

Preface to the Second Edition

The first edition of *Hydrochemistry* was published in 2015. Gratifyingly, the textbook has been well received by the readers, in particular students and lecturers. Therefore, encouraged by the publisher, I decided to provide an improved and extended edition of the book.

The general structure of the book has been retained. However, in order to support the active acquisition of knowledge, the number of examples and problems to be solved by the reader has been significantly increased compared to the first edition. The text is now supplemented by 63 examples within the text. The number of problems to be solved by the reader has been increased to 70.

The problem of the increase in the atmospheric CO₂ concentration and the resulting impact on aquatic systems receive now more attention at various points in the book. In the respective examples and problems, the atmospheric CO₂ concentration has been updated.

Some chapters have been extended by additional topics, for instance, new aspects of water quality (Chapter 1), temperature dependence of equilibrium constants (Chapter 5), coupling of gas–water partitioning and chemical reaction (Chapter 6), relationship between photosynthesis and the carbonic acid system in surface waters (Chapter 7), establishment of redox half-reaction equations (Chapter 10), and sorption-influenced subsurface solute transport (Chapter 12). Furthermore, some minor revisions of the text have been carried out.

I hope this edition will be as well received as the previous one. Thanks to the staff of the publishing house, De Gruyter. I appreciate the fruitful cooperation.

Eckhard Worch
June 2022

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Yet another book on hydrochemistry? This question could arise if one has in mind such famous and well-known standard textbooks as *Aquatic Chemistry* by W. Stumm and J. J. Morgan and *Water Chemistry* by M. M. Benjamin. However, students who have just started studying hydrochemistry often feel overwhelmed with the amount of information presented in these comprehensive monographs of about 1 000 and 700 pages, respectively. What they are looking for is a shorter textbook that provides an easy step-by-step introduction to hydrochemistry, that requires little prior knowledge in chemistry, and that facilitates easier access to the more comprehensive textbooks. This book is intended to close this gap. It is based on over 20 years of experience in teaching hydrochemistry at a beginner level for students of various science and engineering study courses.

This textbook introduces the elementary basics of hydrochemistry in a compacted form with a special focus on reaction equilibria in aquatic systems and their mathematical description. It is designed as an introductory textbook for students of all environment-related courses who are taking their first course in hydrochemistry.

After a short introduction in Chapter 1, basic information on the chemical substance “water” and its extraordinary properties are provided in Chapter 2. Chapter 3 deals with the concentration measures that are needed to quantify the content of water constituents and with the activities as the effective concentrations in reactions. Then, some general properties of aqueous solutions that are independent of the chemical nature of the solutes and that depend only on their concentrations (the so-called colligative properties) are discussed in Chapter 4. Chapter 5 leads to the main part of the book on the different chemical equilibria in aqueous systems, and provides some basics on the chemical equilibrium and its mathematical description by the law of mass action. From Chapters 6 to 12, all important types of chemical equilibria relevant for the hydrosphere are discussed: gas–water partitioning (Chapter 6), acid/base equilibria (Chapter 7), precipitation/dissolution equilibria (Chapter 8), calco-carbonic equilibrium (Chapter 9), redox equilibria (Chapter 10), complex formation equilibria (Chapter 11), and sorption equilibria (Chapter 12).

The text is supplemented by a large number of examples (>50) to facilitate the understanding of the theoretical considerations. Furthermore, each chapter (except the introduction) includes a section with numerous problems (>60 in total) to be solved by the reader. Complete and detailed solutions to all problems are documented in Chapter 13 in order to give the reader the opportunity to verify the own solutions. An appendix comprises a list of important constants, a short introduction to logarithm rules necessary for the equilibrium calculations, and a useful list of the most important equations presented in the textbook.

I would be pleased if this book would find a broad acceptance by students and by all who are interested in hydrochemistry.

Last but not least, I would like to thank all those who contributed to this book by some means or other. Special thanks to my family and especially my wife, Karola, for her patience during the times of intensive writing. Thanks to my students, whose questions and discussions have been an important source of inspiration. Thanks to the staff of the publishing house, De Gruyter. I appreciate the useful support and the fruitful cooperation during the work on this book.

Eckhard Worch
November 2014