Eratosthenes' Geography*: Fragments Collected and Translated with Commentary and Additional Material* by Duane W. Roller

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Roller's *Eratosthenes'* Geography is the first comprehensive treatment of Eratosthenes' *Geographica* since R. M. Bentham's largely inaccessible, unpublished PhD thesis, *The Fragments of Eratosthenes* [1948]. Two earlier German editions exist: Bernhardy 1880 and Seidel 1789. Roller's assessment of the *Geographica* is balanced and synoptic, and it relies on the best of current and earlier scholarship. Asserting that 'Eratosthenes' world overflowed with geographical data' [10], Roller brings together that data and contextualizes it within the intellectual settings of both Eratosthenes' Hellenistic Alexandria and the academic *milieux* of later extractors.

Contributing usefully to current Eratosthenes scholarship,[1] the present volume falls into three parts:

(1) introduction,
(2) translation of the sources, and
(3) commentary.

The introduction is a must-read for anyone interested either in the history of Greek geography or in intellectualism in the Hellenistic Age. The first part, 'Eratosthenes and the History of Geography', surveys the history of Greek geography to Eratosthenes' day, including theoretical and practical initiatives: Necho II and others who attempted to circumnavigate Africa; Anaximander, the first to theorize about the shape of the Earth; Hecataeus, 'probably the first to

[1] Recent scholarship on Eratosthenes' geographical studies has concentrated primarily on the measurement of the Earth: see Cimino 1982, Rawlings 1982, Dutka 1993–1994, and Geus 2004. More broadly, see Aujac 1998, Geus 2002, and Shcheglov 2004.

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see the world in terms of continents' [3]; Herodotus; Eudoxus, who divided the world into zones of latitude; Ephorus, who laid the foundations for the scholarly discipline of geography [6]; Alexander of Macedon and Pytheas, both contributing to the accretion of topographical data; Aristotle, who recorded the first extant estimate of the Earth's circumference, 400,000 stadia; Dicaearchus, who established the main terrestrial parallel and speculated about the effects of topography on the overall shape of the Earth; and Strato, whose theories about the formation of the seas would shape subsequent Greek geographical theory.

Valuable to our understanding of the *Geographica* is Roller's *précis* of Eratosthenes' career [7–15]. His education at Athens emphasized philosophy and, to a lesser extent, mathematics and philology. Called to serve as Librarian at Alexandria and royal tutor, Eratosthenes earned a reputation as a 'broad scholar and creative personality' [12]. Although his publications on philosophy and mathematics were largely derivative, his poetry, in the tradition of Callimachus, was admired. Eratosthenes' literary *éclat*, together with his reputation for broad learning, 'certainly played a role in his appointment as Librarian' [12] when he was called to replace another poet, Apollonius of Rhodes, whose thick style was less in favor with the Ptolemies. Roller, in fact, is sensitive to Eratosthenes' poetical predilections [21, 113, 115] and thereby helps to put Strabo's criticisms into perspective. It is well known that Eratosthenes composed a versified proof of how to double the cube in commemoration of his appointment as Librarian and to honor the regime. Eratosthenes' first geographical work, significantly, was the poem *Hermes*, recounting the god's youth and including a Platonic description of the universe and account of the terrestrial zones [see Geus 2002, 110–128]. Roller, hence, emphasizes how Eratosthenes' training in poetry permeated his scholarship in other areas. Contributing to Eratosthenes' scholarship in geography are his background in philosophy and mathematics, his access to the best of ancient and contemporary books at the Library, the recent augmentation of geographical knowledge from Alexander's exploits, as well as the scholar's own geographical *milieu*. Eratosthenes hailed from Cyrene in Egypt, 'at one end of the Greek world' [10], which had a particular role in shaping his geographical outlook and expanding his geographical knowledge.

Roller then describes the contents of the *Geographica*'s three books. The first book treated the history of geography from the time of Homer. Strabo's extractions disproportionately represent Homeric questions, since he perceived Eratosthenes' treatment of Homer as disrespectful. In Eratosthenes' overview of scientific geographical authors, Roller sees hints of literary authors as well (including Aeschylus and Callimachus [119–121: F8]), again bringing attention to Eratosthenes' training in philology. Eratosthenes, furthermore, following Strato of Lampsacus and Xanthus of Lydia, speculated on the shape and formative processes of the Earth, with particular attention to inland marine phenomena—a practice well-established in Greek intellectualism from Xenophanes (whom Roller cites only for his views on Homer)—and the effects of littoral silting. Strabo makes clear that book 1 ended with a discussion of fabricated geography but 'the extant fragments are tangled with Strabo's own interpretations and prejudices' [22]. Roller concludes that, where Eratosthenes likely emphasized the travels of Heracles and Dionysus, Strabo condemned as fantastical that geography which Eratosthenes took as reliable, particularly the account of the Atlantic related by Pytheas of Massalia.

Book 2 covered Eratosthenes' theories about the shape of the Earth and the inhabited world. The precise contents and arrangement of the book cannot be known, as it is difficult to extricate the mathematical material that may have appeared here from Eratosthenes' *On Measurement of Earth* [see also Bowen 2003], a mathematically simplified *précis* of which may have been included in *Geog.* 2. Acknowledging the problem, Roller concludes that the passages citing toponyms and topographical data, which could just as reasonably be included in book 3, are also necessary in setting for the stage for Eratosthenes' view of the extent of the world [24]: the attribution of some passages is, simply, dubious. Such, unfortunately, is the nature of a collection of fragments of a prolific author.

In the third book, Eratosthenes described the topography of the inhabited world. To this book can be attributed most of the extant fragments, and the topographical information contained therein was considered useful. From Hecataeus onward, geographical accounts proceeded clockwise from the Pillars of Heracles. Eratosthenes, however, broke from this pattern, proceeding from the east to the west.

Roller explains this nonconformity as 'perhaps reflecting the contemporary obsession with India' [24]. Also in accord with the new attitudes of early Hellenistic world, Eratosthenes emphasized locales not ethnicities [see Geus 2005, 243–244]. The book opens with Eratosthenes' paradigm of the world, including two cardinal baselines (east-west, viz. Pillars of Heracles to India, and south-north, viz. Meroe to Thule), major parallels and meridians (rarely straight lines, as Eratosthenes well knew), and an attempt to divide the landmasses into tidy geometrical shapes or σφραγίδες (seal stones), a term applied only to eastern landmasses (India, Ariana, Mesopotamia, and Egypt) and eschewed by later geographers. The particularly comprehensive representation of India in the extant fragments reflects perhaps not only the interests of Eratosthenes' day with the influx of geographical knowledge under Alexander, but also of Strabo's when Augustus attempted to strengthen trade between Rome and India, Roller argues. Nowhere else in the fragments is there apparent detailed source analysis or examination of land and sea routes. Strabo's summaries of Eratosthenes' accounts of India, Ariana, Mesopotamia, and Egypt include topographical, ethnographical, and historical details with primary emphasis on the boundaries (as in Eratosthenes). With Egypt, Eratosthenes abandoned the model of the σφραγίδες in favor of the current vision of Africa as a whole.

Eratosthenes' account then proceeded to the northern Mediterranean. The extant fragments describing the Caspian and Black Seas are strictly geographical: ethnography is lacking and the fragments resemble sailing itineraries. With the north coast of the Mediterranean (Europe), we come to the area where the most geographical advances had been made between the times of Eratosthenes and Strabo. Here Strabo is particularly critical, especially regarding Eratosthenes' discussion of western Mediterranean which depended heavily upon Pytheas, whose journeys were deemed fabricated and absurd by most of his successors, Strabo among them. The *Geographica* ends with discussion of virtue and ethnicity. Eratosthenes, reflecting Alexander's own rejection of the traditional division between (virtuous) Greeks and (non-virtuous) non-Greeks, favored individual virtue over the holistic virtue of an ethnic group.

Roller then explicates Eratosthenes' method, approach, and use of sources. In the extant fragments, over 20 persons are cited by name, mostly authors contemporary with or postdating Alexander

[16–20]. Other sources may have included unnamed sailors and still others may have been lost through the especially complex process of textual recension. Roller deals head-on with the question of autopsy, which continues to baffle modern scholars and popularizers.[2] As Librarian at Alexandria, Eratosthenes had access to perhaps every book written on geography plus the eyewitness accounts of sailors and merchants traveling through one of the world's busiest port towns. 'Unlike Herodotus, Eratosthenes, who worked in the world's finest library, was not interested in fieldwork' [17].

Finally, Roller discusses the reception and later history of the *Geographica*. Employed extensively in antiquity by hostile authors, especially Hipparchus in his *Against the Geography of Eratosthenes*, the *Geographica* was a major geographical source for Strabo, who generally defended Eratosthenes against Hipparchus' often unfair criticisms. In his own day, Eratosthenes was admired primarily as philologist and poet but he is best known today as the originator of the discipline of geography. In antiquity, because of Rome's expansion, Eratosthenes' treatise was quickly made obsolete and broadly criticized. Although used extensively by Strabo and cited by Pliny as a foreign authority in his own geographical books, the text seems to have become rare already by the first century AD. Eratosthenes fails to merit a mention by name in the geographical writers Pomponius Mela and Ptolemy.[3] Equally surprisingly, neither the polymath Plutarch nor the encyclopedist Athenaeus cite Eratosthenes by name [33].

In the second part, 'Eratosthenes, *Geographica*', Roller offers a clear, faithful, and readable translation of the fragments. Relying largely on Berger's collection of fragments, Roller contextualizes the shorter, isolated fragments in efforts to restore them to completeness in so far as this is possible [see e.g., Roller's FF2, 6, 8, 10, 13–16, 34,

[2] Despite the utter lack of evidence, popularizers continue to insist that Eratosthenes personally inspected the well in Syene when calculating the circumference of the Earth [see Bertman 2010, 119–20]. Eratosthenes himself was aware that his measurements were at best approximations: see Strabo, *Geog.* 2.77–78, 80–82, 86, 89, 91–92; Dicks 1960, 31. A greater degree of accuracy was attainable in Greek mathematics than in ancient Greek geography. Strabo, in turn, accused Hipparchus of manufacturing evidence; Dicks [1960, 130–137] defends most of Hipparchus' calculations.

[3] It baffles this reviewer that Ptolemy would have been unaware of Eratosthenes, but the text may have already been lost by Ptolemy's day.

49, 51, 52, 59, 60, 63, 64, 66, 78, 108, 133]. Extractors occasionally mention Eratosthenes by name; but most ancient authors, including Eratosthenes and his redactors, frequently engaged with a range of humble to prominent and authoritative unnamed sources. Roller also reorders where prudent but usually without comment. The Greek text is omitted but full citations to Strabo (and other authors) are provided. Un-Greeked readers will find the primary texts inaccessible. The expert reader will likely find it more profitable to consult Strabo directly in the context of his larger narrative.

Although in the third part, 'Summaries and Commentaries', the commentary is presented separately from the translations, the exegesis of each fragment is prefaced with a summary intended to aid the reader in pulling 'Eratosthenes' thoughts out of such tangles' from Strabo [36]. The greatest challenge in any work on a fragmentary author is extricating the source from redactor. The challenge is further exacerbated in Strabo, our primary source for Eratosthenes from whom over 90% of the fragments derive. Strabo was a highly elliptical writer whose treatment of his own sources was far from linear. He rarely quoted directly or even paraphrased his sources but instead offered synthetic arguments of materials collated from multiple sources. And this procedure of ellipsis and synthesis easily invites confusion: for example, there is no evidence in the extant fragments for maps in the modern sense—the fragments include no words like πίναξ [21]—yet Strabo 2.1.2 implies that Eratosthenes dealt with pictorial maps (πίνακα). Nor did Strabo always cite his sources by name.

> Especially in the case of the information preserved by Strabo, it is not always possible to identify the particular source. One must make a careful path between too narrow a choice and too broad. Mention of Eratosthenes by name has always been a valuable criterion but it is not an absolute one, especially in the case of Strabo's many verbs without subjects. [36]

It is, thus, as Roller observes, sometimes 'impossible to separate out the actual thoughts of Eratosthenes from Strabo's often lengthy reanalyses' [37]. And here is where some may disagree with Roller's conclusions. Which of the fragments are genuinely Eratosthenian and which are Strabonian? Roller remains alert to this challenge and his efforts to disentangle Eratosthenes from the complexities of Strabo's layered narrative shed valuable insights also into Strabo's style,

methodology, and his use of sources [see esp. 122]. Roller reminds the reader that Strabo's chronology allows for specialized geographical knowledge from a Roman point of view, anathema to Eratosthenes who was aware of Rome merely as a place.

In short, Roller's carefully documented commentary is replete with fascinating nuggets. Roller engages with the text, remarking on matters of broad intellectual interest, including philology, history, ethnography, the intellectual *milieu*, and the philosophy and history of geography. For example, when Strabo discusses the size of the Earth and the extent of its inhabited parts, he synthesizes arguments from several sources: notably, when referring to the remote Βρεττανική, he shifts from the Roman spelling to the rare « Πρεττανική » [135: F34]. The change in orthography strongly suggests that Strabo has shifted from a Roman source, ceased his editorializing, and has returned to Eratosthenes, who in turn is quoting directly from Pytheas. Furthermore, Strabo is astonished that Eratosthenes would disagree with Archimedes on matters mathematical [132: F16]: for example, contrary to Archimedes who sees the Mediterranean as a single even surface, Eratosthenes argues that the Internal Sea (Mediterranean) is not constituted as a single surface but rather that its level is higher in some places, e.g., the Corinthian Gulf at Kenchraei where a proposed canal would have submerged nearby islands and disrupted sailing passages. Roller gives a history of the canals through the Corinthian isthmus, confirms the reports of ancient engineers, and surmises that Eratosthenes' source was someone involved in a canal project that was proposed but never completed *ca* 302–301 BC.

Roller, additionally, examines Eratosthenes' 'taste for inventive vocabulary', those common words which have been geographically repurposed [26]. Particularly interesting are Roller's comments on Eratosthenes use of « σπόνδυλος » ('spindle whorl') to describe the shape of the Earth [144–147: F30] and the philological history of « οἰκουμένη » ('inhabited world'). Eratosthenes concept of land masses as σφραγίδες, a vernacular term more familiar than the technical Euclidian term 'rhomboid', represents the author's attempt to describe the world in familiar but geometrical terms [175: F66].

In his gazetteer, Roller lists the toponyms cited in the extant fragments, giving their positions (with references to maps redrawn by the Ancient World Mapping Center) and the sparest accounts

of their history and significance to Eratosthenes' work and times—topographic details are easily accessible but do not unnecessarily clutter the commentary. Thus, Roller succeeds in respecting the inherent differences between ancient and modern geography by not slavishly imposing the distortion of excessive (and often misleading) modern equivalencies within the body of the commentary.

Three appendices are also included. The fragments of *On the Measurement of the Earth* [app. 1] and the *testimonia* [app. 2] for Eratosthenes' life are translated into crisp English. A brief essay 'On Lengths of Measurements' [app. 3] discusses the complexities of ancient standards of mensuration and the pitfalls of attempts at converting them to modern standards. There has been much discussion regarding which στάδιον Eratosthenes may have used [see Engels 1985, Gulbekian 1987] but Roller rightly asserts 'that there is no reason to believe that Eratosthenes always used the same stadion' [271].

Roller presents the author of the *Geographica* not just as the man whose estimate of the Earth's circumference was the most accurate in antiquity but as a scholar with broad interests and broad training, a poet-scientist who was a product of his times. Roller's commentary is informative and carefully documented. His suppositions are cautious yet creative. He thus updates Fraser 1970 and advances Geus 2002. Roller's edition of Eratosthenes is a welcome volume, filling a real gap in the history of Greek geography and ancient science.

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