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## **Hypatia: Sifting the Myths Transcript**

Date: Thursday, 29 October 2015 - 4:00PM

Location: Barnard's Inn Hall

29 October 2015

## **Hypatia: Sifting the Myths**

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### **Introduction**

The first woman mathematician of whom we have reasonably secure and detailed knowledge, Hypatia was the daughter of Theon of Alexandria, mathematician, astronomer, and member of the Museum. Reputed to have outshone her father in her studies, she devoted her life to the teaching of mathematics and Neoplatonist philosophy in Alexandria. She is most famous for her brutal murder (c.415 AD) by a zealous crowd of monks. Much has been written about her, but little is known for certain. This talk attempts to give an account of current thinking on her life and her mathematics.

### **Life and teaching**

Hypatia may not have been the first active female philosopher-mathematician in Greek culture. Other examples are: Theano (6<sup>th</sup> C. BC, associate of Pythagoras); Hipparchia (fl. 325 BC, wife of philosopher Crates); Pandrosion (Alexandria, a generation or two before Hypatia); Sosipatra of Ephesus (first half of the 4th century, Neoplatonist philosopher and mystic); Eudocia Palaeogina (described later as another Theano or another Hypatia); and Asclepigenia (fl. 430 AD, taught the philosopher Proclus). They tend to be mentioned in asides, however, and information about them is sketchy at best, while Hypatia is mentioned in contemporary, or almost contemporary sources, and in all of them described without reservation as a teacher of philosophy and mathematics, practising around the turn of the 4<sup>th</sup> to 5<sup>th</sup> centuries AD.

Because of the brutal manner of her death, she has been "iconised" as a martyr for various causes: women intellectuals, liberated women generally, science and/or freedom of thought amid 'restrictive' Christianity. Journals and art galleries have been named for her. She has been hailed as a romantic heroine in novels (e.g. Charles Kingsley, also author of *The Water-Babies*), and even a film: *Agora*. All of these examples say more about the authors than about Hypatia herself – and few if any of them are based on evidence from contemporary sources. Whatever the artistic merits of novel or film, they are not for consideration today. Today we are concerned with the person herself and her mathematics, and how we can discover something close to the truth.

The main contemporary sources are contained in two extensive Greek collections: the *Suda* Lexicon, a 10th C encyclopaedia, and the *Patrologiae Graecae*, a collection of early Christian writings, edited in the 19th C by J. P. Migne (161 vols). We will mostly be using two works on history contained in these: the *Life of the philosopher Isidorus* (c.450—c.520) by his Neoplatonist pupil Damascius (c.458—after 538), and the *Ecclesiastical History* of Socrates Scholasticus (c. 440). There is also the extensive correspondence of Hypatia's pupil Synesius, and what has come down to us of 4<sup>th</sup> century commentaries on the work of earlier mathematicians. For analysis of all these and more, I am greatly indebted to Deakin, Dzielska, Watts, and Knorr, from the Reading List below.

Hypatia, at first her father's pupil in mathematics, grew to outshine him in this subject, and in philosophy, where she became a renowned teacher in Alexandria. Such was her eloquence, wisdom, and prudence that people came from far and wide to hear her teach. Not only that, despite being female she felt free to don the *tribon*, or scholar's cloak (normally a male garment), and teach philosophy publicly in the city. She would even appear in front of the city magistrates to advise them, for she did not feel embarrassed in going to a male assembly, on account of the self-possession and ease of manner which she had acquired through the cultivation of her mind. Indeed, "all men on account of her extraordinary dignity and virtue admired her the more". All reports say that she was very beautiful and attractive, but that she chose not to marry.

Much of what we know about her teaching and her pupils comes from the letters of her pupil Synesius of Cyrene, a city on the north coast of modern Libya. About 160 of these letters survive, along with other works. Many are directly relevant to his Alexandrian circle, including Hypatia, whom he calls, "mother, sister, teacher, benefactress in all things." Born in the 370s, he studied in Alexandria in the early 390s. In the mid-390s he spent some time in Athens, which does not seem to have impressed him, and in 398 he was chosen as an envoy to the imperial court in Constantinople, to obtain tax remissions for his country. There he had to wait around for about three years for his audience with the Emperor, and he was relieved when in about 403 he could return to Alexandria, where he married and started a family, before returning to Cyrene c. 405. There he lived the life of any young man of substance of the time, "studying philosophy, mathematics, astronomy, everything; farming, hunting, having many a brush with hordes of pilfering Libyans; and every now and then upholding the cause of someone who had undeservedly fallen into difficulties". In about 410 he was consecrated bishop of Ptolemais, near Cyrene, by the Patriarch Theophilus of Alexandria. This was against his will, but he did the job faithfully.

Throughout, he continued to write to his friends recalling good times as students under Hypatia, whom he consulted on philosophy, and the publication of his books. At times, he asked for her help for his friends (she

had influence in high places), and he praised her highly in his dedication of a gift of an astrolabe to an influential official. On his deathbed, he asked to supply him with a hydroscope (hydrometer) of his own design, and shortly afterwards, he addressed his last letter to her. In all, he seems a rather tragic figure, not only dying before he reached forty, but seeing all his three children go before him, the eldest of them not yet ten.

However, it is through Synesius that we know about Hypatia's teaching and her pupils. Many of them Christian, they came from as far away as Libya, Syria, and Upper Egypt. As well as philosophy, they came for a cultural training, and afterwards they became bishops, government officials, estate owners with a high interest in culture, i.e. good solid members of the establishment. This training suited their diverse backgrounds and interests, in a philosophy that aimed to reveal deep truths about God and the nature of the world, and, involving no ritual, did not openly conflict with Christian thought. In a city with a Christian majority she remained a popular teacher. Moreover, in their joint pursuit of enlightenment these students made lasting bonds of friendship, which encouraged them in intensive contemplation and personal temperance.

## Mathematics

It is from Synesius also that we know some of Hypatia's mathematics. As mentioned above, he praised her involvement with the design of an astrolabe he presented to an influential official, and he asked her to supply him with a hydrometer which he described in detail. From this we infer that she would have been familiar with both. Appealing to the *Suda*, we find that she wrote a commentary on the *Arithmetic* of Diophantus, on the *Astronomical Canon*, and a commentary on the *Conics* of Apollonius. Moreover, her father Theon in his commentary on Book III of the *Almagest*, Ptolemy's influential work on the motions of the stars and planets, proudly wrote of the contribution of "my daughter Hypatia, the philosopher".

The works of Apollonius on Conic Sections (c. 200 BC) consisted of eight books, of which the last is lost. Books I-IV have come down to us in Greek via a commentary by Eutocius (early 6th C), and Books V-VII through Arabic translations. Studies of style and language in the two different sections seem to support the idea that Eutocius had access to Hypatia's text and revised it in his edition of the first four books.

Of the *Arithmetic* of Diophantus, six books have come down to us in Greek, and another four in 9<sup>th</sup> century Arabic translation. There are enormous stylistic differences between the two, and it is thought that one of these versions may be based on Hypatia's commentary, as described in the *Suda*, but it is not clear which!

Finally we come to Theon's note on Hypatia's contribution to his commentary on the *Almagest*. The precise meaning is unclear and has been disputed. Did Hypatia merely prepare an edition of the text, while her father prepared the commentary? Or is this an improved edition of the commentary, superseding one of Theon's own? Studies comparing the style and content of Book III of the commentary (the one with Hypatia's involvement) with Books I and II (presumably Theon's alone) have shown methods of computation in Book III, which are superior to similar computations in Books I and II. These methods were identified again in Book IV, and it is thought that perhaps they are Hypatia's while the others are Theon's. This is obviously speculative, but the idea is attractive all the same.

## The last days

While Theophilus was bishop (384-412), things were fairly safe for Hypatia. He had no love for pagans and could be a ruthless and violent opponent. Alexandria had a reputation in the Roman worlds for its volatility, and there were many riots in his time between Christians and pagans, including some Neoplatonist teachers. In 391 these more "muscular" Neoplatonists occupied the Serapeum, the main pagan temple, dedicated to the Alexandrian patron god Serape. It seems that Hypatia and Theon distanced themselves from this disturbance - they were of a more intellectual, less ritualistic brand, but the occupiers were eventually granted an amnesty by Emperor Theodosius provided all pagan images were destroyed, and Theophilus duly razed the temple, angering many of the pagan citizens.

However, Theophilus seemed content to let Hypatia be. He apparently tolerated her school and her "product" (all good solid members of the establishment). He even made two of them bishops. He also tolerated her connections with local power structures, including the government prefect, Orestes. This all changed with his death in 412.

Immediately afterwards, there was violent conflict between his nephew Cyril and his archdeacon Timothy over the succession, and after three days of street fighting, Cyril won. Cyril, who has been described as a most "intemperate man", immediately set about settling scores: Timothy's supporters, the Jews, the pagans. This infringement of civil jurisdiction angered the Prefect Orestes, and a power struggle grew up between the two, during which Orestes was nearly killed in a riot by Cyril's supporters. It seems that Hypatia, along with moderate city officials (Christian, like Orestes, and probably supporters of Timothy) was in Orestes' camp. She was, in a way, a threat to Cyril, having international influence through her students. On the other hand, her influential pupil Synesius was dead by then and could no longer protect her.

One commentator, Damascius, describes an occasion when Cyril, driving through the city, passed a house where there was a happy hubbub of people and carriages, some coming and going, and others were waiting

expectantly. On asking whose house this was, he was informed that it was the house of the philosopher Hypatia, and that she was about to teach. Damascius says that, "When he learned this, his soul was bitten with envy". No doubt, people did not queue up at his house to hear what he had to say. Damascius says that Cyril immediately began plotting her murder.

Whether or not this is true, rumours were spread that that it was Hypatia who prevented Orestes from being reconciled to the bishop, and according to another commentator, Scholasticus: "Some Christians, hurried away by a fierce and bigoted zeal, whose ringleader was a reader (a minor cleric) named Peter waylaid her returning home, and dragging her from her carriage, they took her to the church called Caesareum where they completely stripped her, and then murdered her with tiles. After tearing her body in pieces they took her mangled limbs to a place called Cinaron, and there burnt them." He adds that they inflicted "very great pollution and shame on their homeland", and that in his time the memory of these events was still vivid among the Alexandrians.

In the end no-one was punished, but Cyril was hailed as "a New Theophilus, for he had destroyed the last remains of idolatry in the city" - and was later made a saint. Meanwhile, intellectuals drifted away to Athens.

As for Hypatia, she has become more famous and more highly honoured than her persecutor. Moreover, she might not have been so well remembered if she had not been brutally murdered. Finally, we know we owe much to her for what has come down to us of the mathematics of Euclid, Apollonius, Diophantus, Ptolemy and others.

## Reading list

Deakin, Michael, *Hypatia of Alexandria, Mathematician and Martyr*, Prometheus Books, 2007

Dzielska, Maria, *Hypatia of Alexandria* (tr. F. Lyra), Harvard University Press, 1995

Edward J. Watts, *City and School in late antique Athens and Alexandria* (2006)

Knorr, Wilbur, *Textual Studies in Ancient and Medieval Geometry*, Boston, Birkhäuser, 1989

Cameron, Alan, "Isidore of Miletus and Hypatia: On the Editing of Mathematical Texts", *Greek, Roman, and Byzantine Studies*, 31, 1990, p.103-127

*Dictionary of Scientific Biography*, ed. Gillespie et al, New York, Scribner vol. 6, 2008

J. M. Rist, "Hypatia", *Phoenix*, Vol. 19, No. 3. (Autumn, 1965), pp. 214-225.

Belenkiy, Ari, "An astronomical murder?", *Astronomy & Geophysics*, Volume 51 April 2010, pp. 2.9-2.13

Migne, J.-P. editor, *Patrologiae Graecae*, Paris, 1857-1866 (165 vols)

## General reading

Boyer, C. B., *A History of Mathematics*, 2nd Edition, 1968 (many editions since)

Fowler, David, *The Mathematics of Plato's Academy: A New Reconstruction*, Oxford: Clarendon Press, (1987); paperback edition, (1989)

Heath, Sir Thomas, *A history of Greek mathematics*, 2 vols, 1921 (reprinted 1981)

*Sherlock Holmes in Babylon and Other Tales of Mathematical History*, ed. Marlow Anderson, Victor Katz, and Robin Wilson, Mathematical Association of America, 2004

## Internet resources

The Catholic Encyclopedia:

<http://www.newadvent.org/cathen/>

The Suda online:

<http://www.stoa.org/sol/>

Letters of Synesius:

<http://www.oocities.org/hckarlo/synesius.html>

<http://www.livius.org/articles/person/synesius-of-cyrene/synesius-texts/>

The astrolabe:

<http://www.ifa.hawaii.edu/tops/astl-hist.html>

[http://cse.ssl.berkeley.edu/AtHomeAstronomy/activity\\_07.html](http://cse.ssl.berkeley.edu/AtHomeAstronomy/activity_07.html)

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