Diocles

Summary:

Diocles (*fl*. 190-180 B.C.E.) was a Greek mathematician whose only extant work survives as an Arabic translation of the lost Greek original, titled *Kitāb Dhiyūqlīs fī l-marāyā l-muḥriqa* ("The book of Diocles on burning mirrors").

Article:

Diocles (*fl*. 190-180 B.C.E.) was a Greek mathematician whose only extant work survives as an Arabic translation of the lost Greek original, titled *Kitāb Dhiyūqlīs fī l-marāyā l-muḥriqa* ("The book of Diocles on burning mirrors"). All that can be deduced about the life of Diocles from this work is that he spent at least part of his working life in Arcadia, in the Peloponnese.

The subject matter of Diocles' work - 'burning mirrors' - refers to the process of light reflecting from a mirrored surface to an object in a highly focused way such that the temperature of the surface at which the light is focused rises significantly - the temperature rises sufficiently to the extent that the surface on which the light is focused starts to burn. The practical applications of this process made it a popular subject of study in geometry and optics in the Greek, Arabic and Latin scientific traditions.

Diocles' work however goes well beyond just the study of the geometrical analysis of the process of 'burning mirrors'. In the *Kitāb Dhiyūqlīs* he analyses various geometrical problems - nearly all of which are related to the study of 'conics'. 'Conics' refers to the geometrical study of what happens when the point of a cone-shaped thing intersects with a planar (flat) surface of another thing. Diocles assigns the geometrical analysis of 'burning mirrors' to the category of conics because light, which was regarded as a cone-shaped thing in Greek science, intersects with the flat surface of the object on which it is focused.

The text of *Kitāb Dhiyūqlīs* starts by a lengthy introduction. This introductory part gives an indication of the topics to be covered in the main part of the text. It also mentions issues related to instrumentation; including materials from which they are manufactured. The introduction also situates the subject of 'burning mirrors' as a topic which belongs within the category of a mathematical science. The main part of the text consists of sixteen propositions. Propositions one to five analyse the geometrical cases of conics relevant to burning mirrors from various types of mirrors (parabolic and spherical). Propositions seven and eight analyse the unsolved problems on conics from Archimedes' *On the sphere and cylinder*. Propositions ten to sixteen investigate and solve the problem of the construction of a cube twice the size of an existing one (referred to as either 'the problem of doubling the cube' or the 'Delian problem').

The work in its original Greek appears to have been in circulation during late antiquity. There is evidence of it being used as a source by the late antique Greek author Eutocius (d. c. 540 C.E.): Eutocius refers to 'the method of Diocles' in his commentary on Archimedes' *On the sphere and cylinder*.

Diocles' text was translated into Arabic as *Kitāb Dhiyūqlīs fī l-marāyā l-muḥriqa* ("The book of Diocles on burning mirrors") by an unknown translator but who was clearly familiar with terminology related to mathematics and conics. Diocles' work was also transmitted to Arabic via translation of Eutocius' commentary on Archimedes' *On the sphere and cylinder*. Ibn al-Haytham (d. 430-31/1039-40) probably used Diocles' work in his own detailed analysis of reflection from different kinds of mirrors in Book V in *Kitāb al-manāẓir* ("Optics") and in his *Maqāla fī al-marāyā al-muḥriqa bi l quṭūʿ* ("Treatise on parabolic burning mirrors"), although he does not cite Diocles by name. There is also a named reference to Diocles in an untitled bibliographic work by Muḥammad bin Ibrāhīm bin Sāʿid al-Anṣārī al-Akfāni al-Sakhāwī (d. 1348-49/749) in a section entitled, *ʿIlm al-marāyā al-muḥriqa* ("Science of Burning Mirrors) which immediately follows the section entitled, *ʿIlm al-manāẓir* ("Science of optics").

In Latin, Diocles' work came to be known indirectly. First, via translation from Arabic of Ibn al-Haytham's *Optics* by the late thirteenth century (C.E.). Secondly, from Greek via the translation of Eutocius' commentary on Archimedes' *On the sphere and cylinder* in the middle of the sixteenth century.

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