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Applications Manual for PORTABLE MAGNETOMETERS

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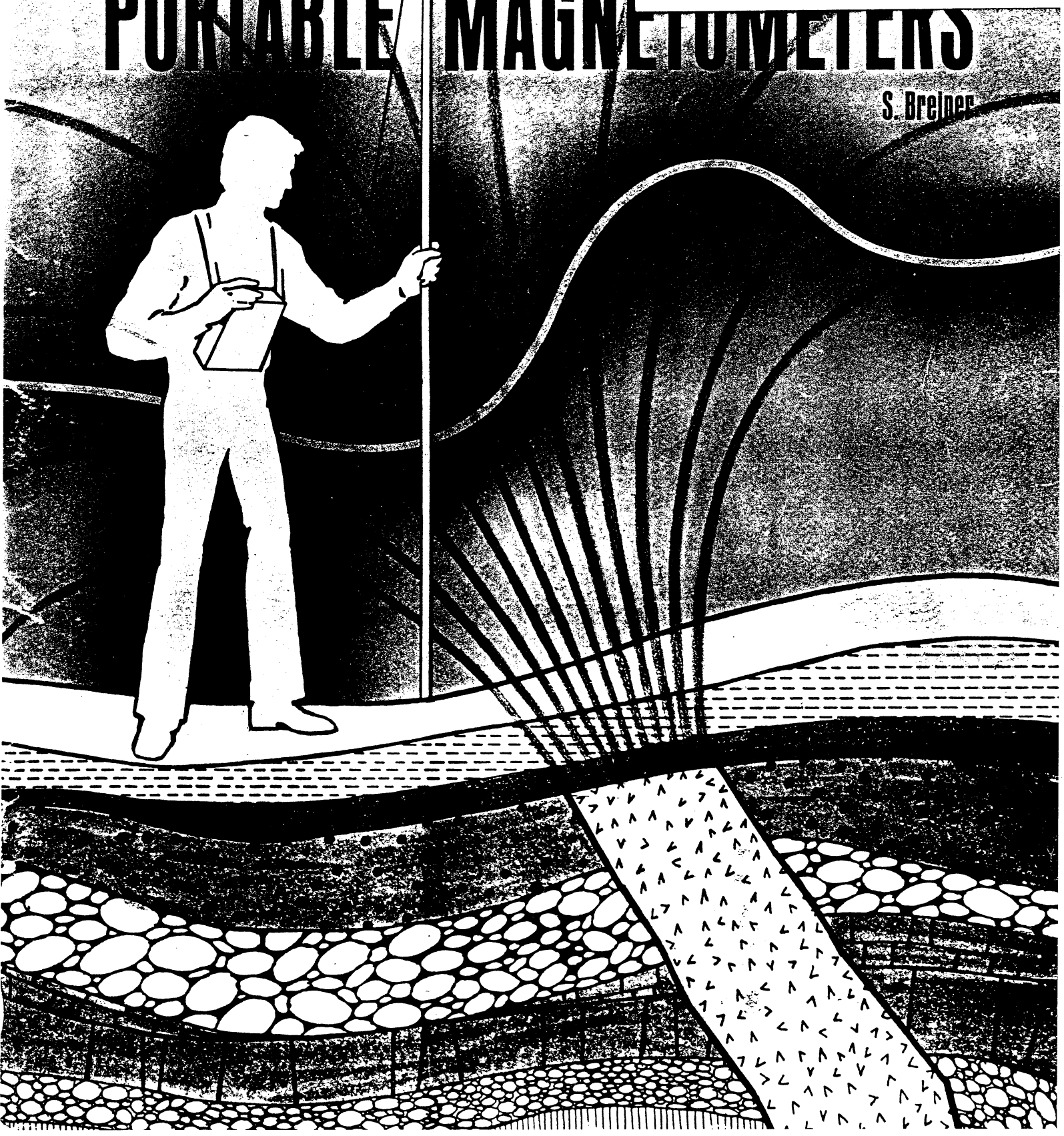

APPLICATIONS MANUAL FOR PORTABLE MAGNETOMETERS

by

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PREFACE

This Manual was written to satisfy most of the needs of the average user of a portable total field magnetometer for both conventional and unconventional applications, including geological exploration, search for lost objects, magnetic measurements of rock or iron specimens and archaeological prospecting. As the name implies, this is a manual or guide for professional and non-professional persons who may not have the time, the requisite background or the ready access to the proper libraries to delve deeply into standard texts, the few that there are, on applied geophysics.

Some of the information that I have included in this Manual may be found in the references cited or drawn from obscure sources, or uncovered amongst equations and confusing terminology in physics or engineering texts. Many of the facts and instructions in this Manual, however, do not appear anywhere else in print. For example, I know of no other readily available reference on the subjects of magnetic search of buried objects, many of the portable gradiometer applications, operational considerations of proton magnetometers and the effect of electrical currents on portable total field magnetometers. Among the less common subjects that are covered are the magnetic properties and detection of common steel objects, facts concerning the detection of buried ruins, methods for sketch-it-yourself anomaly construction, and some help in interpreting anomalies at the magnetic equator. I also tried to simplify some aspects of the potentially complex subject of magnetics using short-cuts wherever possible and deskilling somewhat the fine art of magnetic interpretation. For most portable magnetometer work, I feel this approach is quite adequate. Certainly for the more sophisticated techniques required for interpretation of the usually-more-precise aeromagnetic surveys, the reader is advised to consult the References or persons knowledgeable in the subject.

Figures and examples are used liberally in the explanations because I feel they assist or confirm one's understanding of these subjects. Almost all of the profiles were drawn free-hand according to the techniques described and should not be considered as precise computer-derived curves. They do demonstrate that one can be his own 'magnetics expert' insofar as what is required for most of these applications.

The question of units always arises in any technical publication. Many magnetic measurements, particularly magnetic properties of rocks and geophysical research, use cgs, some physics and engineering applications use mks, while geophysical exploration, for most of the readers of this Manual, still utilizes feet and miles. A mixture of units, hopefully not too confusing, was therefore unavoidable. Subsequent editions of this Manual may be written specifically in carefully selected metric units.

The various chapters were prepared to be read or utilized independent of each other if necessary. For example, someone interested in using the magnetometer for archaeology but who does not particularly enjoy wading through the mathematics of Chapter V, can proceed directly to Chapter VII. He would be aided, however, by subsequently skimming through Chapter V.

I would appreciate criticism or suggestions should anyone note errors or have suggestions on how I may improve later editions. Moreover, if the reader finds that my explanations or facts fall just short of what is required, I am available by telephone or through written correspondence.

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Contents

(continued)

Contents *(continued)*

I.

INTRODUCTION

This Manual is intended for use as a general guide for a number of very diverse applications of portable magnetometers, especially the total field proton (nuclear precession) magnetometers. The diversity of applications and the general complexity of magnetic field measurements limits the depth to which any one subject can be covered, but further information, if desired, can be obtained through the author or from any of the references cited.

Among the applications for which this Manual is written are mineral and petroleum exploration, geological mapping, search for buried or sunken objects, magnetic field mapping, geophysical research, magnetic observatory use, measurement of magnetic properties of rocks or ferromagnetic objects, paleomagnetism, archaeological prospecting, conductivity mapping, gradiometer surveying, and magnetic modeling. The terminology, units of measurement, and assumed prerequisite knowledge are those employed in the field of geology and geophysics.