EXPLORATION GEOCHEMISTRY: DESIGN AND INTERPRETATION OF SOIL SURVEYS

in cooperation with The Association of Exploration Geochemists

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Editors
W.K. Fletcher, S.J. Hoffman, M.B. Mehrtens, A.J. Sinclair and I. Thomson

SOCIETY OF ECONOMIC GEOLOGISTS, INC.
Reviews in Economic Geology, Vol. 3

Exploration Geochemistry:
Design and Interpretation of Soil Surveys

in cooperation with
The Association of Exploration Geochemists

W.K. Fletcher, S.J. Hoffman, M.B. Mehrtens, A.J. Sinclair and I. Thomson, Editors
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Additional copies of this publication can be obtained from

Society of Economic Geologists, Inc.
7811 Shaffer Parkway
Littleton, CO 80127
www.segweb.org

ISBN: 978-1-629495-61-3
FOREWORD

Volume 3 of Reviews in Economic Geology—Exploration Geochemistry: Design and Interpretation of Soil Surveys—represents a major effort by and contribution from the Association of Exploration Geochemists (AEG) and especially its Vancouver connection. The volume draws extensively on the cumulative teaching, research, and industry experience of its five authors, and it contains numerous ‘real-life’ examples of exploration failures as well as successes. A preliminary version of this volume served as the text for a jointly sponsored Society of Economic Geologists (SEG)–AEG Short Course that was given in February, 1987, prior to the combined winter meeting of the SEG and annual meetings of the Society of Mining Engineers and A.I.M.E. in Denver, Colorado.

It has been a special pleasure to work with W. K. Fletcher (Department of Geological Sciences, U.B.C.) whose patience and sense of humor survived the herculean task of initial text and figure assembly. He met his deadlines despite the vagaries of changing figure specifications, colleagues’ schedules, and the Canadian Postal System.

Volume 3 has benefited greatly from the professional attentions of Carol Hjellming (New Mexico Bureau of Mines and Mineral Resources editing staff) who now serves as the part-time official assistant to the Series Editor. In addition to performing more traditional editorial chores, Carol has been instrumental in setting up the procedures and print codes that allowed us to utilize the computer-driven typesetting equipment of the University of New Mexico Printing Plant.

Finally, I wish to acknowledge the continuing support, both moral and economic, of the New Mexico Bureau of Mines and Mineral Resources and its Director, Frank Kottlowski.

James M. Robertson
Series Editor
Socorro, N. M.
April, 1987
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TABLES OF CONVERSION FACTORS . Inside back cover
PREFACE

The principles and practical considerations underlying utilization of soils as a medium for exploration geochemistry are well described in several textbooks. Moreover, not only are soil surveys routinely undertaken in such diverse environments as tropical rainforests and arctic permafrost, soils are probably the most frequently collected and analyzed medium in exploration geochemistry. What, then, is the justification for devoting the third volume in the Society of Economic Geologists Reviews in Economic Geology to this apparently routine, well established prospecting method?

Unfortunately, it is the experience of the contributors to this volume that effectiveness of soil surveys is often compromised when the conceptual simplicity of the method leads to its unthinking application. For example, failure to appreciate the characteristics of the geochemical environments of a landscape can lead to collection of the wrong sample material or choice of unsuitable methods of sample preparation and analysis. Similarly, emphasis on speed rather than quality of sampling, rigid adherence to standard laboratory methods, and simplistic interpretations of high values can result in exploration dollars being wasted on false anomalies while genuine, but more subtle, anomalies go unrecognized or are assigned low priorities. In contrast to the foregoing, rational application of soil surveys depends on the successful selection and linkage of appropriate methods of sample collection, analysis, and interpretation—often on the basis of an initial orientation survey. Decisions must be made at each step and an error at any single step may jeopardize the entire exploration effort.

Chapters in this volume discuss each step in the soil survey from sample collection through analysis and statistical interpretation of the data to selection of targets for followup. Factors to be considered and the decisions that must be made are illustrated by numerous examples and case histories. However, rather than presenting the case histories in a simple narrative fashion, we have attempted to challenge the reader, by asking questions as each case history unfolds, to become a participant in the exploration process. In some—but not all—cases we have provided answers (or our opinions as to what reasonable answers might be). The case histories are largely from our own experience and many reflect our geographical bias towards northern glaciated regions. We do not believe this to be a deficiency insofar as this volume is intended not as a comprehensive guidebook to interpretation of soil surveys but as an introduction to undertaking surveys in a thoughtful and logical fashion. Indeed this volume will be a success if its omissions provoke you into asking similar (though not necessarily the same) questions of your own geochemical landscapes and soil surveys.

ACKNOWLEDGEMENTS—In preparing this volume the authors were assisted by many individuals and organizations who generously contributed their time, technical facilities, experience, and comments. We are especially grateful to our respective employers for their support and freedom to use company case histories even when these were not entirely flattering. Of the many who encouraged and assisted, the following deserve special mention: Riofinex and CARGO Partners for giving M. B. Mehrtens use of the Coed-y-Brenin and Tonkin Springs case histories, respectively; BP-Selco, D. K. Mustard, C. M. H. Jennings and G. G. Mitchell for their assistance to Stan Hoffman; and Placer Development Limited for their support of Ian Thomson's contributions. Donna M. Baylis greatly assisted K. Fletcher in editing and preparing the text. Finally, we must acknowledge the patience of Jamie Robertson, Series Editor, Reviews in Economic Geology, and the support of both the Association of Exploration Geochemists and the Society of Economic Geologists.

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