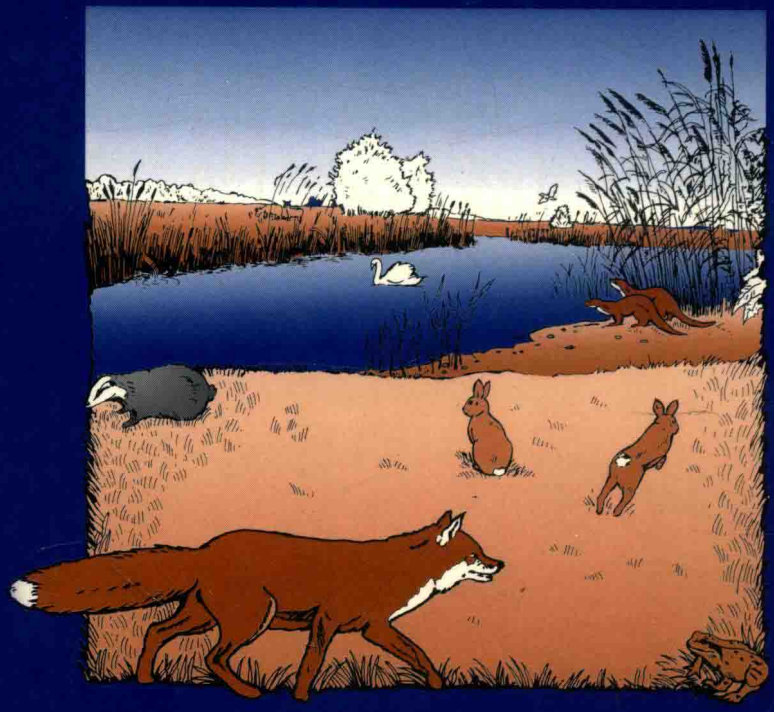
UNDERSTANDING OUR ENVIRONMENT

An Introduction to Environmental Chemistry and Pollution

Third Edition



Edited by R.M. Harrison

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An Introduction to Environmental Chemistry and Pollution

Third Edition

Edited by

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Preface

The field of environmental chemistry goes from strength to strength. Twenty-five years ago it existed in the UK in the form of a few isolated research groups in Universities, Polytechnics, and Research Institutes, but was very definitely a minority interest. It was not taught appreciably in academic institutions and few books dealt with any aspect of the subject. The awakening of environmental awareness, first in a few specialists and subsequently in the general public has led to massive changes. Environmental chemistry is now a component (optional or otherwise) of many chemistry degree courses, it is taught in environmental science courses as an element of increasing substance, and there are even a few degree courses in the subject. Research opportunities in environmental chemistry are a growth area as new programmes open up to tackle local, national, regional, or global problems of environmental chemistry at both fundamental and applied levels. Industry is facing ever tougher regulations regarding the safety and environmental acceptability of its products.

When invited to edit the second edition of 'Understanding Our Environment', I was delighted to take on the task. The first edition had sold well, but had never really met its original very difficult objective of providing an introduction to environmental science for the layman. It has, however, found widespread use as a textbook for both undergraduate and postgraduate-level courses and deserved further development with this in mind. I therefore endeavoured to produce a book giving a rounded introduction to environmental chemistry and pollution, accessible to any reader with some background in the chemical sciences. Most of the book was at a level comprehensible by others such as biologists and physicians who have a modest acquaintance with basic chemistry and physics. The book was intended for those requiring a grounding in the basic concepts of environmental chemistry and pollution. The third edition follows very much the same ethos as the second, but I have tried to encourage chapter authors to develop a more

international approach through the use of case studies, and to make the book more easily useable for teaching in a wide range of contexts by the incorporation of worked examples where appropriate and of student questions. The book is a companion volume to 'Pollution: Causes, Effects and Control' (also published by the Royal Society of Chemistry) which is both more diverse in the subjects covered, and in some aspects appreciably more advanced.

Mindful of the quality and success of the second edition, it is fortunate that many of the original authors have contributed revised chapters to this book (A. G. Clarke, R. M. Harrison, B. J. Alloway, S. J. de Mora, C. N. Hewitt, R. Allott, and S. Smith). I am pleased also to welcome new authors who have produced a new view on topics covered in the earlier book (A. S. Tomlin, J. G. Farmer, M. C. Graham, and A. Skinner). The coverage is broadly the same, with some changes in emphasis and much updating. The authors have been chosen for their deep knowledge of the subject and ability to write at the level of a teaching text, and I must express my gratitude to all of them for their hard work and willingness to tolerate my editorial quibbles. The outcome of their work, I believe, is a book of great value as an introductory text which will prove of widespread appeal.

Roy M. Harrison
Birmingham

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CHAPTER 1

Introduction

ROY M. HARRISON

1 THE ENVIRONMENTAL SCIENCES

It may surprise the student of today to learn that 'the environment' has not always been topical and indeed that environmental issues have become a matter of widespread public concern only over the past twenty years or so. Nonetheless, basic environmental science has existed as a facet of human scientific endeavour since the earliest days of scientific investigation. In the physical sciences, disciplines such as geology, geophysics, meteorology, oceanography, and hydrology, and in the life sciences, ecology, have a long and proud scientific tradition. These fundamental environmental sciences underpin our understanding of the natural world, and its current-day counterpart perturbed by human activity, in which we all live.

The environmental physical sciences have traditionally been concerned with individual environmental compartments. Thus, geology is centred primarily on the solid earth, meteorology on the atmosphere, oceanography upon the salt water basins, and hydrology upon the behaviour of freshwaters. In general (but not exclusively) it has been the *physical* behaviour of these media which has been traditionally perceived as important. Accordingly, dynamic meteorology is concerned primarily with the physical processes responsible for atmospheric motion, and climatology with temporal and spatial patterns in physical properties of the atmosphere (temperature, rainfall, *etc.*). It is only more recently that *chemical* behaviour has been perceived as being important in many of these areas. Thus, while atmospheric chemical processes are at least as important as physical processes in many environmental problems such as stratospheric ozone depletion, the lack of chemical knowledge has been extremely acute as atmospheric chemistry (beyond major component ratios) only became a matter of serious scientific study in the 1950s.