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Book review: Groundwater Hydrology of Springs: Engineering, Theory, Management, and Sustainability, edited by Neven Kresic and Zoran Stevanovic (Elsevier, 2010)

David Drew

Keywords review (book) · groundwater management · karst · water supply

Springs are one of the most spectacular manifestations of hydrogeology. A river may emerge fully fledged from the ground; hot mineralized springs have long attracted the attention of people; the location of early settlements throughout the world was often strongly influenced by the reliable source of water provided by a spring. Today springs are still major sources of public water supplies particularly in karstic regions. It is surprising then that conventional hydrogeological education pays so little attention to the phenomenon. Many of the most respected and widely utilised text books barely allude to the topic—two pages in Fetter (1994), the same in Schwartz and Zhang (2002), three pages in Todd and Mays (2005), half a page in Domenico and Schwartz (1997). The classification of springs given in almost all texts harks back to that of Meinzer (1927) or Bryan (1919), some 80–90 years ago. Large springs are most common in karstic areas and karst hydrogeology is likewise given only brief coverage in the major hydrogeology text books.

The only recent publication dealing with springs is *Springs and Bottled Waters of the World* (LaMoreaux and Tanner 2001); thus, a book specifically devoted to the hydrogeology of springs is very welcome. Kresic and Stevanovic (2010) have edited and contributed to a collection of contributions by 19 authors. Approximately one quarter of the volume is concerned with the hydrogeology of springs, one third with aspects of analysis, and the remainder of the book to case studies. The full title of the book is *Groundwater Hydrology of Springs: Engineering,*

Theory, Management, and Sustainability and these aspects do indeed permeate the contents of the book including the case studies. For example, the first chapter is entitled 'Sustainability and management of springs' with the hydrogeological aspects being consigned to succeeding chapters. Chapter 2 provides a thorough and systematic survey of spring types and of their significance at the interface of the groundwater and surface-water systems. Spring classifications are discussed but little advance is offered on the historic Meinzer (1927) classification.

One of the longest (single topic) chapters is that on spring modeling by Neven Kresic and this reviewer also regards it as the core of the book. Kresic gives a rigorous and thoughtful overview of the problems involved in modeling, and therefore in understanding, spring behavior and an excellent summary and critique of the methods available with which to undertake modeling. It is followed by an equally authoritative and focused chapter written by William B White, which provides an overview of spring water quality. This section of the book is rounded off with a chapter on the delineation of spring protection zones by Nico Goldscheider and an overview of the utilization and regulation of springs by Stevanovic.

The final chapter of the book comprises 10 subsections each of which describe a specific spring or the springs of a particular area. All the springs described are karstic and are exploited. Regional surveys of springs include south-eastern Europe, Iran/Iraq and southern Turkey while the studies of individual springs relate to springs in Austria, USA, Romania, China, Montenegro and Slovenia. Thus, the springs do not represent a global or a geological sample with the notable absence of springs in western Europe and in the Middle East. There is a degree of consistency in the format of each sub-section of this chapter. The hydrogeological setting is explained, the exploitation of the spring is discussed and the management and protection of the spring water is examined. The weight given to each of these aspects varies, so, for example the section dealing with the springs of the Edwards Plateau in Texas (USA) is primarily concerned with protection, whereas the accounts of other springs pay much less attention to this aspect. Some famous springs are described—Dumanli in Turkey and Klaffer which supplies Vienna (Austria) for

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- Reports of observed hydrogeologic phenomena;
- Overviews of hydrogeologic systems of interest in various regions;
- State-of-the-art reviews;
- Philosophy of scientific methods in hydrogeology;
- Interaction between populations and hydrogeologic systems;
- Economics of hydrogeologic systems;
- Ramifications of hydrogeology on both environmental protection and optimal employment of natural resources; and
- History of hydrogeology and biographies of eminent hydrogeologists.

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