Mine Water
Hydrology, Pollution, Remediation
by Paul L. Younger, Steven A. Banwart & Robert S. Hedin


This is a long awaited and much needed excellent book on mine water (hydrochemistry, water engineering and treatment technologies) by three authors with many years of experience gained mainly in the UK and USA in mine water management and the remediation of polluted mine waters, with a Foreword written by Professor Rafael Fernandez Rubio. The authors, two of them also with long experience as university teachers, have included in the Preface a list of a large number of experts who significantly contributed to the development of the concepts and practices presented in the book.

The book consists of five main chapters: Chapter One—Mining and the Water Environment, Chapter Two—Mine Water Chemistry, Chapter Three—Mine Water Hydrology, Chapter Four—Active Treatment of Polluted Mine Waters, and Chapter Five—Passive Treatment of Polluted Mine Waters, as well as an Index of terms and an Appendix with a glossary of mining and related terms relevant to mine water science and engineering. A long list of about 500 references will be very useful for any reader interested in a deeper insight into specific topics.

As stated by the authors in Chapter One, the book mainly addresses: (a) environmental scientists and engineers involved in assessments of environmental impacts and/or regulatory decisions in mining districts; (b) hydrologists, hydrogeologists, geologists, chemists, civil engineers involved in mine drainage problems; (c) mining engineers who need to get acquainted with environmental water management issues; and (d) scientists and engineers interested in problems of flow and transport in karst terrains, in and around underground waste repositories, and in other redox boundary zones. Unfortunately, the last item above promises too much because complex problems related to flow and transport in fissured rocks of double porosity, and karstic rocks of triple porosity are not discussed.

The title of the book also seems to be promising too much, as the content is limited mainly to collieries in the UK, with occasional short presentations of problems encountered in other types of mining. For instance, the solution mining of sulphur, though mentioned on p. 41, is not discussed. Similarly, salt mining and mining of coal and ores from geological formations containing brines separated from modern recharge are omitted, though due to deformations of rocks above mine workings, inflows of shallow waters to such mines often occur. It is also a pity that the authors do not mention the environmental tracer methods, which are useful in determining the origin of water inflows. On the other hand, it is understandable that the book is mainly based on the authors’ own experiences, and they have successfully avoided the book being too large.

The book is clearly written, enabling an easy understanding, even by non-specialists, and at the same time preserving a sufficient degree of accuracy and deep insight into the problems discussed, especially those related to the hydrochemistry of mine waters. Well-drawn figures, good quality photographs and worked examples are very helpful in a better understanding of the issues discussed.

Unfortunately, the book is not free of some minor shortcomings. A number of equations are poorly edited, though it creates no difficulty in their understanding. The Greek letter δ is used instead of a proper symbol of the partial derivative (∂). The derivation of equation 3.11 contains mistakes, which start with equation 3.2, in which the change in the volume should be presented as $\Delta V / \Delta t$ to be consistent with dimensions (L² T⁻¹). In equation 3.6, $V$ is missing to yield consistent dimensions, whereas in equation 3.8 both $\Delta t$ and $V$ are missing. However, as the mistakes cancel, the final equations have correct forms. The list of references is not in a proper alphabetical order, which sometimes makes it difficult to spot a sought reference.
There are also some minor inconsistencies and/or inaccuracies in some definitions. The same flow velocity is defined on p. 144 as “the average interstitial velocity” (v) and on p. 259 as “average groundwater flow velocity within the mine system” (v_a). Equation 3.26 is not obtainable from 3.18 and 3.22, but is the definition of the velocity of water flowing in an open channel. Figure 3.45 in its present form is rather misleading, as the “rebound time” is not shown. Equation 3.55 is the hydrodynamic definition of the mean residence time of water in a system. Contrary to the suggestion given in the text, the piston flow and well-mixed reactor models yield exit concentrations, which are different related to the mean residence time of water (identified in the book with the first flush, t_f). Equation 3.56 does not seem to be rigorous (t variable does not appear on the RHS, L is not defined, and working time, t_w, is not clearly defined). The shape of the erfc function is not exponential as required by the data shown in Fig. 3.45. The dispersivity in that equation is an apparent parameter, which depends on the distribution of flow times resulting from different flow paths, and has nothing to do with the dispersion coefficient (D). An example with fitted equation 3.56 would be perhaps more indicative. Considering the doubts expressed in the last paragraph on p. 259, equation 3.56 should either be discussed in more detail or perhaps omitted, especially as it is related to conservative pollutants (there are no reactive or source terms in that equation). On p. 136, table 3.1, clay is regarded as aquifer. The term “effective porosity” defined in footnote 3 on p. 133 is perhaps the most confusing in hydrogeological literature as it usually refers to a specific process. Considering the flow and transport processes in fissured rocks with a porous matrix containing stagnant water, perhaps the definition “which refers to the amount of interconnected pore space available for fluid transmission” is the most adequate (Lohmann et al., 1972: Definitions of selected ground-water terms—revisions and conceptual refinements. US Geol. Survey Water-Supply Paper 1988).

As already mentioned, the above-listed shortcomings are of minor importance, and this excellent book is a must in the library of everybody who is interested in any problem related to mine water. Undoubtedly, this valuable book is also worth translating into other languages.

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Publications received by the Editor

The following publications have been received and may be reviewed in a future issue of Hydrological Sciences Journal. [Newsletters and journals are listed here in acknowledgement of reviews or publicity they have published of recent IAHS publications.]:


Forthcoming papers

The following papers have been accepted for publication in subsequent issues of Hydrological Sciences Journal:

SHENG YUE, PAUL PILON & BOB PHINNEY: Canadian streamflow trend detection: impacts of serial and cross-correlation