les institutions qui les possèdent donnent leur autorisation. À ce jour, on y trouve 278 lettres transcrites, dont 135 avec les manuscrits. Il faut espérer qu'Irène Passeron et son équipe seront en mesure de mener à bien cette ambitieuse entreprise dans les prochaines années et de mettre ainsi à la disposition de la communauté scientifique un outil d'une valeur inestimable. Les historiens des mathématiques seront parmi les bénéficiaires les plus reconnaissants.

Andreas Kleinert
Institut für Physik, Martin-Luther-Universität Halle-Wittenberg, Germany
E-mail address: kleinert@physik.uni-halle.de

Available online 24 April 2017

http://dx.doi.org/10.1016/j.hm.2017.04.004

From Alexandria, Through Baghdad. Surveys and Studies in the Ancient Greek and Medieval Islamic Mathematical Sciences in Honor of J.L. Berggren
Edited by Nathan Sidoli and Glen Van Brummelen. Springer, 2014. xv+583 pp.

The voluminous work under review is offered to J. Lennart Berggren (Simon Fraser University, Canada) to honor his long and valuable career which began forty years ago. As an internationally recognized historian of mathematics, Berggren is, in the editors' words, "much more than just a scholar. We find among his publications a dedication to taking the results of our labors to the broader community. Len worked tirelessly producing and editing encyclopedia articles, and he wrote a variety of articles for pedagogical and popular publications" (p. x). The contributions that Berggren has made to the history of both ancient Greek and medieval Islamic mathematics are authoritative among his peers. All the contributions collected here by Nathan Sidoli (Waseda University, Japan) and Glen Van Brummelen (Quest University Canada) represent very well Berggren's two principal research fields.

The book is composed of three parts, consisting of surveys and studies, updated papers, and unpublished contributions.

Part I is dedicated to several surveys dealing with the history of Greek mathematics and medieval Islam. Several successive periods are considered in order to encompass the historiography from the 1970s until 2014. It ends with a useful index of subjects (p. 139–42).

The first chapter (p. 3–15) is the "History of Greek Mathematics: A Survey of Recent Research" published by Len Berggren himself in *Historia Mathematica* in 1984.[1] One of the main purposes of this paper, well-known to historians of ancient mathematics, is to show that the three decades (1950–1980) must be considered as decades of considerable change in the historiography of ancient Greek mathematics even if no major new texts were discovered. But, Berggren wrote: "for new blood, the old texts are read in new ways by a new generation of scholars, and the whole puzzles are as intriguing as ever" (p. 12), and he had contributed to this. The second survey (p. 17–23) "Mathematical Reconstructions Out, Textual Studies In: 30 Historiography of Greek Mathematics" is the famous paper written by Ken Saito (Osaka Prefecture University) in the French *Revue d'Histoire des Mathématiques* in 1998.[2] It completes perfectly the preceding survey focusing on changes which occurred, after the 70s, in the reading of ancient texts. Unlike the first

---

[1] J. Lennart Berggren. 1984. History of Greek Mathematics: A Survey of Recent Research. *Historia Mathematica* 11/4, 394–410.

[2] Ken Saito. 1998. Mathematical Reconstructions Out, Textual Studies In: 30 Historiography of Greek Mathematics. *Revue d'Histoire des Mathématiques* 4/1, 131–142.

two chapters, the third one (p. 25–50) "Research on Ancient Greek Mathematical Sciences, 1998–2012" by Nathan Sidoli, one of the editors of the book under review, is original. It provides a welcome addition covering *grosso modo* the first decade of the 21st century, including several references written earlier but omitted by Berggren and Saito. Sidoli describes not only the main topics of the domain, but also the methods which researchers have applied (divided into several parts: textual studies, Material Culture and Social and Institutional Context, mathematical and logical studies, balanced reconstruction and finally new readings).

The three following chapters are devoted to the medieval period, primarily in the Islamic world, the second axis in Berggren's research. It begins with two republished papers (p. 51–99) of Berggren: "History of Mathematics in the Islamic World: The Present State of the Art" in the *Middle East Studies Association Bulletin* (1985) and "Mathematics and Her Sisters in Medieval Islam: A Selective Review of Work Done from 1985 to 1995" first published in *Historia Mathematica* (1997).[3] In those two papers, the author's aim is to "provide to scholars of Islamic culture an account of the major themes and discoveries . . . on the history of mathematics in the Islamic world" (p. 51). Mathematics is naturally considered in its largest sense as it was developed in Islamic countries (from central Asia to *Andalus*), i.e. with, among others, arithmetic, algebra, geometry, trigonometry, as well as mechanics, optics, mathematical instruments, and even mathematical geography. These papers are still as useful as when they were first published. Paralleling Sidoli's contribution on Greek mathematics, the second editor, Glen Van Brummelen, completes the previous chapters with "A Survey of Research in the Mathematical Sciences in Medieval Islam from 1996 to 2011." In this chapter (p. 101–38),[4] the author, like Berggren in the two preceding surveys, limits himself to works published in European languages. While this choice may be regrettable, it is understandable, given the vast quantity of such works. To begin, Van Brummelen is interested in Greek and Indian influence on Islamic sciences. He then deals with regional influences (with a special emphasis on *Andalus* and Maghreb) before presenting the specialized works on geometry, the mathematics of astronomy, on geography, arithmetic and algebra.

All these surveys, with all their bibliographical references (just under one thousand entries), are very useful for scholars and graduate students who are interested in ancient Greek mathematics or mathematics in medieval Islam. All of them also demonstrate the vitality of the history of ancient Greek and Islamic mathematics.

Part II is devoted to seventeen mostly original studies, in many fields (primarily mathematics and astronomy) from ancient Greek literature to medieval Islam. All of them are written by well-known scholars among Berggren's colleagues. Part II begins with the paper (p. 145–74) "Mechanical Astronomy: A Route to the Ancient Discovery of Epicycles and Eccentrics" where James Evans (University of Puget Sound, USA) and Christián Carlos Carman (National University of Quilmes, Argentina) discuss the close dual relation between astronomy and mechanics in the ancient Greek world. Well illustrated, the next paper (p. 175–88) "Some Greek Sundial Meridians" is authored by Alexander Jones (ISAW, New York University). The latter presents archeological documentations to explain the original mechanisms (meridians scales to be precise) of three Greco-Roman sundials. The first one (I. Milet. Inv. 46), a penciled copy of a marble fragment, has never been detailed in a published paper since its discovery by a German excavation in Miletus in 1900. The second is an inscription, discovered near Alexandria (Egypt) in 1901, explaining the use of a sundial, and the third is a sundial itself found in Histria (Romania) in 1950.

[3] J. Lennart Berggren. 1997. Mathematics and Her Sisters in Medieval Islam: A Selective Review of Work Done from 1985 to 1995. *Historia Mathematica* 24/4, 407–440. J. Lennart Berggren. 1985. History of Mathematics in the Islamic World: The Present State of the Art. *Middle East Studies Association of North America* 19/1, 9–33.

[4] Note that a website is maintained by the author in order to complete his paper but unfortunately, the URL mentioned (p. 101) [https://pub.questu.ca/~gvb/islamsci.html] is not accessible on January 2017.

Next, four papers deal with Archimedes or the Archimedean tradition. The first of these is the chapter "An Archimedean Proof of Heron's Formula for the Area of a Triangle: Heuristics Reconstructed" (p. 189–98) in which Christian Marinus Taisbak (Copenhagen University, Denmark) comes back to his article published in *Centaurus* in 1980, correcting it and adding an heuristic approach.[5] After that, thanks to Ken Saito and Pier Daniele Napolitani (University of Pisa, Italy), in "Reading the Lost Folia of the Archimedean Palimpsest: The Last Proposition of the *Method*" (p. 199–226), the reader can discover a part of the *Method*, one of the major surviving works of Archimedes where he determines the volume of solids using a virtual balance. In the useful and interesting appendices, the authors detail the volume of the sphere and those of the hoof and the vault for which Archimedes' proofs are lost. They also present some material elements about the palimpsest, with in particular a "Page by Page Reconstruction of the Quires Containing the Method" (p. 223–4). The last two papers on the Archimedean tradition question the legacy of this tradition in the Ottoman Empire and in Islamic countries. İhsan Fazlıoğlu (Istanbul Medeniyet University) and F. Jamil Ragep (McGill University, Canada) contribute "Archimedes Among the Ottomans: An Updated Survey" (p. 239–54). They discuss the presence of Archimedean material in several Ottoman works produced between the fourteenth and the eighteenth centuries. On this occasion, they highlight both the importance of Islamic scientific *foyers* like Marāgha or Samarkand and the role of Ottoman scholars themselves. They achieve their contribution with the Arabic edition of the *Risāla fī ᶜamal al-mīzān al-ṭabīᶜī* [Epistle on Constructing the Natural Balance] written by the Ottoman Taqī al-Dīn al-Rāṣīd (d. 1585). The last paper on the Archimedean tradition, "More Archimedean than Archimedes: A New Trace of Abū Sahl al-Kūhī's Work in Latin," (p. 259–74) is due to Jan P. Hogendijk (University of Utrecht, Netherlands). The author comes back to the Latin translation of the *Kitāb al-ma'khūdhāt* [Book of Assumptions] made by Giovanni Alfonso Borelli and Abraham Ecchellensis (al-Hāqilānī in Arabic) in 1661. The original text is attributed to Archimedes but lost in Greek. Thanks to Thābit ibn Qurra (d. 901), we have an Arabic translation, edited later by Naṣīr al-Dīn al-Ṭūsī (d. 1274). In the Latin version of the Renaissance, translators added two propositions missing in the aforesaid texts. Hogendijk detailed them (with the Latin text and an English translation in appendix) and, above all, he argued that both propositions derived from an al-Kūhī's work (10th c.).

Two papers deal with Theodosius' *Sphaerica*. The first one is authored by Robert Thomas (University of Manitoba, Canada) and entitled "Acts of Geometrical Construction in the *Spherics* of Theodosios" (p. 227–38). The author questions the geometrical constructions proposed by Theodosius using the semiotical idea of *ideal agents*, and by having "put forward the notion that much mathematics could be regarded as basic strategic thinking for actions of ideal agents, which may be thought to be like game-playing" (p. 227). The second one is a short contribution (p. 255–58) of Richard Lorch (University of Munich, Germany): "The 'Second' Arabic Translation of Theodosius' *Sphaerica*". He argues, thanks to a terminological comparison, that we have at least two different Arabic versions of Theodosius' *Sphaerica*: the well-known version translated into Latin by Gerard of Cremona which was edited by the author,[6] and another version transmitted by two Arabic manuscripts in Hebrew script. Probably from the western area of the Arabic tradition, this latest version could have been used by Moses ibn Tibbon for his thirteenth-century translation into Hebrew.

The three following papers are more or less on the Islamic West. In the large and helpful survey (p. 275–96) "Les mathématiques en Occident musulman (IX^{e}–XVIII^{e} s.): Panorama des travaux réalisés entre 1999 et 2011" (with more than 100 recent references), Ahmed Djebbar (University of Lille, France) describes the circulation of scientific writings between the Islamic East and West (Maghreb and *Andalus*),

5 Christian Marinus Taisbak. 1980. An Archimedean Proof of Heron's Formula for the Area of a Triangle; Reconstructed. *Centaurus* 24/1, 110–116.

6 Paul Kunitzsh and Richard Lorch. 2010. *Theodosius' Sphaerica: Arabic and Medieval Latin translations*. Franz Steiner Verlag, Stuttgart.

and mathematical activities in the Muslim West (above all algebra, computation, theory of numbers, geometry and combinatorics). Then, in "Ibn al-Raqqām's *al-Zīj al-Mustawfī* in MS Rabat National Library 2461" (p. 297–28), Julio Samsó (University of Barcelona, Spain) proposes a study focused on *zījes* (astronomical tables) attributed to Ibn al-Raqqām, polymath from the Islamic West (Tunis, Bijāya, and Granada). In particular, he gives a very precise description of one of the aforesaid *zīj* which was newly discovered (1997) in a Moroccan manuscript belonging to the National Library in Rabat. Thirdly, in "An Ottoman Astrolabe Full of Surprises" (p. 329–42), David A. King (J.W. Goethe University, Frankfurt, Germany) presents a very particular Ottoman astrolabe from *ca.* 1700. Indeed, even though this astrolabe still keeps secrets in itself, King shows that it is composed of several plates from an 11th-century *Andalusi* astrolabe. Some pictures of them accompany King's descriptions.

Both of the following chapters deal with the famous *al-ḥāsib al-Miṣrī* [Egyptian reckoner] Abū Kāmil (d. *ca.* 930). The first one (p. 343–58) is an updated biobibliographical article on "le deuxième algébriste de langue arabe, voire le premier pour l'influence" (p. 343) in Sesiano's words. It is actually a new edition, carefully reviewed and commented on by Jacques Sesiano (EPFL, Switzerland) of the precious article "Un algébriste arabe: Abū Kāmil Šuğa[c] ibn Aslam" published by Adel Anbouba from Beyrouth (Lebanon), in 1963, in an ephemeral Lebanese review. The second one (p. 359–408) is an original contribution of Jacques Sesiano on "Abu Kamil's *Book on Mensuration*" first described in 1996 by the author.[7] It is a very valuable chapter for the history of practical geometry in Islamic country.[8] Indeed, it is the first complete Arabic edition (based on a single fourteenth-century manuscript) with English translation of the *Kitāb al-misāḥa* [Book on mensuration] attributed to Abū Kāmil.

Next, Tzvi Langermann (Bar-Ilan University, Israel) proposes a study on "Hebrew Texts on the Regular Polyhedra" (p. 409–68). This important chapter on Platonic solids in Hebrew tradition significantly improves our knowledge of the small group of texts on the same subject first presented by Langermann and Hogendijk[9] and completed by Hogendijk himself with the publication of the Arabic text of Muḥyī al-Dīn al-Maghribī (d. 1290).[10] Here, Langermann offers us a Hebrew edition and English translation of an Arabic-Hebrew text attributed to Qalonymos ben Qalonymos (d. 1328), probably of Greek origin and perhaps based on a work of al-Kindī (d. 973). He aggregates selected passages (Hebrew edition and English translation) of a geometrical encyclopedia of unknown authorship which presents both similarities and interesting differences with the previous text.

We follow our reading with "a Treatise by al-Bīrūnī on the Rule of Three and its Variations" (p. 469–86) by Takanori Kusuba (Osaka University, Japan). This chapter is a preliminary analysis of the *Maqāla fī rāshīkāt al-Hind* [Treatise on the *Rāshīkā* of India], the only work on Indian mathematics extant in all the writings of al-Bīrūnī (d. 1048). And, as Kusuba concludes, it is "a strange mixture of Indian and Greek mathematics" (p. 484). Preparing a critical edition of this text, the author bases this analysis on a printed version made in Hyderabad in 1948.

The penultimate paper (p. 487–502) of Part II is written by Sonja Brentjes (Max Planck Institute for the History of Science, Germany) on "Safavid Art, Science, and Courtly Education in the Seventeenth Century". The purpose is mainly methodological. For Brentjes, "we need to find fresh ways of looking at the sciences in the seventeenth century within Safavid culture" (p. 488). By following this objective, she contributes to a cultural history of sciences in a specific context, taking into account the production of scientific manuscripts in the environment of the Safavid court. This chapter is beautifully illustrated with

7 Jacques Sesiano. 1996. Le Kitāb al-misāḥa d'Abū Kāmil. *Centaurus* 38/1, 1–21.

8 Marc Moyon. 2017. *La géométrie de la mesure dans les traductions arabo-latines*. Brepols, Turnhout.

9 Jan Peter Hogendijk and Tzvi Langermann. 1984. A hitherto unknown Hellenistic treatise on the regular polyhedra. *Historia Mathematica* 11, 325–326.

10 Jan Peter Hogendijk. 1994. An Arabic text on the comparison of the five regular polyhedra: Book XV of the revision of the Elements by Muḥyī al-Dīn al-Maghribī. *Zeitschrift fur Geschichte des arabisch-islamischen Wissenschaften* 8, 133–233.

several miniatures taken from translations into Persian of the *Kitāb suwar al-kawākib al-thābita* [Book on the Images of the Fixed Stars] of ᶜAbd al-Raḥmān Ṣūfī (d. 998).

Finally, the last chapter (p. 503–27), "Translating Playfair's Geometry into Arabic: Mathematics and Missions" is written by Gregg De Young (American University in Cairo, Egypt). The Arabic translation, by the Protestant missionary Cornelius Van Dyck (d. 1895), of the popular – in Britain and America – *Elements of Geometry* of John Playfair (d. 1819) is finely described by insisting on different choices of the translator (transliteration, diagrams, vocabulary, etc). De Young sees it as "a part of a larger movement to import European learning in the sciences into the Ottoman Empire" (p. 503).

Part III is entirely dedicated to the story of π with the single updated study (p. 531–61) "The Life of π: From Archimedes to ENIAC and Beyond" of Jonathan M. Borwein (University of Newcastle, Australia), first published in Italy in 2008.[11] The Scottish mathematician, who died very recently, collaborated on this subject with Berggren and Peter B. Borwein in the famous editorial project *Pi: a source book* whose third and latest edition is 2004.[12] In this paper, J.M. Borwein proposes a wide and fascinating chronological account of the calculation of π and its decimal digits from Antiquity to today. And, thanks to Borwein, we can easily understand that "the life of π captures a great deal of mathematics – algebraic, geometric and analytic, both pure and applied – along with some history and philosophy" (p. 556).

The book under review ends with two indexes as complete as they are useful: one of personal names (p. 563–75) and one of ancient and medieval Titles (p. 577–83).

To conclude, this collection of papers dedicated to Berggren is useful not only for the entire community of historians of mathematics but also for anyone curious and interested in ancient Greek or medieval Islamic mathematics. This beautiful book is a reflection of the production of Berggren. It is simultaneously scholarly and pedagogical. His authors give the readers both new information in the domain and some methodological points of view. I think that, thanks to these qualities, it will soon become a must on the shelves of libraries.

Marc Moyon
XLIM-MATHIS Université de Limoges – UMR CNRS 7252,
123, Avenue Albert Thomas, 87060 Limoges Cedex, France
E-mail address: marc.moyon@unilim.fr

Available online 11 April 2017

http://dx.doi.org/10.1016/j.hm.2017.03.005

[11] Jonathan M. Borwein. 2008. La vita di pi greco: from Archimedes to ENIAC and beyond. In Bartocci, C., Odifreddi, P. (eds), *Mathematics and Culture, Volume II. La matematica: Problemi e teoremi*, Guilio Einaudi Editori, Turino, pp. 249–285.

[12] J. Lennart Berggren, Jonathan M. Borwein and Peter Borwein. 2004. *Pi: A Source Book*. Springer: New York.