

How to determine the circumference of the Earth ?

Eratosthene (b. Cyrène ca. 276 B.C. — d. Alexandrie ca. 194 B.C.), chief librarian of the Library of Alexandria, read or heard that in Syene (today's Assouan, a city near the Tropic of Cancer), the Sun's rays reached the bottom of a narrow deep well at noon on Solstice day.

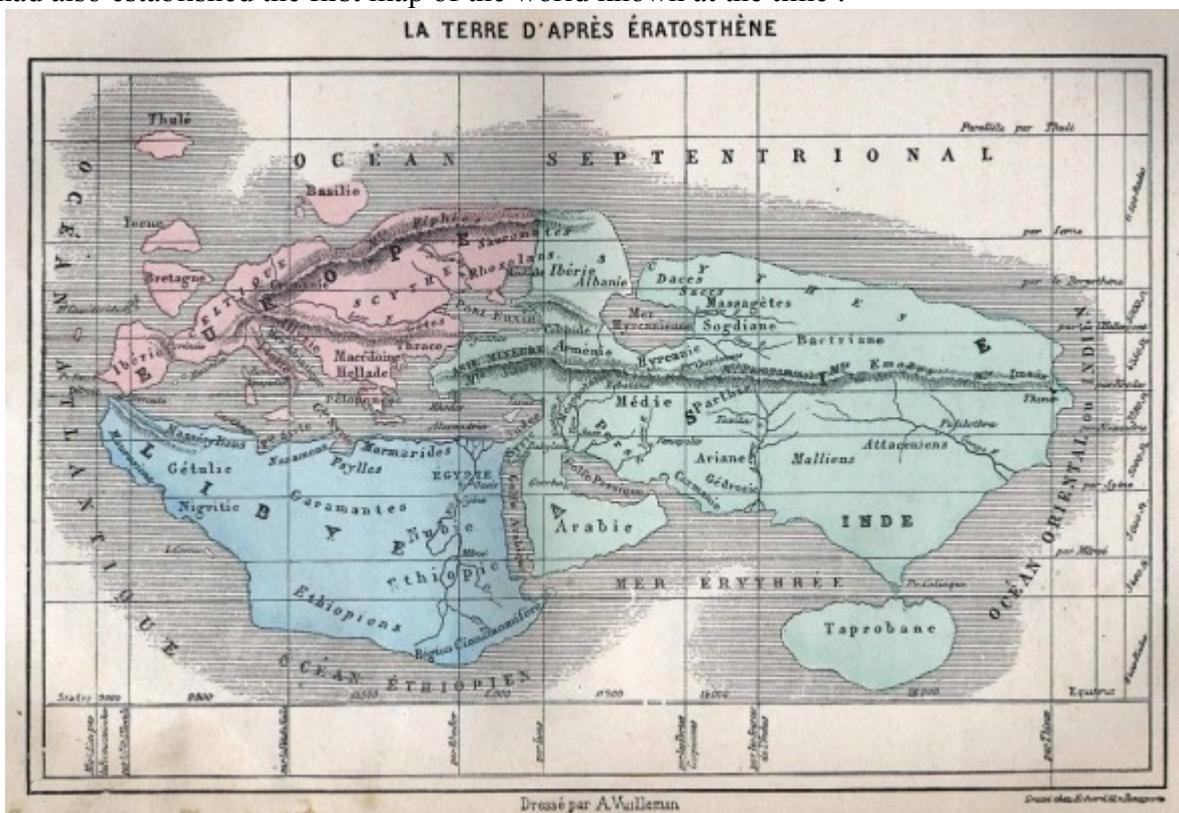


On the contrary, in Alexandria, a city situated more to the north, the light at the same hour made an angle with the vertical that he attributed to the Earth's curvature.

Towards 200 B.C., he planted a gnomon in Alexandria and measured the angle between it and the direction of the solar rays ; he found 1/50th of a circle.

Eratosthene knew the distance, determined by some bematists, between Syene and Alexandria : 5000 stadiums.

He had also established the first map of the world known at the time :



Reproduction de la carte d'Eratosthène par A. Vaillemant dans "La Terre et les mers, ou description physique du globe" de L. Figuiet, Paris, Librairie Hachette, 1884.

First reflection :

- 1) In which country did Eratosthene live ? Identify it on the map.
- 2) What did the horizontal and vertical lines represent on this map ?
- 3) What do Eratosthene's hypotheses rest on ?
- 4) Explain and comment on the expressions « Tropic of Cancer », « noon », « Summer Solstice » and « gnomon ».

Second reflection

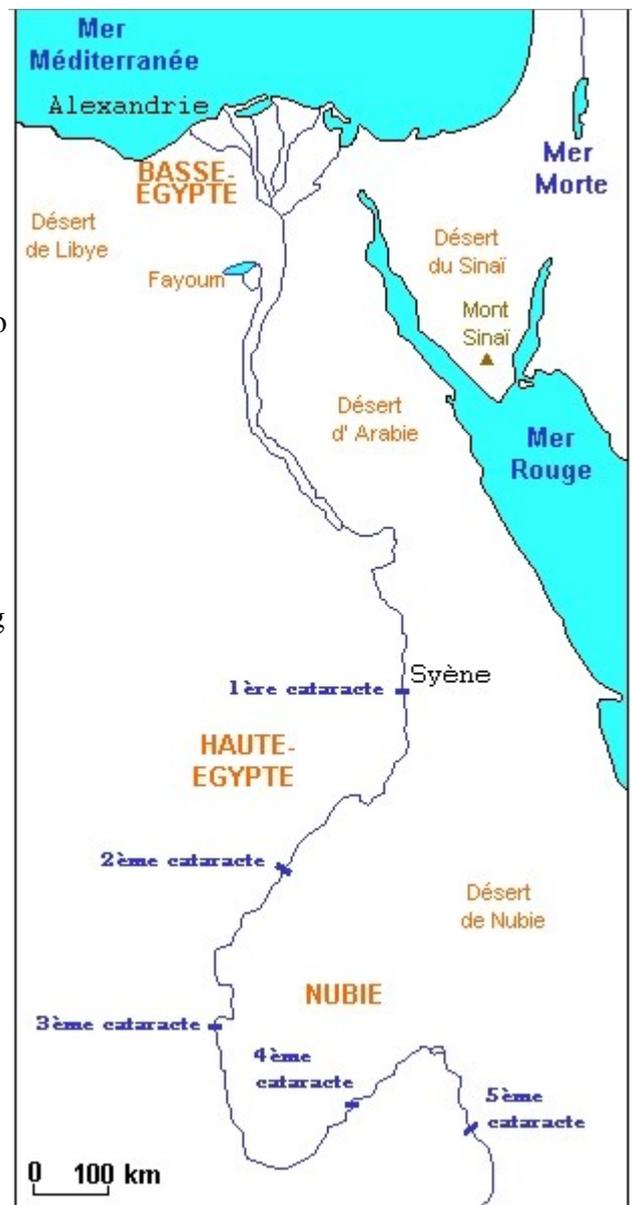
- 1) State three simple facts which illustrate the Earth's sphericity.
- 2) Which argument can justify the idea that the Sun's rays which reach the Earth are parallel to each other ?
- 3) How did Eratosthene plant his gnomon ?
- 4) Illustrate, with the help of an annotated diagram, Eratosthene's method.
- 5) Using Eratosthene's observations and knowing that a stadium equals approximately 160 meters, calculate the circumference of the Earth

Find out its ray.

Compare it to the current value.

Third reflection :

- 1) Eratosthene's method supposes that the two cities, Alexandria and Syene, are situated on the same meridian. Say if it's really the case after having defined the term « meridian ».
- 2) Taking into account the method used by Eratosthene, identify the possible causes of error.
- 3) Imagine an experimental protocol to recreate Eratosthene's experience using the cities of Cognac and Rabat.



Carte d'Egypte (d'après A. Houot)