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Preface

The study of ground water is like the study of any other geologic field: It requires one to go outside and get dirty, observing firsthand the processes at work in and on the earth. As with most geologic specialties, most of the action takes place underground, out of sight. Successfully piecing together the puzzle of what is happening depends on the geologist’s ability to think in four dimensions, to use imagination, and to extract the maximum amount of information possible from the skimpiest of clues.

In hydrogeology, as with other geologic specialties, we get some information by relying on “outcrops.” Outcrops of water are springs, streams, lakes, and oceans. We also use test borings, geophysical studies, chemistry, physics, and loads of common sense to determine what is going on underground. But unlike most other geologic fields, in hydrogeology, the object of our study moves about, even as we study it. This presents a different set of challenges. It is made all the more compelling because of the environmental and social costs of ignorance of ground water movement. And as a young field, hydrogeology is only now defining its standard practice. Although standard texts exist that define the practice of field geology (notably Compton’s Geology in the Field), few describe the practice of field hydrogeology. This book attempts to do so.

This text is intended for two audiences. It may be used as a textbook for courses in field hydrogeology at the junior/senior undergraduate or beginning graduate level. It also is intended to provide background for entry-level professional hydrogeologists who wish to review basic concepts before their first day on the job.

What This Book Is
This book describes basic field techniques in hydrogeology. It begins by explaining the steps and considerations in planning a field study. It devotes a chapter to field techniques in surface water, and then moves on to ground water. Following these are chapters on methods and considerations for describing soils and rocks, drilling boreholes, designing and installing wells, and sampling and analyzing well water. The book details construction of hydrogeologic maps, cross-sections, and flow nets. And, finally, it describes some typical field situations the entry-level hydrogeologic professional is likely to encounter.

What This Book Is Not
This book is not a basic textbook in hydrogeology. It assumes that the reader has completed an introductory course in hydrogeology. It does not define basic terms
or explain basic concepts. Nor is it a text in geology. The reader should be familiar with sediments, rocks, minerals, and geomorphological landforms.

This book is not an explication of regulations pertaining to ground water. A complex hierarchy of statutes and regulations on the federal, state, and local levels governs investigations into ground water supply, contamination, and remediation. For the ground water consultant or engineer, it is imperative that these be studied and adhered to. However, an overview of these regulations in this book would have to be so general as to be of limited use. It probably also would be out-of-date before the book's ink is dry, due to the rapidly-changing nature of the field. Hydrogeologists affected by these regulations should study them in another source.

This book is not a text on safety at field sites. Although it points out some commonsense safety rules and practices, many hazards and dangers exist that are specific to a field site, job, situation, and moment in time. Health and safety plans should be formulated by a qualified health and safety officer for any field job.

Knowledgeable readers will notice that some important topics have been left out of this text. To keep the book to a compact and field-portable size, the number of topics investigated was necessarily limited. Perhaps most notable among methods not included here are those in field geophysics. Readers are advised to consult texts in that field (for example, see Burger, 1992).

A Note to Students and Teachers
This book may be used as a text for a course in field hydrogeology. Topics explored in such a course may be tailored to suit the region and interests of the class, using this text as a guide. The class should be scheduled to include sessions at least six hours long, to provide ample time for travel to and from field sites and for performing field tests. Hydrogeological field camps are an ideal setting in which to learn hydrogeology. However, field hydrogeology can be taught and learned even in fairly conventional academic situations.

Why Field Hydrogeology?
My first field experience in hydrogeology was a trip led by Professor Sam Harrison, then at Allegheny College in northwestern Pennsylvania. He had been asked by a client to investigate and characterize the hydrogeologic conditions at a site, and he took our hydrogeology class there one rainy spring afternoon. I was excited by the prospect of seeing a real live hydrogeology project underway.

I am not sure what sort of drama and excitement I expected to find at the site. Perhaps I expected a network of wells, large enough for a 19-year-old to clamber into and watch water seep through the sides. Perhaps I imagined a huge trench, the wall of which would be a cross-section of the earth, layers of sediment and rock clearly delineated, and an upside-down triangle marking the water table.

Whatever I expected, I was sorely disappointed with the real thing. When we got to the site, it looked like a field. An empty field. No excitement; no drama. I learned a valuable lesson in that field: The real excitement of hydrogeology, the real drama of ground water, takes place in a hidden world beneath our feet. In a
subterranean network of tiny pores, cracks, and solution cavities, cool, sparkling fluids seep and percolate, dreadful toxins glide silently along, dissolved cations aimlessly zigzag past one sand grain after another, then happen on a crystal of clay and are adsorbed for a millennium.

To play a part in the drama, or even to discern the plot, we must piece together the clues given to us in well-water levels, chemical concentrations, and borehole logs. This book provides some keys to unlocking the mysteries.

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