches of *civil engineering*, to the many subdivisions of *geology and mineral exploration*, to *geophysical evaluation*, to *agricultural and land-use studies*, to *forestry and botanical studies*, to *urban planning* and other *regional investigations*, and to the general field of *military studies*. Last, and quite important, he will be able to read of various practical aspects associated with interpretive operations, as well as with the aforementioned basic aspects of photogrammetry.

For the *student*, young or old, at college or work, who wishes to learn and use interpretation, the recommendation is made that he begin at the beginning and proceed to the end, skipping only those chapters of Part III that are completely foreign to his field.

For the *teacher*, the arrangement of the book as a whole is believed suitable for classroom presentation. There are no classroom problems as such, this being left to the imagination and ingenuity of the instructor, who should have no trouble with such a broad spectrum of possibilities.

For the person who wants to use the book as a manual, it is possible to do so provided that basic sections are chosen for expansion along the lines of interest. Part I may be used as a manual of principles and elements, Part II as a manual of landforms and geomorphology as seen through the air photo, and Part III as a manual of practice.

For the *practical person*, who wishes to know what aerial-photographic interpretation can do, without caring how, the recommendation is made that he confine his reading to Chapter 1 and Part III.

When this effort was first envisaged, the author felt a certain amount of doubt concerning his ability to fill a whole book. He now, probably like most other writers, realizes the absurdity of such a doubt. Because of the variety of topics and factors that should be covered, the problem has not been one of filling a book but rather one of keeping the book to a reasonable length without excessive dispersiveness and/or cursory treatment.

Consideration has been given to the balance of fact, speculation, and opinion. It was originally thought that the book should be composed only of facts. This approach soon raised questions. What is a fact? And what opinion? What is experience? And what speculation? How are value and readability consistent with facts alone? The original approach was soon discarded. Facts appear, but so does speculation because speculation points to the future; and opinion because, in a "first" book of sorts, the author feels that opinion has merit (if only that it is a starting point for dispute).

As a last prefatory remark, let it be understood that the author hopes that this book will be read because of an unprejudiced interest in the subject. Agreement is not necessary, only interest. It has been the author's objective to include the essence of his (and others') experience, knowledge, and *current* understanding of a broad and complex subject, for the reader's consideration.

Donald R. Lueder

The author wishes to thank his wife, Jean, for aid in preparing the bibliography and index, together with his mother, Ethel M. Lueder, for much work on the illustrations. He also acknowledges, with much appreciation, their tolerance during the period in which this book was completed.

W. Radford and W. Bennett gave individual permission to use portions of their work.

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How does one acknowledge all the aid that is received in the preparation of a book? It is virtually impossible, since one would have to search back through his development to select those people who most guided and aided his training and progress as well as those who directly facilitated the production of the final synthesis, the book, *per se*. Only a few may be selected, therefore, and these, unfortunately, must be almost entirely restricted to persons in the latter category. With this in mind, the author begins.

First, he acknowledges the efforts of M. Dan Morris, who first encouraged him to produce a book and approached the publishers in his behalf. May everyone have such a friend.

Next, he must thank his major contributors: H. S. Scott, who prepared Chapter 20 on geophysics; R. N. Parkinson, for the sections on structural geology; Walter Creswick and W. H. Rockwell, for the chapter on agricultural surveys; and J. F. Cunningham and V. Merritt, for their discussions of forestry.

Other contributors have been Ta Liang, on landslides; F. M. Hanna, on the Airborne Profile Recorder; D. K. Erb, with a brief section on ground water; R. A. Dunbar, with a section on interpretation in tropical areas; and J. G. Wilkinson, with a section on photogrammetry. J. G. Wilkinson also reviewed the original manuscript in so far as it touched specifically upon photogrammetry, and many of his suggestions are incorporated herein.

To make one exception in this cataloguing of direct contributors, the author wishes to pay tribute to his original mentor and the true originator of the subject, D. J. Belcher. His early observations and presentations were largely responsible for the author's embarkation in the field.

Thanks for the use of their extensive aerial-photographic libraries are given to The Photographic Survey Corporation and Hunting Technical and Exploration Services Limited.

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I

Principles and Theories of Photo Interpretation

INTRODUCTORY STATEMENT

It is the primary purpose of Part I to define, indicate the significance of, and discuss the ramifications of the major and minor elements of the aerial-photographic pattern. These include *landform and rock type*, the *surface-drainage pattern*, *erosion features*, *gray tones*, and *miscellaneous details*.

A chapter is devoted to each of these subjects, and it must be emphasized that every attempt has been made to give them a fairly complete treatment, consistent, of course, with limitations on space and knowledge. In providing this treatment, fundamentals are discussed, but considerable space is also devoted to the exposition of affecting factors, supporting evidence, discouraging indications, and unknown quantities. This treatment is intended to show that, while each element has an a priori simplicity, its true significance is quite complex and may be contingent upon such things as academic knowledge, regional experience, selective field check, and photo experience.

Let the reader of this book, who is interested in learning the process of interpretation, make no mistake. A complete and thorough understanding of the subject matter of Chaps. 1 to 6 in all its complexity is absolutely essential to effective aerial-photographic interpretation.

This essence of the subject must be thoroughly absorbed before the material of Part II can be properly appreciated. To the extent that it is not absorbed, the reader will not truly obtain a full appreciation or become a really good interpreter.

There is one other point. The subject matter of Part I contains a certain small amount of material that may be found in other books, or may already be possessed by the reader. This is necessary to "set the stage," provide adequacy of treatment, or develop an approach. Most of it is set in small type and may be omitted by anyone who feels already proficient.

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