A CONFERENCE ON ANCIENT SCIENCE

C. J. TUPLIN, T. E. RIHLL (edd.): *Science and Mathematics in Ancient Greek Culture* (With a Foreword by L. Wolpert). Pp. xvi + 379, ills. Oxford: Oxford University Press, 2002. Cased, £50. ISBN: 0-19-815248-5.

Here are gathered annotated papers read at a conference held at Liverpool in 1996. The subjects are diverse, and 'technology' could have been included in the title of the resulting book. The level of scholarship is high throughout. In a short review some of the reasonings and conclusions can be reported, but the seventeen chapters deserve a longer, detailed discussion.

Lewis Wolpert in the Foreword argues that love of knowledge, made possible by leisure, drove Greeks to philosophy and thence to science, but, he claims, 'most of Greek science turned out to be wrong'. Wolpert's admiration of Archimedes is manifest, but he is puzzled by the rarity of experiment in Greek science and the lack of a developed experimental method. The notion of air being the primary substance is ascribed to Anaximander (p. ix), but does not Anaximenes deserve a mention here?

Rihll, writing on Greek science in context, has helpful thoughts about recent scholarship and rightly emphasizes that ancient scientists—except perhaps in mathematical astronomy—were not working in accordance with our scientific method. He discusses candidly the slavery that made intellectual pursuits possible for many Greeks. The reviewer applauds the conclusion that the emergence of scientific thinking in Greece is a historical problem of the first order, 'and not just for ancient historians'.

In 'Words for Sounds', Andrew Barker subtly explores mismatches between adjectives designating attributes of sounds and the acoustic domain. Barker, who believes Archytas 47 B1 D.K. to be genuine (p. 29), asks why Archytas seems to have connected high with loud and low with quiet. The suggested answer is that oddities in acoustical theories originate in the meanings of inherited terms. The terms are metaphorical, yet the metaphors, even as late as Ptolemy's *Harmonics*, were assumed somehow to describe the phenomena.

J. L. Berggren's discussion of Ptolemy's maps explains geometrical problems connected with latitude and lengths of daylight. He remarks upon the problem of determining the longitudinal extent of the known world; and the claim is made, reasonably (p. 54 n. 32), that winds with their directions form part of the ancient conception of the world. The entire chapter is a lucid contribution to the study of mathematical geography.

Harry M. Hine examines ancient studies of earthquakes and volcanoes. Seneca wanted to learn more about the changing appearance of Mount Etna, but in general there was little demand for a geological literature concerned with earthquakes and eruptions. Hine points out that if Pindar's Typhos was pressed down not only by Etna but also by the heights of Kyma, the monster was enormous. Such poetical evidence has a place in scientific study, because there were links, even if they are hard to perceive, between those who studied seismic events and those who suffered from them.

A long contribution by Alan C. Bowen considers astronomical prediction with particular reference to the tale of a lunar eclipse associated with the battle of Pydna. Texts of Polybius, Cicero, Livy, Plutarch, and Pliny are pondered. In Pliny, Sulpicius Gallus predicts the eclipse before the battle, thus freeing the Roman army from anxiety. Bowen argues that here is an instance of cultural appropriation. Chaldeans and Babylonians had been known as predictive astronomers, but now, for Pliny, prediction

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https://doi.org/10.1093/cr/54.1.82 Published online by Cambridge University Press

by Greeks and Romans also is a service to mankind. The proper function of astronomers was thus not only to explain but also to foretell.

R. Hannah argues, on the basis of the parapegma in Cod. Vind. Philos. 108, that Euctemon's seasonal calendar had a zodiacal framework. It is clear that Euctemon made use of traditional day-counts between star observations in setting out his calendar, and it may well be, as Hannah suggests, that Euctemon was particularly concerned to place agricultural festivals closely in exact times of the year. Yet there is still room, perhaps, for van der Waerden's suggestion that Euctemon used both zodiacal months and day-counts of intervals.

L. Taub, discussing Alexandian astronomical instruments, proposes that equinoctial rings, though declared inaccurate by Ptolemy, were employed for predictive purposes, including weather forecasting and astrology. These practical functions would perhaps explain why the rings continued so long to be used. J. J. Coulton contributes a fine chapter on Hero's dioptra, its construction, and its use. Hero assumes that what is exact in theory will be accurate in practice, but the dioptra was not equivalent to a theodolite. Hero himself was not a surveyor, and he does not give the dioptra a part in the only ancient evidence for the establishing of a framework of measured triangles. S. Cuomo writes about Hero's *Belopoeica.* He has instructive thoughts about the need for security, even during the *Pax Romana.* Missiles can reassure cities and contribute to the *ataraxia* of the citizenry.

J. R. Milton looks for reasons why atomism made so little progress outside Epicureanism. One reason, apart from the exclusivity of the school, is the primitive character of Epicurean astronomy, but more fundamental, Milton argues, were boundary problems between full and void—there was no evidence for thinking that atoms were one shape rather than another. Milton also has illuminating remarks upon Newtonian and later corpuscularian thought.

R. Netz asks why there were so few mathematicians in antiquity in comparison with, say, historians. Part of the difficulty was that mathematicians worked in isolation. Also, their studies, even at a popular level, did not attract the interest of non-mathematicians. But, above all, mathematics is difficult. There is much wisdom in Edward Hussey's essay on Aristotle and mathematics. He insists that there is for Aristotle a correspondence between mathematical objects and objects in the world, since the world is spatially extended. Geometry is the science of things occupying space. But Aristotle also compares time-stretches and physical quantities with lines, and so he moves towards a truly mathematical physics (pp. 224–5). The argument firmly supports the plea to see all Aristotle's thinking as interconnected. He is not only a scientist and a philosopher but also a mathematician, one who perhaps was aware that he could not do all that needed to be done.

A testing chapter by C. M. Taisbak shows that Euclid did not state and prove the Fundamental Theorem of Arithmetic: every number is either a prime or a product of primes in one way only (*Elements* 9.14 is weaker, and Euclid is there concerned with measurement of continuous lines, not with factors). Yet Euclid could have proved the theorem. However, says Taisbak, he saw no case for doing so. In his arithmetical books Euclid is basically concerned with measuring, not with products and multiplication.

V. Nutton, in 'Ancient Medicine: Asclepius Transformed', shows how Hippocratic medicine has ceased to be a specialism but has become widely accessible to students of the Greeks. He remarks upon the removal of the division between Cnidian and Coan doctrines, and urges us to go behind Galen's criticism of his opponents, since he is a prejudiced witness to their doctrines. Feminism has helped to draw classicists' attention to medicine (p. 254); more recent fashions have been less helpful. Sources must never be

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neglected. Teun Tieleman considers Galen's opinions on the seat of the intellect in connexion with both tradition and experiment. Galen made use of Erasistratus (for the arterial system) and of Herophilus (for the nervous system), and was himself responsible for some improvements in experimental method (pp. 267–8), but he fails to explain how the three parts of the soul interact physiologically. Galen, it is shown, is not so much an experimental scientist as an empirical Platonist.

Rihll and J. V. Tucker examine knowledge of materials in Classical Athens. Their particular concern is with mining and connected activities at Laurium. Silver production is described; its size and importance to Attic society are emphasized. Skill in smelting and cupelling is shown to have lacked the support of theoretical understanding. Theories of Theophrastus and others about materials are examined. A rugged realism pervades the discussion: 'Practitioners need to know what to do and when to do it; they do not need to know why something happens'. 'Know what' knowledge is not written down; it is passed on only by 'being there' and being taught by someone who has the knowledge (p. 298).

C. Anne Wilson, writing on distillation, sublimation, and the four elements, offers original insights into ancient chemistry. Her erudition is deep and extensive. She moves with ease from copper in Plato's *Timaeus* to Gnostic baptism; from the production of mercury out of cinnabar to the origins of 'Greek fire'. Her text penetrates into 'the enclosed world of the chemical art' and reveals secret wine-distilling as a cultic activity in Gnostic and pre-Christian communities.

This is an immensely instructive book. The reviewer praises editors and contributors for their scholarship. Texts are cited and translated. There are indices and a bibliography. Many of the problems cannot yet be solved, but the right questions are asked throughout.

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IAMBLICHUS' LIFE OF PYTHAGORAS

M. von Albrecht, J. Dillon, M. George, M. Lurje, David S. du Toit: *Jamblich: ΠΕΡΙ ΤΟΥ ΠΥΘΑΓΟΡΕΙΟΥ ΒΙΟΥ. Pythagoras: Legende–Lehre–Lebensgestaltung*. Pp. 352. Darmstadt: Wissenschaftliche Buchgesellschaft, 2002. Cased, €25.90. ISBN: 3-534-14945-9.

This is the fourth volume published in a series ('SAPERE') intended to present Greek and Latin texts of late antiquity in a manner showing their intrinsic interest and bringing to bear an interdisciplinary approach, for the use not only of scholars but also of a wider interested public. Iamblichus' *De Vita Pythagorica* (= *VP*) is certainly an appropriate text in this regard, and the contents of the present volume correspond to the approach to such texts proposed by the series. Thus, following a brief introduction to the life of Iamblichus and to the *VP*, we are given the Greek text and a German translation of the *VP*, followed by five essays by various scholars concerning the *VP* in itself and as compared to the Christian Gospels and to Athanasius' *Vita Antonii*. The volume also includes a bibliography and indices. Some

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