Minutes of Feb. 19 meeting (Mark S. reporting):

Genia presented proposition 2 of the Method, emphasizing the connection between the proportions between lines in the circle and the Pythagorean theorem. Barry pointed out that the only reference to the Elements in prop. 2 concerns XII.10, and wondered why Archimedes seems to presuppose greater familiarity with solid than plane geometry on the part of his readers. Genia suggested that the selection of one of the bodies that is to be analyzed on the balance using the "mechanical method" determines the other body or bodies; it is interesting to think about whether Archimedes was aware of this. We discussed the meaning of the word *ephodos*, which Archimedes uses instead of the more usual *methodos*; he seems to have chosen it to emphasize the work's heuristic character. (Paul agreed to track down earlier uses of the word in e.g. Aristotle and report back to us next week).

There was further discussion of the senses in which the *Method* can be considered a "heuristic" work. Mark S. noted that most of the propositions proved in the Method are demonstrated elsewhere in Archimedes, the only exceptions being (he thinks) the theorems mentioned in the introduction, which Archimedes promised to prove in the Method itself (and evidently did in the latter sections which have been lost). Thus Archimedes seems to have been reluctant to circulate any results that he had not proved. Mark S. argued that there is no reason to suppose with Dijksterhuis that the Method was intended for a restricted audience, as opposed to the rigorous "published" works.

Doug pointed out that there are well-established traditions in Greek thought that deny that a line is composed of points, or an area of lines (e.g. Aristotle); was Archimedes not aware of these? It would be worth exploring the implications of this in a future meeting. Doug also noted that Archimedes' procedure in proposition 2 implies that one can place both the sphere and the cone at the end of the balance beam in a way that would be physically impossible, since the centers of gravity of both would have to coincide with the end of the beam. Mark S. suggested that one could simply conceive of both sphere and cone as suspended from a balance beam, which itself was suspended at its center of gravity from the end of the main balance in the proposition. That of course suggests that Archimedean "magnitudes" can be disconnected bodies, as was discussed in the previous session. Sam raised the possibility that Archimedes might have come to his proposition on the volume of the sphere by weighing physical cones and spheres; it was pointed out that the construction of such figures would have been tricky.

David asked why Archimedes never attempted to make the arguments of the Method rigorous (by e.g. considering finite slices with a determinate width).

Mark S. presented a photograph of the figure to proposition 1 of the Method and noted that it is inaccurately drawn. We then discussed the implications of this for understanding the mathematical knowledge of the scribes and the role of the diagrams in the original texts.

Claire presented Democritus' "cone fragment" and some of the claims that have been made about it by scholars such as Luria and Heath. It seems impossible to determine

what Democritus meant by the fragment, though it is clear that Epicurus has some notion of "minimal parts" that are the smallest things that can be conceived of inside the physical atom. Vlastos does not think that the notion of an atomist geometry founded on the Epicurean minimal parts makes any sense (nor that there is any evidence for it), but he does not consider the mathematical contexts in which the use of indivisibles can be extremely fruitful. That Democritus proved the results on the cone and cylinder that we know from Euclid XII.3-10 (which propositions are themselves presumably due to Eudoxus) seems to have been unknown to Archimedes when he wrote "On the sphere and cylinder", since he there states that no one before Eudoxus recognized the truth of those theorems. The question of how Democritus might have justified the theorems on the cone and cylinder remains open for further discussion.

David suggested that one reason that Archimedes may view the "mechanical method" as non-rigorous is that he nowhere defines the concept of center of gravity. Mark S. remarked that this goes against Dijksterhuis' claim that the method is non-rigorous solely because of the use of indivisibles, not because of the appeal to the balance model (what he calls the "barycentric method".) This is a crucial question as we turn to the Quadrature of the Parabola.

The reading for next week is: Quadrature of the Parabola 6-17

Johann will present the text and Jim W. will give a presentation on the different ways of reading Archimedes as represented by Heath, Dijksterhuis, and a literal translation. Paul will also give a brief presentation on the uses of *ephodos* in earlier Greek literature.