bibliography (more than 600 references to modern literature) is by no means the main intent of the book, but it is a very welcome and valuable side effect.

The scholarship in this book is extremely sound, in large part because Van Brummelen is one of the today's leading experts in this subject matter. He has personally contributed much to our understanding of Ptolemy's mathematics as well as any number of original research results in Islamic and early Western mathematics. The book is filled with many authorative translations from original sources, e.g. by Toomer, Berggren and Jones, Sidoli, and often Van Brummelen himself. It would be hard to overstate the positive impact of all these quotations in establishing for the reader an accurate sense of the contributions of these ancient authors, of how they worked, how they thought, and how they approached science in their era.

Van Brummelen has promised a second volume that will cover the history of trigonometry from 1550 to modern times, but he asks for our patience until it appears. Let us all hope that our patience will not be abused too much.

Florida State University DENNIS DUKE

PARAPEGMATA

Astronomy, Weather, and Calendars in the Ancient World: Parapegmata and Related Texts in Classical and Near-Eastern Societies. Daryn Lehoux (Cambridge University Press, Cambridge, 2007). Pp. xiv + 566. £68. ISBN 978-0-521-85181-7.

This work is a source book and study of all known parapegmata and related texts at the time of publication. Lehoux takes a *parapegma* to be originally any instrument that uses a peg to keep track of our current position in some cyclic phenomena (p. 12). Such artifacts can be slightly modified by replacing the peg with some other indicator of our place in the cycle and, hence, transformed into literary objects. Lehoux also includes a number of related texts that discuss the sort of cyclic phenomena generally found in parapegmata — such as stellar phases or seasonal and weather phenomena — but which lack the crucial marker helping us find our current place in overall the cycle. This is the first monograph on parapegmata in some time and the most comprehensive to date.

When most of us think of parapegmata (if we are inclined to such things), we turn to the astrometeorological variety, since the majority of all parapegmata and the best known of the extant literary and archaeological sources are of this type. Lehoux's broader characterization of these sources, however, sheds light on a number of the most general features of the parapegmata, which might otherwise have been obscure. Moreover the parapegmata were situated in a interesting locus formed at the intersections of observational and theoretical endeavours such as astronomy and meteorology, normalizing practices such as calendrics and the regulation of the cycles of daily life, and the material culture of producing objects and texts meant to

codify this phenomena and help users situate themselves within various temporal cycles. Lehoux places the parapegmata in their intellectual and social context and provides an introduction to the sometimes exasperating varieties of ancient methods of regulating time.

The work is divided into two parts. Part I consists of seven introductory chapters, which I will discuss below. Part II provides the sources, and is divided into a catalogue and texts with translations. The sources are classified into the following types: astrometeorological, astrological, astronomical, other parapegmata, reports of parapegmata, related texts and instruments, dubia. Texts are provided for any source that is obscure, or bordering on obscure, or for which Lehoux has established a new edition. Translations are provided for all sources. Part II is a valuable contribution to scholarship and will be of great use to specialists and others looking for specific sources in the parapegmata, but it is unlikely that anyone will simply read through this section from beginning to end. The book closes with two appendixes (ancient authorities cited in the parapegmata, correspondence of modern editions), a bibliography, and two indices (astrometeorological and general).

Part I, on the other hand, is a fascinating read. Lehoux begins with a general discussion of parapegmata as objects, which distinguishes between their form and content and uses these distinctions to develop a general sketch of the their history. This is followed by a discussion of the Roman parapegmata that shows how the Romans adopted the parapegmata technology of the Greeks to track a wide range of different temporal cycles.

One of the most interesting chapters focuses on the type of sign indicated by the parapegmata and analyses the claims that the parapegmata were produced by making observations and linking these with predicted events and that they were meant to be used by making observations and looking these up in the parapegmata, and thence deriving predicted events. Lehoux shows that there are difficulties involved with either of these claims and concludes that the parapegmata functioned by providing theoretical signs which are observed by consulting the position of the peg or the date of the text, which tells us the stellar phase, which in turn directs us to some predicted event. The observed sign (peg, date, etc.) is an indication of the weather, not insofar as it is a *sign of the weather*, but insofar as it tells us where we are in a cycle which has been established perhaps partly by observation but in practice largely by tradition.

Another key chapter discusses the relationship between parapegmata and calendars. Without getting too bogged down in the intricacies of ancient calendars, Lehoux shows that parapegmata acted as extra-calendrical devices for tracking phenomena that were not directly linked to the local calendar. This chapter also discusses how the parapemata could have been calibrated with the local calendars and the relationship between parapemata and other luni-solar cycles, such as the Metonic and Callippic cycles. Two final chapters discuss related material in the Babylonian and Egyptian sources, and in pointing out that the Egyptian material has closer parallels to the Greek and Roman sources conclude that the specifics of these traditions in the different ancient cultures were closely bound to the individual needs of the culture in which

they existed and hence do not show evidence of wholesale transmission.

Lehoux has provided the most exhaustive study of parapegmata to date with an engaging discussion of the historical and intellectual implications of these sources. This work will be essential for anyone working on ancient astronomy, calendrics or related areas.

Waseda University NATHAN SIDOLI

EARLY INDIAN ASTRONOMICAL INSTRUMENTS

The Archaic and the Exotic: Studies in the History of Indian Astronomical Instruments. Sreeramula Rajeswara Sarma (Manohar, New Delhi, 2008). Pp. 319. Rs 795. ISBN 81-7304-571-2.

Although much has been written on the gigantic masonry instruments of Sawai Jai Singh, there is hardly anything comprehensive and insightful on their antecedents. The book under review rightly fills the long-felt need to have an authentic account of Indian astronomical instruments from the time of Āryabhaṭa (5th cent. A.D.) until the end of Mughal period (17th cent.). It is a formidable task to prepare such a volume, as it requires not only scholarship in Sanskrit but also a detailed survey of a wide range of material spread all over the world in libraries, museums, art galleries and private collections. Nonetheless, S. R. Sarma has been quite successful in his endeavour.

This volume is essentially a collection of papers previously published by Sarma, long-time editor of the *Indian journal of history of science*. Its title is apt — "archaic" as it describes very old instruments like the sinking bowl variety of water clock (*ghaṭī-yantra*), and "exotic" as it describes highly ornate and versatile instruments such as the astrolabe. The book consists of 15 chapters organized into four parts. The first part, beginning with a detailed account of the context in which the author undertook studies on Indian instruments, emphasizes the need for studying the instruments together with Sanskrit astronomical texts. Here, besides explaining some of the astronomical instruments described by Brahmagupta (*c.* 627 A.D.), Bhāskara II, Parameśvara and others, the author emphasizes the role played by instruments in the development of scientific thought and technology. In the chapter on perpetual motion machines, Sarma traces how ideas spread from India first to the Islamic world and then to Europe. He asks: "In today's world of narrow loyalties, one is accustomed to ask to whom the credit should go: is it due to Brahmagupta for the origin of the ideas, or to the Islamic World for its elaboration and spread, or to the Occident for its practical application?" (p. 75).

The four chapters in Part II are devoted to the bowl that sinks and tells time, a variety of water clock used in India from about the 4th cent. A.D. until perhaps 1900. Sarma describes interesting rituals associated with the setting up of this device for determining auspicious moment for weddings, etc. He concludes with a note of