Measuring the past

All Done with Mirrors
by J. F. Neal
Secret Academy Press: 2000. 274 pp. £25, $38

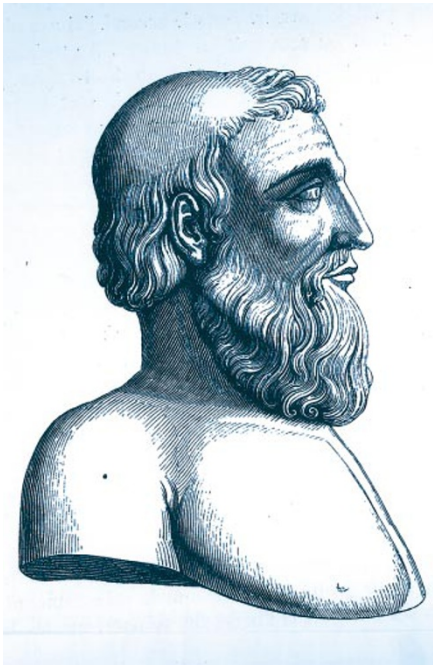
Michael Vickers

Thanks to John Neal's remarkable new book, ancient metrology — once the playground of Newton, but now largely ignored even by archaeologists — should cease to be a pariah subject and regain its place at the centre of the study of antiquity. In the past, the widely attested variations in ancient reported linear measurements have been put down to sloppiness on the part of our ancestors. But Neal is able to show that such variations belong to a logical, elegant and cohesive system partially based on divisions of the Earth's surface at different points on the longitudinal meridian.

The Earth is not a true sphere, but is subject to polar flattening, which means that the longitudinal meridian, or the great circle through the poles, is essentially elliptical. The distortion is minute, but it creates a measurable variation from degree to degree. Degrees nearer the poles are longer than those at the Equator. Thus, a widely accepted value for the Greek foot of 1.0114612 feet proves to be 1/360,000th part of the longitudinal meridian degree at just under 38° latitude, the same latitude as that of the Aegean.

Elaborating a scheme first noted by the philosopher and historian John Michell, Neal observes that feet (or cubits) stand in a ratio of 175:176 to larger units in a series. This at once explains the Roman architect Vitruvius' account of an odometer — an instrument for measuring the distance travelled by a wheeled vehicle — that contained a mechanism designed audibly to release a stone into a box every mile, in his case, 400 revolutions of the 12½-foot-perimeter wheel to the 5,000-foot mile. If Vitruvius' 4-foot radius to 12½-foot perimeter, or 3.125π ratio, was strictly adhered to, there would have been a discrepancy of more than 28 feet in every mile. But if the shorter Roman foot of 0.967680 feet was used for the diameter of the carriage wheel, and the longer Roman foot of 0.973209 feet used for the perimeter, the calculation of the mile is accurate in terms of the longer measure. The difference between $^{22}/_{7}$ and $^{25}/_{8}$ can be expressed as 3.142857 = 176, and 3.125 = 175 (both values of π were used in the ancient world).

Neal notes that if a diameter is a multiple of either four or eight, 3.125 may be accurately used to maintain an integral number in the perimeter, because the ratio between using true π as the module of measurement of the diameter is the 175th part less than that of the perimeter. There was thus a practical



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Marcus Vitruvius Pollio: not missing the mile.

purpose underlying variational fractions between the ancient standards (and this is but one of many), and they can no longer be put down to carelessness or error.

Although the system is complex, it is blindingly obvious once it is tabulated. Roman, Greek, Egyptian and Babylonian measures are seen to be interrelated. Life is breathed again into the late Alexander Thom's 'megalithic yard', a unit of measurement Thom found to have been consistently used at many prehistoric megalithic sites. As Neal points out, "not only is the megalithic system largely ignored by archaeologists, it is opposed — even by the numerate among their ranks". This position is now untenable, as it can be shown that the megalithic yard shared an origin with the Sumerian cubit. And the foot-measure used in England — equivalent to a Greek foot — proves to have played a pivotal role in the whole metrological system. It is ironic that just as it is being thrown on the scrap heap of history, its historical importance is beginning to be recognized.

Another problem besetting metrology is that it has become the lodestar of internerds and pyramidiots. Neal is extremely careful of the feelings of mathophobes, and develops his ideas in a way that the innumerate can follow and the mathematician enjoy; he gives short shrift to "pyramid-inchers" and "inch-prophecy theories" (look up, but not for long, the Great Pyramid on the web). By contrast, this is a sober and thoughtful analysis with far-reaching consequences for the study of the past. More than that, it is a major contribution to the history of science. ■

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A passion for butterflies

A nineteenth-century collection of the Large Blue (*Maculinea arion*), which became extinct in Britain in the late 1970s, one of the many fine illustrations of butterflies and those who studied them in *The Aurelian Legacy: British Butterflies and their Collectors* (by Michael Salmon, Harley Books: 2000, £30.00). The story of the Large Blue well illustrates the mania that gripped some nineteenth-century collectors, with the taking of "more than 2,660 specimens" of this rare butterfly at a Cornish site in 1896. Most of the entomologist-collectors described by Salmon were fortunately less acquisitive and laid the foundations of our present knowledge of butterfly biology and ecology. This information-packed but highly readable account of 300 years of British lepidoptery, practised largely by amateurs, is a must-read for butterfly afficionados and social historians alike.

The amateur tradition continues, and records collected by thousands of volunteers between 1995 and 1999 provided the data for *The Millennium Atlas of Butterflies in Britain and Ireland* (edited by Jim Asher *et al.*, Oxford University Press: 2001. £30.00, $40.00). This handsomely produced book records the most comprehensive survey of butterflies ever undertaken in Britain and Ireland, and provides an invaluable picture of the state of all the native species, now under threat from habitat destruction if no longer from the killing bottle and collecting box. Happily, the Large Blue figures in this book as well, having been reintroduced to managed sites in the 1980s and 1990s.