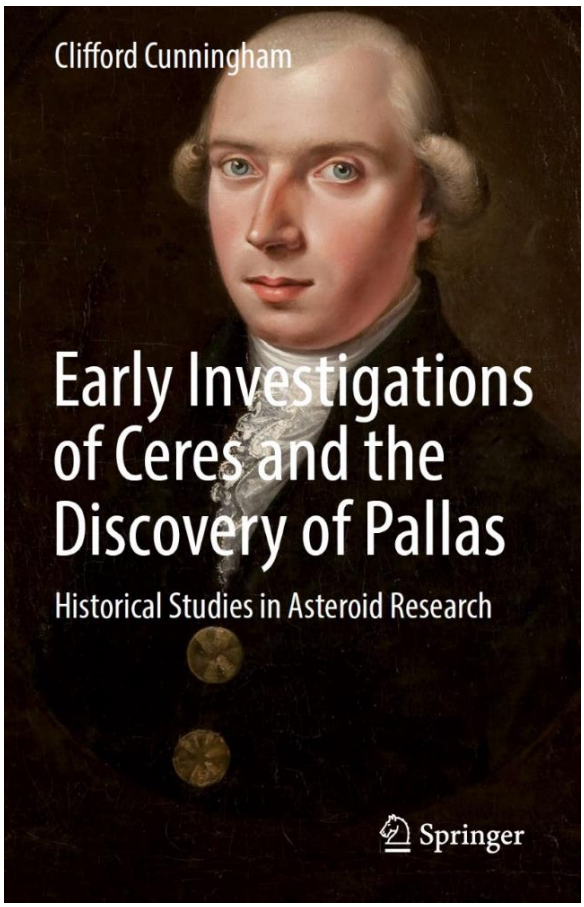
with a bit of England and English satire thrown in, while Chapter 3 explores professional rivalries among the leading German, French and English astronomers of that time. The following chapter recounts the origin of the term 'asteroid' to describe these newly discovered objects that clearly did not belong to the same class of objects as the planets. The section on "What is a Planet? A View from the Eighteenth Century" raises a question that invokes deeply held opinions even today and will likely undergo further revisions as our knowledge of exoplanets expands.

In Chapter 5 we arrive at The Discovery of Pallas by Olbers, on 28 March 1802. Rather than describing the discovery events in detail in his own words, Cunningham tells the story as told



in the words of Olbers himself from a letter. Few words are spent on the actual discovery before the narrative moves on to a discussion of the nature of Pallas. This is followed by a discussion of the 'exploded planet' hypothesis of Olbers, presented on 15 May 1802. The remainder of this chapter deals with Bode's attempt to preserve his law and an extensive section on how the public learned of the discovery of Pallas. More details of the circumstances of the discovery of Pallas would be welcome here. While Olbers was searching for another planet, in the broad sense, he was following Ceres on 28 March—so was it sheer luck that Pallas was close by, thus enabling its discovery? Did Olbers have a broader strategy in his search for a new world? Why was Olbers looking for another planet in the first place, since Ceres had filled the gap between Mars and Jupiter? Appendix B gives the positions of Ceres and Pallas in 1801–1802, but the ephemeris for Pallas (Figure A2) covers only dates in April and May, not 28 March. Giving the location of both bodies on the discovery date would enable the reader to judge the degree to which chance was crucial in the discovery of Pallas.

Chapters 6–10 reproduce original logbooks, letters, books and scientific papers by various participants in this story and contain interesting insights into the origin of various ideas. For example, Ende suggested to Olbers that Pallas might have resulted from a cosmic catastrophe (the 'exploded planet hypothesis'), but is never given credit for this, as Cunningham notes. Another example is in the letter from Gauss to Olbers where Gauss introduces the idea that these bodies might collide:

> Both paths would come frightfully close together at a place not far from the area where the two stars are. Our descendants could perhaps some day be spectators of the most terrible phenomenon: the collision of the two celestial bodies!

Today studies of asteroid collisional evolution are a fundamental component of understanding the origin and evolution of this population.

These two books are definitive works on the discoveries of Ceres and Pallas and provide deep insights into the broader context and impact of these events. They are intended primarily for the historian of planetary science and those interested in the impact of new discoveries in science on human culture. While the vast amount of material assembled in these volumes may be intimidating for the casual reader, they do provide a rich resource for both serious researchers and students of asteroidal history. Cunningham has done a great service to this field by producing these works.

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***Roman Portable Sundials: The Empire in Your Hand*, by Richard J.A. Talbert. (Oxford, Oxford University Press, 2017). Pp. xxi + 236. ISBN 9780190273484 (hardback), 170 × 240 mm, US $55.**

Richard Talbert, the William Rand Kenan Professor of History at the University of North Carolina, is the world's leading authority on ancient geography. He has now brought this expertise to bear on portable sundials that embody

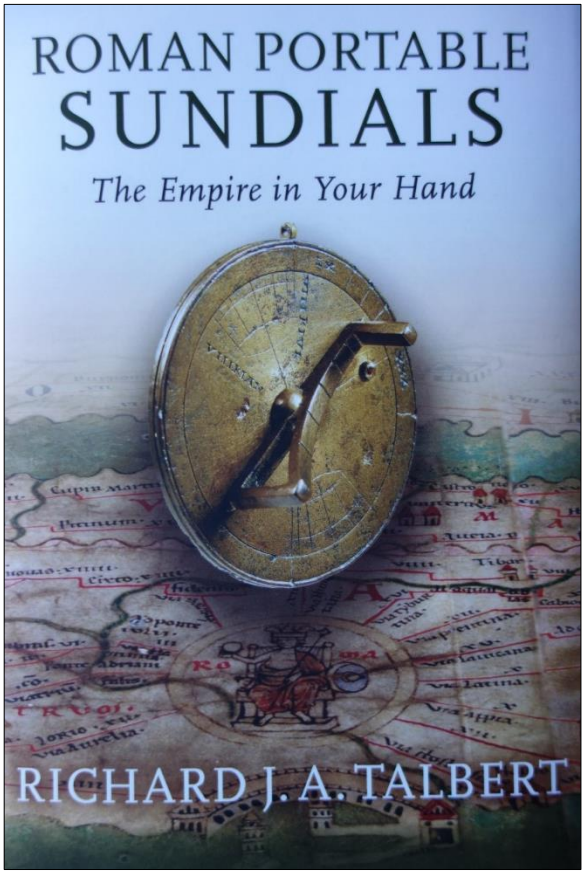
spatial data.

During the annual conference of the Classical Association of Canada in May 2017, at which we both presented research papers, I was able to interview Professor Talbert about his book, and this is what he told me:

> I am not interested in these instruments *as such* … For the ancient sundials, all the conversation has always been about how these instruments are designed and produced and how accurately they can tell the time.

This book is a noted and welcome departure from those purely technical studies, and gives us a novel insight into the role of time in everyday Roman life.

Talbert looks not just at portable sundials, but at a subset of them that contain geographical information. "On the reverse there is a listing of



either province, island or city names each with its own latitude figure …" Talbert explained. He then elaborated:

> What interests me as a historian, is that when you look at these lists, almost all of them are pretty clearly individual creations. They can fit as many as 36 names on these sundials. These belonged to people who are cosmopolitan: they have a vision of the whole Greek and Roman world. They then pick some that they want to have on the back of the sundial as a kind of speed dial list.

This way of regarding these portable sundials opens up a whole new field of investigation into ancient Roman people and society. Talbert told me he terms it 'mental mapping', a way of getting "… a glimpse of what these peoples' world view was."

In the first, rather brief, chapter, Talbert notes only one mention of portable sundials in ancient literature. It comes from Vitruvius (late first century BCE) who tantalising says sundials were made "… for taking on a journey and hanging up." (page 10). As the author makes clear, our certain knowledge about portable sundials derives entirely from the extant examples. Who made them, where they were made, who owned them, and many other basic questions, cannot yet be answered.

Chapter 2, which comprises 90 pages, is a case-by-case review of each portable sundial that is engraved with geographic information. In all there are 16, although Talbert suggests that others may be languishing in private hands or museum collections. Of the 16, several have been lost, and we are left only with a diagram. Most consist of circular disks, but one in the Archaeological Museum at Philippi in Greece comprises three nested rings. "It's design is remarkable …" the author writes. "It matches that of the 'astronomical ring dials' known from the Renaissance onward and not previously thought to have had any forerunners." (page 76). It likely dates from between 250 and 350 CE.

The center ring of this unique example comprises two half-rings, which contain four locations: Alexandria, Rhodes, Rome, and Vienne (located in the southeast portion of France). The inner ring (marked with 12 divisions for the hours) includes a slit "… pierced in the center by a small hole. Rays of the sun passing through this hole mark the time." (page 81).

The remaining three chapters look at the existing evidence for clues about the use of these small sundials. Some derive their geographical information from Ptolemy's *Geography* (ca. 150CE). In this volume, Ptolemy gives the position of 6,000 settlements and features across the known world. Talbert notes "His inspiration came from celestial mapping …" (page 119) in his *Almagest*, which is known in astronomy as the most influential book of all time as it shaped our understanding of the cosmos to the time of Copernicus and beyond.

Talbert's book concludes with an intriguing appendix about a marble fragment found in Budapest in 1990. Talbert is the first to suggest that this is a sundial-makers' manual that was "… discarded sometime during the second or third centuries CE." (page 218). This highlights the likelihood that future archaeological discoveries will

reduce the level of conjecture about portable sundials that Talbert was obliged to take.

This is a fascinating and eminently scholarly book that is the first to focus attention on this important aspect of Roman timekeeping, and Oxford University Press is to be commended for publishing the many photographs with the clarity required to see the fine details commented upon by the author.

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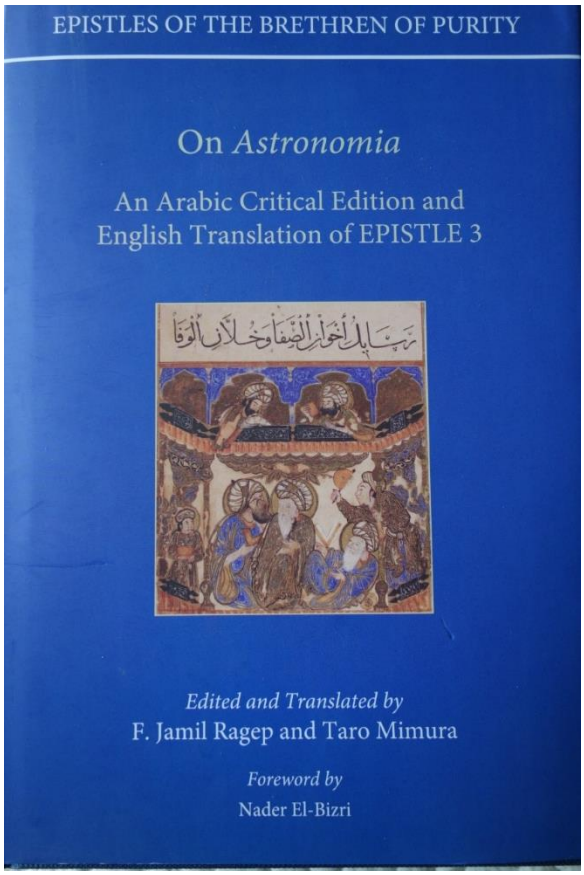
***On* Astronomia*: An Arabic Critical Edition and English Translation of EPISTLE 3*, edited and translated by F. Jamil Ragep and Taro Mimura, foreword by Nader El-Bizri, Epistles of the Brethren of Purity (Oxford, Oxford University Press in association with The Institute of Ismaili Studies, 2015), pp. 352. ISBN 9780198747376, 156 × 234 mm, £50.**

The Brethren of Purity were a secretive society in tenth-century Iraq. They gained prominence in the history of Islamic science and philosophy through fifty-two Epistles that were widely read and copied. Written by anonymous members of the fraternity, the Epistles covered various branches of the natural sciences, philosophy, and theology. The brethren were perhaps not among the greatest scientific authorities of their age. However, they were still influential in bringing together, and popularizing, diverse areas of knowledge. Due to their prominence, modern scholars started editing the Epistles and translating them into European languages as early as the nineteenth century. However, these editions and translations were incomplete and often uncritical. The Institute of Ismaili Studies in London built on these efforts to produce a more definitive edition of the Arabic text as well as an English translation. After an introductory book published in 2008, Epistle 3, *On* Astronomia, is the eighth volume in the Institute's series.

The word *Astronomia* in the epistle's Arabic title (*al-asṭrunūmiyā*) is the transliteration of a Greek word that encompasses both astrology and astronomy in the modern sense. The Epistle covers both areas of knowledge, but with a focus on astrology. It is primarily didactic and scientifically neither 'creative' nor 'insightful', as the editors write in their introduction (page 4). The astronomical and astrological contents can be found in earlier works by Ptolemy, Abū Maʿshar, and Farghānī. The most interesting aspect of the work is perhaps its adaptation and combination of Arabic and Greek, Islamic, Christian, and pagan thought. The Epistle quotes the Qur'an as well as the gospels of Matthew, Mark and Luke. Muhammad is part of the Epistle, as are various Biblical figures, including Abraham, Jesus, John the Baptist, Moses, Noah, and Zachariah. Among Greek philosophers and scientists, Aristotle, Diogenes, Ptolemy, Pythagoras, and the Pythagoreans appear. The Brethren of Purity engaged in such syncretism in order to demonstrate the harmony of the Universe and to offer the reader moral and spiritual guidance. The Epistle's subtitle describes it as a text "… for improving the soul and rectifying character." (page 21). Understanding God's perfect design of the cosmos would help people adopt proper conduct and reach happiness and salvation, the fraternity argued.

The Epistle contains around thirty-two main chapters plus thirteen additional ones at the end of two of the manuscripts. The astronomical content includes the yearly motion of the Sun, the seasons, and solar and lunar eclipses. The



Brethren of Purity also described the motions of Saturn, Jupiter, Mars, Venus and Mercury through the orbs, which are, "… spherical, transparent, and hollowed-out bodies." (page 26). Astrological chapters characterize and divide the zodiacal signs. Furthermore, the Epistle relates these signs to the Sun, Moon and planets through accounts of houses and detriments, decans and their lords. Other chapters are devoted to divine providence and salvation as well as numerology.

The editors have produced the most comprehensive and useful edition and translation of the