

Foreword

Problems related with salt-water intrusion into aquifers continue to attract the attention of hydrogeologists, researchers interested in earth sciences and professionals. This is due to the combination of several factors, such as the growing and diversity of hydraulic, water supply, environmental protection and land use problems to be considered, the increasing use of groundwater, the construction of challenging infrastructures and water works, the increasing concern on environment preservation and freshwater quality, and the recently acknowledged value of brackish and saline groundwater as a source for desalinisation.

The physical and chemical processes which explain saline water behaviour in the ground and the characteristics of coastal aquifers are currently well understood. The tools to carry out studies and assessments of many different kinds and purposes are already at hand. But in fact, only a part of hydrogeologists and groundwater professionals understand in depth the complexity of flow and mass transport in real media under variable water density conditions. Also, the means to get a more or less complete set of observations are often not available, and then specialists must rely on partial information or data that mix the behaviour at different depths. More practical experience is still needed as well as good examples and simplified methods, with a good definition of their applicability and limitations. Also, new knowledge on deep formations, on groundwater flow near or through soluble formations, and on trace substances behaviour in saline groundwater is needed.

The management of coastal aquifers and of continental aquifers that may be affected by saline water intrusion is an issue of growing interest due to the increasing pressure for groundwater development, leading to an intensive use of groundwater resources. This involves not only how to develop groundwater, but how to deal with technical, administrative, legal and property restrictions, and the technical and managerial implementation means to protect and restore water bodies and the environment.

Many of the issues at the stake are the competence of hydrogeologists, in its broad meaning, but some aspects are the competence of specialists in other disciplines, whose contribution is needed to advance groundwater knowledge and technology and to accomplish social goals. This means openness to other disciplines and knowledge transfer not only to hydrogeological groups, but to the different diffusion centres and gatherings events involving other sciences, managerial interests, administrative, social and policy environments.

The Salt Water Intrusion Meeting (SWIM) is a very loose contact group of specialists on saline water problems and coastal aquifers, from mostly European countries, that almost 40 year ago decided to start regular meetings to show and share their progress in the subject. Neither a permanent organisation nor secretariat exists, but the good relationships among researchers and professionals. New people are being engaged as the older ones retire. Each meeting, on a biennial basis, is organized by a national group of experts or by an institution which offers to do it in previous meetings. They are charged with the task by the SWIM group through agreement of its senior members, who help in finding candidates to arrange and

organize the following meetings. Up to now candidates have appeared, and the meetings – 18 with the present – have been convened in places of the Baltic, North Atlantic, Atlantic and Mediterranean areas. It is hopefully expected that this way of doing things will continue as such in the future. From Miedzidszroje (Poland) and Delft (The Netherlands) now to Cartagena, and next to Cagliari (Sardinia, Italy), and then to Aveiro (Portugal) or Ghent (Belgium). SWIM is informal but, once a place is decided, the support of local and international organizations is welcome. Along the history of SWIM, UNESCO and the International Association of Hydrogeologists (IAH) have been frequent partners.

The Salt Water Intrusion Meetings have been and are a nice opportunity for sharing knowledge and new developments among hydrogeologists and other persons interested in the same problems. This is the reason why SWIM progressively opens to other scientists and professionals. A meeting every two years, in a dominantly European environment – but progressively opened to other continents – is a welcome event to show progress, maintain personal links and open new possibilities and frontiers. Although the progress produced in two years may not be too much, there are always some new developments, projects, studies and observations, and also changes in the framework, like that produced by the European Union Water Framework Directive and the coming one related to the Groundwater (Daughter) Directive under discussion. This justifies continuing with the traditional pattern.

The meeting in Cartagena has attracted 135 scientists and professionals: 103 from 12 European countries and 32 from other parts of the world (North America, South America, North Africa, Near and Middle East, Asia and Australia). After a selection stage they have contributed 95 communications, both oral and as posters. They contain some new knowledge and open new perspectives to the saltwater intrusion issue that were duly considered during the meetings. However, for the preparation of a printed book it was decided to select material contributing some significant new knowledge, and submit them to a peer review procedure before being accepted. The result of this process is this book. Not all the initially selected material is available, since some authors decided to send their contribution to journals or have had not the time to complete the paper, or their research or study was not sufficiently advanced at the moment to present final results. A few papers that were offered but not presented due to last moment problems have been included, since their contents are of interest. The full printed information is included too in the Compact Disc accompanying this book, in which also the coloured version of some figures is included.

Printed papers have been classified into seven sections after the dominant topic, but sometimes this arrangement is quite arbitrary since a paper may deal with more than one aspect. The categories in which the 59 papers presented in this publication have been classified are the following:

- 1) Saline water intrusion dynamics
- 2) Modelling of saline water intrusion
- 3) Geological and hydrogeological aspects in saline water intrusion
- 4) Geophysics in saline water intrusion
- 5) Hydrogeochemical and isotopic aspects in saline water intrusion
- 6) Saline water intrusion and aquifer management
- 7) Case studies

The 18th Salt Water Intrusion Meeting held in Cartagena is the result of the invitation and the organizational effort of the Technical University of Cartagena (UPCT) and the Geological Survey of Spain (IGME), with the support of the Technical University of Catalonia (UPC). Important supporters and contributors to the meeting are the UNESCO's International Hydrogeological Programme (IHP), the International Atomic Energy Agency (IAEA) and the International Association of Hydrogeologists (IAH-AIH), both through the international council and the Spanish Chapter. This support has also allowed inviting some experts from developing countries to share their experiences with "SWIMMERS" and show what is being done on saline water problems in aquifers. The participation of some SWICA promoters has also contributed to enlarge the scope of the meeting and strengthen the links between both initiatives.

Our acknowledge have to be extended to some firms that have contributed to make the meeting more effective, and also to the different persons who have volunteer to help in the organization and running of the meeting. The Seneca Foundation, Regional Agency for Science and Technology of the Murcia Autonomous Government, have provided financial support for the manuscript preparation and dissemination.

This publication is financed by the Geological Survey of Spain (IGME) by including it in its publication series on Hydrogeology and Groundwater. We would like to thank the efforts of Mr. Argimiro Huerga, who made the required arrangements, and to the Editorial Commission for the effort in making the final review.

Luis Araguás, Dr. Geol.
Instituto Geológico y Minero de España (IGME)

Emilio Custodio, Dr. I. E.
Universitat Politècnica de Catalunya (UPC)
(former Director of IGME)

Marisol Manzano, Dr. Geol.
Universidad Politécnica de Cartagena (UPCT)

April 2005