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The Greeks: Historians and commentators

Johan Ludvig HEIBERG (1854-1928), Danish historian.

Heiberg discovered the Archimedes Palimpsest, which contains the only copy of The Method. His edition of Euclid's Elements was translated into English by Heath. He also wrote on Ptolemy's Almagest.

T. L. (Sir Thomas) HEATH (1861-1940), British historian.

Heath's 2-volume work on Greek mathematics was cited above. In addition, he wrote:
Diophantus of Alexandria: A study in the history of Greek algebra, CUP, 1885;
Aristarchus of Samos, the ancient Copernicus, OUP, 1913.
He also edited translation of
Apollonius of Perga: *Treatise on conic sections*, CUP, 1896;
Archimedes: *Works*, CUP, 1897;
Euclid, *The thirteen books of Euclid's Elements*, CUP, 1908.

B. L. van der WAERDEN (1903-1996).

Van der Waerden was one of the leading algebraists of the 20th C., best known for *Moderne Algebra*, I (1930), II (1931) (2nd ed. I, 1937, II, 1940). His book of 1983 is cited earlier.
Otto NEUGEBAUER(1899-1990).
Thesis (on RP), *Die Grundlagen der ägyptischen Bruchrechnung*, Springer, 1926 [The foundations of Egyptian calculations with fractions].
Worked on MP, 1928. Founded *Zentralblatt für Mathematik und ihre Grenzgebiete* (Zbl), 1931.
Left Nazi Germany for USA; founded *Mathematical Reviews* (MR) 1940 (electronic version: MathSciNet).
N. M. SWERDLOW, Otto E. Neugebauer, 1899-1990: A biographical memoir. Biographical Memoirs, 1998, National Academies Press, 26p [available on the Internet].

We shall meet van der Waerden later (Week 10). He was a colleague of David Hilbert (Week 9) at Göttingen, and also of Emmy Noether (Week 10).

David H. FOWLER (1937-2004).

Fowler's book of 1987 was cited earlier. From his obituary in *The Times*, 10.5.2004:

"The mathematician David Fowler, who has died aged 66, was one of the leading authorities on the history of mathematics in ancient Greece.

What distinguishes the modern world from the mediaeval world most clearly is science. Mathematics is, broadly, the common core of all science. The first cultures to produce serious mathematics were the Egyptian – witness the superb standard of the surveying of the pyramids – and the Mesopotamian (from whom we inherit counting in sixties, for seconds and minutes). But it was the Greeks who first began to apply logical reasoning to mathematics systematically, and in particular to use mathematical proof. Proof is the essence of mathematics, and hence the underpinning of science. Mathematics that still survives was being done in the Greek world by the sixth century BC. Pythagoras' theorem, that we all learn in school and use for marking out right angles, dates from this time. In particular, if we take a right-angled triangle with two sides of length 1, Pythagoras' theorem tells us that the long side – the hypotenuse – has length $\sqrt{2}$, the 'square root of two'. This number, as the Greeks proved (probably in the fifth century BC) is irrational – cannot be represented as a fraction, or ratio of whole numbers. This discovery put Greek mathematicians into a quandary. They knew a great deal about rational numbers (the fractions of our school arithmetic). They knew a great deal about geometry, and lengths of geometrical objects. They valued logical, rigorous proof very highly. But they could not put all this together. This was unavoidable – the mathematical machinery needed to handle general – 'real' – numbers was not developed till 1872. But it did present authors of Greek mathematics books with fearsome problems.

In Alexandria around 300 BC, Euclid wrote his Element of Mathematics, in twelve Books. Euclid's Elements dominated mathematics for nearly two thousand years, and remains one of the two most famous mathematics books ever written (with Newton's Principia, of 1687). The ordering of the material in Euclid seems very strange to a modern eye, and is dictated by these problems.

David Fowler's principal contribution was a systematic study of the internal structure of Greek mathematics, with all this in mind. In Euclid, for example, most of what is said stands the test of time very well. But it is what is not said, and why it is not said, that really counts here. The crux is Euclid's Book V, on the theory of proportion, and Book X, on irrationals and 'incommensurables' – pairs of numbers having an irrational ratio.

The key institution in all this was Plato's Academy in Athens, in the fourth century BC. Plato's friend Thaetetus worked on proportion, and this led Eudoxus, a pupil of Plato, to develop his theory of proportion, on which Euclid's Book V is based. We take real numbers and division for granted. The Greeks, in effect, developed a theory of ratio (logos in Greek) without either of these, using a technical procedure known as anthyphairesis. Fowler's study *The Mathematics of Plato's Academy: A New Reconstruction* was published by Oxford University Press in 1987, and is his lasting memorial."

Wilbur R. KNORR (1945-1997).

An American historian of mathematics, he wrote extensively on mathematics in antiquity. See e.g.

David H. FOWLER, In memoriam, Wilbur Richard Knorr (1945-1997). An appreciation. *Historia Mathematica* **25** (1998), 123-132 [available on the Internet].