

THE COLLECTIVE REVIEW PAPERS PRESENTED AT THE 6TH IAGA WORKSHOP ON ELECTROMAGNETIC INDUCTION IN THE EARTH AND MOON

Preface

The 6th Workshop on Electromagnetic Induction in the Earth and Moon took place during the week of August 15–22, 1982 in Victoria, the capital city of British Columbia, Canada. It marked the 10th anniversary of the very first such workshop which was organized in Edinburgh in 1972. In the interim period biennial workshops have been held successively in Ottawa, Sopron, Murnau and Istanbul. It was originally intended to hold the 6th Workshop in Livermore, California, U.S.A., but early in 1982 unforeseen circumstances necessitated its transfer to another location. The Programme Committee invited the Physics Department at the University of Victoria to act as the new host of the Workshop in the hope that its relative nearness to Livermore on a global scale would not cause the serious disruption of travel arrangements for some delegates that might otherwise have occurred.

Despite the late change of location, the eventual registration of 143 participants representing 16 different countries and all 5 continents made this the best attended of the six workshops held so far. The Workshop was sponsored, as usual, by the International Association of Geomagnetism and Aeronomy and received financial support from the International Union of Geodesy and Geophysics. The Local Organizing Committee is also most grateful to the University of Victoria, the Department of Energy, Mines and Resources, Canada, and the Natural Sciences and Engineering Research Council of Canada for the provision of generous financial assistance at very short notice. Without their support the Workshop could not have taken place.

The scientific programme was divided into 10 sessions. Session 1 (Electromagnetic instrumentation), which was organized partly as a poster session, and Session 10 (Electromagnetic studies in the lithosphere and asthenosphere, including shield and active regions) consisted of contributed papers only. All the other sessions were introduced by a 30 min review paper presented by an invited speaker, followed by shorter contributed papers. A total of 105 scientific papers were read at the meeting. As Chairman of the IAGA Working Group I–3, Professor A. Ádám of Hungary presided over the closing session which included short reports summarizing the principal results presented in the scientific sessions followed by concluding remarks by the Chairman.

With the appearance of this Special Issue the tradition (initiated at the Edinburgh Workshop) of publishing the review papers in a single journal issue is maintained. There are now six of these special issues – the last three published by *Geophysical Surveys* – which together serve as an invaluable reference source for researchers working in the field of electromagnetic induction. It is also hoped that these surveys of the latest developments in electromagnetic studies of the Earth and the role that these

studies play in geophysical investigations will be of interest to general readers of this journal. For the benefit of this wider readership we summarize below the topics covered by the individual reviewers, and indicate how together they contribute to our general understanding of the electrical properties of the Earth.

The first four papers are theoretical in nature and deal with the problems of inversion (inferring the conductivity of the Earth from electromagnetic data collected at its surface) and of forward modelling (calculating the electromagnetic response of a given conductivity structure to a given source). The paper by Parker is a timely review of the one-dimensional inversion problem. Although several methods have been developed for constructing profiles compatible with real data, Parker points out that the major task of making geophysically useful inferences about the class of acceptable one-dimensional models is still largely incomplete. The same can also be said of forward modelling in three dimensions where much work also remains to be done. In the next two papers Hohmann and Varentsov bring us up-to-date on the 'state of the art' in this subject with their surveys of the various algorithms based on differential equation, integral equation or hybrid methods that have been developed over the past few years. These two papers nicely complement each other with Hohmann concentrating mainly on work reported in the North American and Western European journals whereas Varentsov, who unfortunately was unable to present his paper in person at the Workshop, brings to our attention the important contributions to the subject recently made by scientists in the USSR. Forward modelling in three dimensions is one way of shedding light on the vexed question of 'current channelling' – the guiding of remotely induced currents by local conductivity anomalies. In an exhaustive review of this controversial topic A. G. Jones considers the evidence from field data and laboratory model studies as well as from numerical modelling. He concludes that the phenomena attributed to channelling can sometimes be explained more simply by direct induction while in other cases the question remains open. Doubtless we shall hear more on this subject at future workshops.

The remainder of the reviews deal to a large extent with the experimental and applied aspects of electromagnetic induction studies. Law reviews applications of recent marine sea floor electromagnetic measurements to the study of the thickness of the lithosphere, the electrical conductivity structure of the sea floor, the effect of oceans on the geomagnetic field, and the flow structure of ocean currents. He concludes with a brief discussion of the role the Earth's magnetic field may play in affecting the migration of fish. Ward gives a thorough review of controlled source electrical methods for crustal studies, and provides bases for selecting appropriate methods for specific exploration situations. He includes useful illustrations that clarify the various techniques as well as figures of typical results displayed in ways appropriate for geophysical interpretation. Alabi brings together up-to-date information on magnetometer array studies carried out in the various regions of the world including Africa, Australia, India, North America, Scandinavia, Scotland, and the USSR. He discusses the treatment and interpretation of array data and concludes that the increasing activity in array studies is surely leading to clearer pictures of the tectonics on a continental scale. Berkthold deals

with the specific application of electromagnetic methods to the investigation of geothermal regions. He reviews a wide range of techniques (employing either natural or artificial source fields) suitable for studying different geothermal structures. Electrical and electromagnetic techniques prove particularly successful since the distribution of resistivity in a geothermal area is determined by both the host rock distribution and the actual object of the search, the hot water. Laštovičková gives a timely review of worldwide laboratory measurements of electrical properties of rocks and minerals. Since electromagnetic studies of the Earth depend so strongly on the conductivity structure, it is most essential that the electrical properties of rocks and minerals in the Earth's crust and mantle be well understood.

A day of relaxation midway through the Workshop took the form of a one day sight-seeing excursion along the beautiful Malahat Drive on Vancouver Island, a ferry trip from Nanaimo to Horseshoe Bay on the Mainland, travel through Capilano Canyon to Grouse Mountain followed by the return to Victoria via Vancouver and the ferry cruise through the Gulf Islands. In addition visits to the nearby Pacific Geoscience Centre, the Institute of Ocean Sciences and the Butchart Gardens were enjoyed. It is planned to hold the 7th Workshop in 1984 at the University of Ife in Nigeria.

*Department of Physics,
University of Victoria,
Victoria, British Columbia,
Canada, V8W 2Y2*

H. W. DOSSO and J. T. WEAVER
Guest Editors