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Book reviews

Karine Chemla (ed.), **The History of Mathematical Proof in Ancient Traditions**. Cambridge: Cambridge University Press, 2012. Pp. xv+596. ISBN 978-1-1-7-01221-9. £100.00 (hardback).
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For several years now, France has been 'the' place for research into the history and historiography of mathematics, acting as a catalyst and convergence point not just for home-grown historians, but also for many international scholars. Remarkably uninhibited by hierarchies that elevate one mathematical tradition over others, or by fusty distinctions between 'pure' and 'applied' or between context and technical content, the historical work produced in and around French research centres has successfully combined the analysis of the nitty-gritty of mathematics with insights into how mathematics has been used, particularly in administration and politics, and this within the wider cultures of Greece, China, India and Mesopotamia, to mention just antiquity. At long last, a substantial single volume on the history of ancient mathematics makes the cutting-edge research of scholars, some of whom normally publish in other languages, accessible to the English-speaking reader.

The History of Mathematical Proof gathers sixteen papers by fifteen authors, ranging from clay tablets from the Old Babylonian period (2000–1600 BCE) to nineteenth-century Vietnamese treatises containing evidence about earlier Chinese mathematics. As explained in the acknowledgements, the volume originated from a working group and an associated workshop. Consequently, many of the papers have already been shaped in the context of collective discussion. Thus, to some extent, the authors here are singing from the same hymn sheet. Despite the inevitable variety that characterizes any edited collection, two main trends can clearly be recognized, which underlie the bipartite structure of the book, and together constitute the main general argument. In a nutshell, there are two deeply entrenched notions in the history of mathematics as it is (was?) traditionally done: one is that, historically, 'rigorous mathematical proof' means 'deductive proof', and the second that deductive proof is the achievement and distinguishing feature of the Greek way of doing mathematics. *The History of Mathematical Proof* aims to show that both notions are inaccurate and should be put to rest. On the one hand, ancient cultures, including the Greeks themselves, whose mathematics was much more pluralist than we give it credit for (as the contributions by G.E.R. Lloyd and Ian Mueller emphasize), experimented with many different types of proof, taken here in general as the act and process of persuading the reader/listener that a certain mathematical procedure or result is correct and effective. Thus the second section of the book thoroughly explores, among other things, a variety of ways in which algorithms were established and shown to work. On the other hand, as the first part of the book shows (in chapters by Reviel Netz, Dhruv Raina, Agathe Keller and François Charette), the idea of rigorous deductive Greek proof and the mirror image of non-Greek mathematics as lacking rigorous proof are to a significant extent the construct of eighteenth- and nineteenth-century scholars.

Impossible as it is to do justice to all the papers in such a short space, a contribution to the first section stands out, in my view: Bernard Vitrac's 'The Euclidean ideal of proof in *The Elements* and philological uncertainties of Heiberg's edition of the text'. Vitrac takes the reader on a long tour of manuscripts, direct and indirect traditions, and textual variants, in order to show that one of the classics of Western science and its celebrated demonstrative architecture are the product not simply of Hellenistic genius, but rather of many intervening hands, through the centuries, from many different cultural contexts. Long, but written very clearly and carefully, this is the definitive genealogical account of what we today call Euclid's *Elements*, and it should be required reading for historians of science, as well as classicists, not just for its contents, but also for the way in which it makes highly technical philological expertise accessible and indeed gripping.

Finally, we come to the introduction, by Karine Chemla, director of one of the main research programmes in the history of ancient mathematics, and one of the driving engines behind the historiographical turn that this book encapsulates so well. Again, it is a long piece, and when I first read it, I thought it could be shorter. But, as I moved through the papers in the volume, I realized that in fact Chemla's introduction really is the key to the whole book – she has the rare capacity to make each paper say perhaps even more than might have been in the authors' original intentions, while somehow not homogenizing their differences. Chemla's introduction frames the sixteen contributions that make up this volume within a shared research programme, revolving around the two points I have mentioned above; she explains how they individually contribute to it, and moreover manages to cast that same research programme into the future, by laying out further avenues for exploration and not shying away from the political import of what academic research can tell us about knowledge, objectivity and the construction of cultural identity. Overall, this volume is a milestone – the history of ancient mathematics has its very own French revolution, and it has finally crossed the Channel.

Serafina Cuomo
Birkbeck, University of London

Marco Beretta, Francesco Citti and Lucia Pasetti (eds.), **Seneca e le Scienze Naturali.** Florence: Leo S. Olschki Editore, 2012. Pp vi + 273. ISBN 978-8822-261982. €29.00 (paperback).
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In November 2008, a group of researchers from different fields met in Ravenna, Italy. This volume contains a collection of the essays – in Italian, English and German – proceeding from that meeting. The great challenge of the book lies in its interdisciplinary character: Seneca's scientific work *Naturales Quaestiones* has been treated not only by philologists, but also by scholars from other fields. However, one does not know the authors' educational background – which can be considered at the same time as a merit and as a deficiency of the book.

Marco Beretta explores Seneca's concept of natural law, in relation to the Epicurean idea of a natural legacy. In the first part of his essay, the author presents a short doxography dealing with the different ways the idea of natural law had been conceived before Seneca. Whereas some ancient philosophers thought of it in terms either of habits ('what usually happens in nature') or harmony ('normal functioning of the body'), Stoics rather conceived it within a providentialist view of nature. This attitude contributed to linking natural phenomena with their prime cause; that is, the divine law (p. 5). Thus, in the strong Stoic view, natural laws, as they imply necessity, are inexorable. Seneca's idea of natural lawfulness is indeed consistent with Stoics' view, but Beretta states that the ancient philosopher would likely have read Lucretius, for his providentialism and finalism are not so strong as in other Stoic scholars. In fact, Lucretius rejected astrology as a scientific tool of inquiry, even though this was implied in Stoicism. Thus Seneca's conception of natural lawfulness seems close to the idea of natural law in classical mechanics for its main characters: universality and invariance.

Piergiorgio Parroni analyses Seneca's dramatic language as a scientist. Since the aim of Stoic science is to turn humans into better persons, *Naturales Quaestiones* displays a peculiar style, which is not far from Seneca's moral works and deeply pathetic. Knowledge of natural phenomena is urged, then, mainly because they can affect mankind – as, for example, is the case with earthquakes. Thus the context of fear of death amplifies the dramatic emphasis of scientific knowledge. The imaginative power of allusions is required to emphasize a scientific statement, as it deprives it of its bleak theoretical features by charging it with the pathos that makes science and humanities meet (p. 29).

Harry Hine questions Seneca's originality and independence in scientific matters and states that the ancient writer was indeed a creative philosophical thinker, as he 'gives a distinctive and probably novel Roman stamp to his philosophizing' (p. 32). This novelty is inferred by the author from the fact that Seneca does not generally translate Greek terms, but he is rather interested in the history of Latin terminology of the meteorological phenomena he is writing about.

Francesca Romana Berno focuses on the theory of the four elements, as it has been treated in *Naturales Quaestiones* Book 3. More specifically, in that passage Seneca exploits the idea of the transformation of elements. Water is not going to run out, nor can it be produced: each element is