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Mapping in the Mind: The Earth from Ancient Alexandria

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– Ce n'est pas le géographe qui va faire le compte des villes, des fleuves, des montagnes, des mers, des océans et des déserts. Le géographe est trop important pour flâner. Il ne quitte pas son bureau. Mais il y reçoit les explorateurs. Il les interroge, et il prend en note leurs souvenirs. Et si les souvenirs de l'un d'entre eux lui paraissent intéressants, le géographe fait faire une enquête sur la moralité de l'explorateur.
– Pourquoi ça?
– Parce qu'un explorateur qui mentirait entraînerait des catastrophes dans les livres de géographie. Et aussi un explorateur qui boirait trop.
– Pourquoi ça? fit le petit prince.
– Parce que les ivrognes voient double. Alors le géographe noterait deux montagnes là où il n'y en a qu'une seule.

Antoine de Saint-Exupéry, *Le petit prince*, ch. 15

How is it possible, and, indeed, why is it necessary, to depict and to make visible something invisible, something that does not exist as such in front of the human eyes until an analogical rendering has been achieved?[1]

Here, I focus on the small-scale mapping project of large areas, indeed the whole world, and investigate some of its technical, logistic and scientific components as well as some of its intellectual and social dimensions. I am concerned with the intellectual process that leads from gathering partial and empirical field data to assembling these within a single general frame and thus producing a new object, the map of the 'inhabited world'. Such questioning is probably the best way to understand what a map is, to interrogate its power and its social function. One could also interrogate the map's claim to represent the world in a way that challenges the concept of mimesis itself. Beyond its technical aspects and its cultural contexts, the history of small-scale cartography deals with this challenge: giving a material reality to something that human senses cannot grasp and providing this graphical device with a symbolic power, a social (and political) authority and an intellectual (or spiritual) efficiency. Any map is an

interface – pragmatic, cognitive, metaphysical – between its users and the world that surrounds them. Those who look at it and who share the scientific, semiological keys to its understanding are assumed to concur that they look at something beyond the drawing itself. As an optical as well as an intellectual prosthesis, maps allow human senses and the human mind to achieve a new level of reality. Maps are impossible without such a shared belief about the materiality and the reality of the world they display, about the claim of the drawing to stand as a substitute for this world, more accessible to study than the reality itself. Even if such a map is criticized, corrected and completed, its power as a representation is never denied.

Cartographic history should not be confined within the frame of the history of sciences and of geographical knowledge *stricto sensu*. It encompasses many other components of a culture: its conception of the world, physical and metaphysical, its cognitive categories that bring knowledge and truth within reach of the human mind, the social construction and sharing of such knowledge about the world. Cultural context is a key to variation in the history of cartography. Chinese, Indian, Native American, Islamic and early European cartographies, beyond the apparent similarities of their maps as graphic artifacts, reflect deeply different intellectual and visual universes.

A precise and culturally specific investigation is perhaps the best way to contribute to a general understanding of the many implications and indeed the peculiarity of the mapping project itself.[2] My topic is a particular step in the development of ancient Greek cartography. I underline both its cultural specificity and its contribution to a broader reflection on the nature and the power of maps in general.

INVISIBLE MAPS, CARTOGRAPHIC DISCOURSES

In fact, we have lost most of the ancient small-scale maps.[3] I do not include Byzantine and early Renaissance Ptolemaic plates as specimens of ancient Greek cartography *stricto sensu*.[4] The *Tabula Peutingeriana* is an obvious exception, but it belongs to the class of Roman itinerary maps, and is a thirteenth- or fourteenth-century reproduction of a late Imperial Roman original. What we do possess, however, is a corpus of ancient texts and a set of statements about small-scale maps. Such sources provide the historian with indirect, diversely focused traces of the use and the impact of maps in the ancient world. They allow us to draw precise limits around the visual, intellectual and pragmatic area occupied by maps in this society.[5] Any mapping culture should itself be mapped, as a topography

of interacting and sometimes overlapping intellectual zones, and the result of such a research, in ancient Greece, clearly suggests the very limited functions and diffusion of maps in this society.

Travelling, exploring, seafaring, war-making, ruling and founding remote colonies did not necessarily imply the use of maps. There is not a single ancient Greek source that depicts someone using maps in a practical situation.[6] Such a fact has two implications. First, 'geographical knowledge'[7] did not depend on maps, but on other media, such as travel reports, sea journeys and periegeses, descriptions of a particular country. Geography relied on words and discourses, on human memory. Second, maps had other functions: the way they were drawn, the information they encompassed, the way they were diffused, simply did not allow practical and field uses.

Literary testimonies about map-making may be read spatially, in concentric circles. Closest to the map itself are texts by cartographers or by geographers who had a technical interest in cartography. The second circle includes authors who occasionally depicted someone using a map. In the third circle are writers using maps to generate and organize a geographical description. Such texts stand in place of the map and had a far greater efficacy in shaping the mental horizon of their listeners or their readers. The information produced by maps was diffused through verbal descriptions, not through maps themselves. Consequently, one should be aware that categories such as vision, audition, memory and imagination do not escape the variations of culture and of history, and that in a precise cultural surrounding, listening to a geographical description could create for the listener mental forms as vivid and efficient as a world map.[8]

I shall focus on the first circle, where Greek cartographers and geographers wrote about maps and map-making. Strabo (*b. c.* 63 BC; *d.* AD 21–5), as a witness and a compilator of the Hellenistic cartographic tradition, is a major source for the historian of Greek science. The seventeen books of his *Geography* provide us with an ambiguous picture.[9] On the one hand, Strabo was familiar with maps, at least with a certain kind of small-scale map, and he discussed them at length, even reproducing some instructions about how to draw them. He also titled his work 'Geography' and as such followed the example of the cartographer Eratosthenes. On the other hand, most of this *Geography* is a literary description of the world, not a map, and this description relies on traditional patterns: catalogues of place names, terrestrial or maritime itineraries. Strabo's text thus belongs the third circle, even beyond – a literary geography that did not rely at all on map-making but on the compilation of a library.

When Strabo comments on map-making, he wants us to believe that he is familiar with the construction of maps, and he involves himself in polemical debates with the predecessors whose treatises and maps he read and used. Such a paradoxical situation – no maps in his *Geography*, but a technical discussion about maps in the first two books of the treatise – should be considered as a relevant sign. In the ancient Greek world, map-making could have implied a different balance between writing and drawing. It was perhaps a process in which debating, commenting, criticizing and correcting previous maps, translating into arguments and descriptions what could be fixed on the diagram, were equally aspects of map-making. We have to investigate the complex meaning of the Greek verb *graphein* – drawing, writing, depicting – a polysemy inherent in the term 'geo-graphy'.

GREEK MAPPING CULTURE: AN HISTORICAL OUTLINE

A preliminary question suggests itself: is it possible to write the history of an object such as the map? Are we certain that the presence of maps at successive periods warrants the intellectual cohesiveness of their history, even within the framework of the same culture? Maps were drawn and used in various intellectual contexts, and such variants determine the true meaning of these drawings. Herein lies the positive counterpart of the loss of actual Greek maps: we rediscover them through discourses, through the concepts and words of the Greeks themselves.

In the second half of the third century BC, when Eratosthenes, head librarian in the Ptolemies' palace in Alexandria, committed himself to rectifying the small-scale maps he probably found in the collection, Greek cartography had existed for more than three centuries.[10] Extant testimonies, although rare and elliptical, give us a clear enough picture of the early development of ancient Greek maps. Map-making did not start from practical needs, from empirical surveys or from a technical and professional tradition among Ionian tradesmen and sailors. The first Greek map was a part of a broader intellectual project: description of the cosmos or, more precisely, accounting for its genesis, from the 'boundless' element of its origin to the appearance of humankind on earth. Anaximander of Miletus, pupil of Thales, was one of those sixth-century learned and wise men, private persons and citizens in their small autonomous political communities, who decided to write their own views about the 'nature' of the world, as an alternative to the mythico-poetical tales of Homer and Hesiod.[11] Anaximander used technical metaphors, geometrical shapes, astronomical observations and calculations in order

to understand and to render comprehensible for his listeners the natural phenomena and the order of the world. The map was a by-product of Anaximander's treatise *On Nature*. It probably looked like a geometrical drawing of a flat disk surface of the inhabited earth (the *oecumene*), displaying the rough shapes of the Mediterranean Sea while the outer limit was perfectly circular, surrounded by the river Okeanos. Such a drawing was abstract and indeed unsuited to practical use. It could have encompassed, in a very stylized way, some information about the areas explored by Greek colonization since the eighth-century BC – the Black Sea area, Italy and Sicily, the eastern Mediterranean shore.[12] But it is striking to note that the map did not create geographical knowledge from the ground. Anaximander drew his map at a stage when Homer's *Odyssey* and the various accounts of the Argonauts' saga, poetry, oral and possibly (but not attested) written nautical directions, had already conveyed a geographical knowledge, in lists of place- and tribe-names, orientations and itineraries.

Greek geography thus leads from a shared knowledge about more or less mythical places and tribes, from a general cosmological frame (structured by the sun's progression in the sky, and its variation, in summer and in winter) to this first visual model, elaborated by a thinker in search of the hidden rules, order and components of the natural world, beyond the traditional language of myth and poetry. As a result, this first map made possible a new way of conceiving and discussing the inhabited earth, and provided its users with a tool to organize the nomenclature of places and tribes, to gather knowledge about them, to order this information independently from any actual itinerary or travel, as a continuous mapped surface of places.

In the second half of the sixth century BC, Hecataeus of Miletus wrote a *Periegesis* (or 'Circuit of the Earth'), apparently attempting, as far as we can tell from the available fragments,[13] an inventory of places, countries, rivers, mountains and tribes, according to a circuit around the Mediterranean Sea. It is debatable whether he drew a new map or simply modified and completed Anaximander's. But his *Periegesis* was a text, gathering information from various sources: personal travels, information drawn from sailors and tradesmen, saga and poetry. Such an inventory of place- and tribe-names would have been impossible without the frame of a map: it helped to organize the distribution of names according to a methodical and abstract movement around the Mediterranean Sea. Herodotus, in the second half of the fifth century BC, is another witness to the use of maps to organize literary descriptions of space. He sought to

translate the visual patterns into various geometrical metaphors, but we know that he did not draw a map himself.

During the sixth and fifth centuries BC, one can see the origins of both a distinction and interaction between map and discourse. The map helped to gather, organize and unify a heterogeneous knowledge about places and tribes, but its purpose was also more abstract and theoretical. Like the metaphor or the geometrical figure, illustrating the sphere of the universe, the map gave a material and visual reality to an invisible reality. It was an *a priori* and abstract device; it imposed a shape, borders and patterns of symmetry on the inhabited earth, whose Mediterranean shores only were known to the Greeks. If such maps sometimes interacted with and influenced geographical descriptions, all indications are that their development followed a path of its own beyond the mainstream current of Greek geography. Map-making in the Greek classical and Hellenistic world was practised by a tiny number of individuals, scholars interested in philosophy, mathematics, astronomy and geometry. During the fourth century BC, map-makers were found in philosophical schools at Athens: in Plato's Academy, Eudoxus was engaged in various mathematical and astronomical researches, and it seems he drew a map in connection with his treatise 'Circuit of the Earth'. In Aristotle's Lyceum, a world map was displayed on the wall of the 'lower portico'.[14] Aristotle himself used maps, as the *Meteorologics* treatise testifies. And his pupil and fellow researcher Dicaearchus committed himself to drawing a map, providing it with a new geometrical frame and probably using new topographical data available from Alexander's Asiatic campaigns.

Pre-Hellenistic Greek cartography displays some consistent characteristics. It dealt with small-scale maps only. We have not the slightest idea about their visual design, but since Anaximander, maps were always linked to written treatises, although they were not necessarily included in the papyrus roll. They were independent plates and we know that one of them, at least, was engraved on a bronze plate. The rarity of available data about maps in the Greek classical world followed from the fact that the political, commercial and military situation of Greek cities did not make necessary either the practical use of such small-scale drawings, nor of large-scale maps. On the contrary, map-making was an activity linked to philosophy and the sciences. There was no social or political control over map-making, upon its diffusion and its use. Nobody fixed norms or criteria regarding maps: each map-maker was absolutely free to propose his own views about the shape of the world, his own calculations of its size, his own geometrical frame, his own selection of places. Control over

maps rose from the cartographers themselves, as they began to gather the work of their forerunners and to develop their own research from it.

Nor did the ancient technology of book-making (manuscript papyrus book-rolls) permit a wide-scale diffusion of these drawings, or their precise and exact reproduction. Even had such a technology existed, it is difficult to imagine who could have been the intended audience. Cartography was a part of the mathematical sciences, not of daily life. Descriptive geography and ethnography followed their own parallel paths, mainly among historical writers. There was no Greek cartographic school comparable to the Hippocratic school of medicine, for example, with its organization, its methodological and deontological rules, or to the philosophical schools, organized around the writings of their founders.

MAP-MAKING AND POWER IN PTOLEMAIC ALEXANDRIA

Did the shift from Athens to Alexandria, from the classical Greek city to the Hellenistic kingdoms, change this situation and create new functions for small-scale maps?

To answer this question, we need to evoke the new historical background. First, a vast volume of new field data was gathered during Alexander's expedition in Asia: road measurements, geographical and ethnographical observations, diaries, samples and such like. Second, the Ptolemaic rule in Egypt was a model example of the new Greek kingdoms created *ex novo* in the former satrapies of the Persian Empire. Greeks had to rule over large territories, over native populations, where each new kingdom was competing for prestige with its neighbours and to protect or to extend its borders. Last, the Ptolemaic dynasty created official institutions devoted to science and scholarship: the Museum and its Library.

Importing to the new Egyptian kingdom the model of the Aristotelian school in Athens, Ptolemy I Lagos changed the size as well as the functions of this institution. Royal sponsorship of culture, sciences and literature helped the new monarchy to establish its pre-eminence among the other kingdoms. Alexandria became an attractive place for scholars, poets and scientists, who found in the king's palace the greatest library of the ancient world and thus access to the whole Greek literary heritage. One of the underlying dynamics of Alexandrian culture is its magnetic power of attraction: collecting all the texts ever written in the Greek world as well as by the Barbarians, attracting individuals from across the Hellenized world. Producing a map of the earth was a logical development in this new capital city, itself a microcosm of the greater world beyond.

Curiously, the mapping project did not appear immediately. We have to wait until c. 245 BC, when Eratosthenes of Cyrene left the philosophical schools in Athens to become head librarian at Alexandria. He was given this prestigious appointment by Ptolemy III Euergetes, thanks to his reputation as a mathematician and Platonic philosopher. His new position allowed Eratosthenes to undertake various scholarly works – literary and grammatical studies, historical chronology – but he also committed himself to scientific research: mathematics and geometry, geodesy, geography.

At first glance the extant sources about Eratosthenes' map do not link it explicitly to a political project, to the ruling symbolism of the Greek dynasty. Eratosthenes' map belonged to the same tradition as Anaximander's, Eudoxus' and Dicaearchus' maps: it was an abstract and geometrical construction, deeply rooted in scientific studies rather than a practical device. Eratosthenes' cartographic activity did not include drawing large-scale maps of the Egyptian frontiers, of the Delta, of the Nile valley, of the Greek settlements such as those in the Fayum area. And Eratosthenes was not the head cartographer of the Land Survey Offices of the Ptolemies' administration. Cartography, as practised within the Museum, was not a tool for warriors, tax-collectors, merchants or ambassadors.

The Alexandrian map, however, cannot be divorced from the exercise of power. As a symbolic instrument, it superseded the actual limits of Ptolemaic rule and provided it with a universal dimension. If Alexandria realized Alexander's dream and became a microcosm in which the whole of the Greek and Barbarian culture was condensed, the map could illustrate the pretensions of the dynasty to rule over the whole world through symbolic mediations. The map, like the thousands of papyrus rolls archived in the Library, condensed the whole earth into the king's palace itself. Eratosthenes may have given the inhabited earth the shape of a chlamys – the Macedonian military cloak.[15] The chlamys was a consistent symbol of royal power in Greco-Egyptian iconography. The chlamys was also the shape of the city of Alexandria itself. The architect and city planner Deinokrates, who was appointed by Alexander the Great, was probably responsible for this design. If Eratosthenes chose to give the earth the shape of the city, the political symbolism was obvious: there was an analogical link between Alexandria and the earth, the microcosm and the macrocosm.

On a more general level, mapping the whole earth could be considered as a process of intellectual control. Through their geometry and their language, the Greeks took hold of the earth, its countries and tribes, and organized them according to their own categories. Thus they acquired

intellectual mastery of this space: its most remote parts were absorbed within a single homogeneous mathematical space, according to a single geometrical order. In an act of power, through lines, shapes, place names and mathematical positions, the map-maker appropriated the earth and imposed his own view of its order, through the territorial, political and cultural divisions in which he organized it.

The Alexandrian map also foregrounded another feature. The map-maker, the recipients of the map, the intellectual and political circles that commissioned the map, all appropriated a local knowledge and empirical data about remote places and countries. These were gathered from the periphery of the world to its centre, the Ptolemies' palace in Alexandria. The power inherent in the map lies in conveying a knowledge beyond the sum of the many bits of information it encompasses. Local data are given new meaning, are integrated into a set of relationships that brings forth new information about them, in an interplay between the centre and the periphery, empirical data and geometrical construction, to which I now turn.

MAPPING THE WORLD FROM WITHIN A LIBRARY

The two first books of Strabo's *Geography* are one of the principal ancient Greek sources for the conceptual and scientific frame of cartography. Our entry point into this discussion is a statement about a whole picture of the earth. Before starting the chorographical description of the earth, Strabo reminds his readers about his own travels through the Mediterranean world, far more extensive than those of all other geographers. These travels delimit an area of direct geographical knowledge: outside it, Strabo had to rely on oral or written sources; he had to 'trust' other travellers. This insistence on travels should not be overestimated: it is a topos whose origin should be sought in Herodotus' *Histories*.[16] The personal look at a country, at tribes, at historical events and characters ('autopsy') is the most valuable epistemological criterion in ancient historiography. But geography challenges this traditional conception of knowledge. To what extent does autopsy help the geographer or the map-maker in his project to represent the whole earth?

Strabo himself was aware of this paradox, and he added the following refinement, whereby the autopsy of travellers is relativized:[17]

> However, the greater part of our material both they and I receive by hearsay (*akoé*) and then form our ideas of shape and size and also other characteristics, qualitative and quantitative, precisely as the mind forms its ideas from sense impressions – for our senses report the shape, color, and size of an apple, and also its smell, feel, and flavor; and from all this the mind forms the concept of apple. So, too, even in the case of large figures, while the senses perceive only the parts, the mind forms a concept of the whole from what the senses have perceived. And men who are eager to learn (*philomatheîs*) proceed in just that way: they trust as organs of sense those who have seen or wandered over any region, no matter what, some in this and some in that part of the earth, and they form in one diagram their mental image of the whole inhabited world.

This statement echoes a shared topic in Hellenistic philosophy: what is the 'criterion' of knowledge? And how does one reach the concept of an object, from and through the various and partial testimonies of senses? If the concept of apple results from the gathering of the heterogeneous data of perception and from their intellectual synthesis, the concept of earth itself also results from the addition and transformation of partial data. Strabo describes a twofold process: first, the mental assembly of partial data to produce a whole picture; second, the shift from empirical and visual data to the mental diagram. Such processes divide the tasks between two categories of actors. First, travellers who have a direct but limited knowledge of a country. These act as the sense organs moving at the periphery of the world and bringing experience back to the centre. Second, the geographer, who remains at the centre and reorganizes partial and empirical visions into a coherent mental diagram. The key points of Strabo's description are the hierarchical organization of knowledge and the conception of *akoé* (hearsay) as a medium of communication of visual data, as a 'tele-visual device'.

The central position of the map-maker, collecting information from travelling sources about the most various parts of the world, is a variant in a more general Alexandrian process. This 'imperial' culture displayed a strong centripetal dynamic. The Alexandrian Library gathered all the books ever written in both the Greek and Barbarian worlds and from this totality scholars produced new intellectual projects such as bio-bibliographical catalogues, organizing the corpus of poets, of dramatists and prose-writers, and building up encyclopedic collections of words, quotations and facts.[18] Alexandria is a perfect example of what Bruno Latour calls 'les centres de calculs' ('centres of calculation'), those places where local and partial information, samples or extracts are collected and processed in order to produce a more general level of knowledge and synthetic devices such as maps, diagrams, tables of measures or statistics.[19]

Another key element in Strabo's description is his model of the transmission of field observations, from the traveller to the cartographer through the *akoé*, that is through discourse. *Akoé* encompasses both oral

and written testimonies, 'hearsay' as well read texts.[20] Such a fact has several consequences. Writing and then reading a travel report does not prevent the transmission of the data gathered by the traveller's senses. This proficiency of the *logos* as a medium for local knowledge implies that to verify its reliability one cannot use empirical checks, but is forced to interrogate the *logos* itsef, according to internal criteria of cohesiveness and credibility. Another indirect way to check the *logos* is to examine carefully the credibility of its author.

The diagram of the inhabited earth is like the concept of an apple: a result of the synthetic activity of the mind, gathering data from the senses. Such a philosophical statement about the production of conceptual knowledge could be read as an account not only of Strabo's own practice as a geographer but also of Eratosthenes' map-making activity within the Alexandrian Library. That Eratosthenes perfectly matched such a motionless, disembodied cartographer, exploring the world through the written reports found in the Library, is emphasized by Strabo when he discusses the polemic between Eratosthenes and Hipparchus about the dimensions of India. Eratosthenes considered his own theory was 'fully attested by those who were in these places, since he read many reports that his Library had in abundance, this library whose importance Hipparchus himself evokes'.[21]

We cannot reconstruct the holdings of the geographical section in the Alexandrian Library, but it is beyond doubt that there were geographical texts, travel reports and probably a few maps as well. They were perhaps registered in the 'Tables' (*pinakes*) of Callimachus, the standard reference-work of Alexandrian librarianship, but we do not know if geography had a section of its own.[22]

The Alexandrian Library acted as an archive for recent documents. Among them, the surveys of the so-called 'bematists', those land-surveyors and distance-measurers who accompanied Alexander's army during its expedition through Asia, in the Persian Empire and its eastern allies (331–323 BC).[23] Surveyors such as Baiton, Diognetos, Philonides, Amyntas, Archelaos are only names today, known from a few rare fragments quoted by Pliny or Eratosthenes. It is beyond doubt that the bematists brought back to the Greek world a huge amount of field data, place names, distances, but also various descriptions of landscape, fauna and flora. The Seleucid kings, who ruled over the inner tracks of Asia after Alexander's death, probably gathered similar materials. Nearchus, as the commander of Alexander's navy, sailed from the mouth of the Indus to that of the Tigris, along the shore of the Indian Ocean, and wrote a

Periplus describing his sea-journey. Seleucid ambassadors or governors in eastern Asia, such as Deimachos, Patrokles and Megasthenes, were the main Hellenistic sources for the ethnography and geography of India. Another geographical text used by Eratosthenes was the treatise *On the Ocean* by the physician Pytheas of Massalia (*fl.* end of the fourth century BC), who sailed along the Atlantic shore of Europe as far as the mysterious island of Thule and was the major pre-Roman source about far western and northern lands.

The Ptolemies also ordered commercial and military expeditions into the interior of Africa (under such men as Philon, Dalion, Aristocreon, Bion, Basilis and Simonides Minor), while Timosthenes, the commander of their navy, was asked by Ptolemy II Philadelphus to survey the Mediterranean Sea, to describe and register its harbours and the notable points of its shores. The result was the treatise *On Harbours*, in ten books, which included measurements, orientations, lists of place names and quotations from previous geographical treatises. Such fieldwork was certainly available to Eratosthenes in the Alexandrian Library. A later geographer, Marcianus of Heraclea, accused Eratosthenes of plagiarizing Timosthenes' treatise word for word.[24]

These various travel reports fit rather well with Strabo's description of the genesis of the cartographic image. A striking fact is that the Ptolemies, looking for crucial geographical information (for military, political and commercial purposes), did not ask for maps but for written reports, land and sea itineraries. Transforming these field data into a map would not have answered the pragmatic needs of the Ptolemies. Eratosthenes' map and geographical treatise encompassed the information in part, while modifying its form, content and scope, a modification which prompts an enquiry into this Alexandrian concept of the map itself. What was a map? What was its purpose? To answer this, I broaden the scope of enquiry to encompass mapping in the early modern world.

THE 'CARTOGRAPHIE DE CABINET' PARADIGM

Within the Alexandrian Library, in order to build up a whole picture of the world, one had to move slowly along a course of mediations and analogical operations, from empirical data to the final intellectual scheme. Claudius Ptolemy (*fl.* second century AD), Al-Idrisi at the court of Roger II of Sicily in Palermo (*fl.* twelfth century),[25] and Jean-Baptiste Bourguignon d'Anville (1697–1782)[26] are other examples of what may be regarded as a major paradigm in the history of cartography.

Beyond their specific historical context, all these map-makers shared a

basic common position: all were 'motionless minds', processing the scattered data provided by travellers, geographers, ambassadors and former map-makers. Drawing a new map – of the whole earth or of a part of it – demanded some basic conditions: first, being settled in a place where a large amount of information was available, such as a royal court, a library and a commercial crossroads; second, a precise working method. Geographers had to read and interpret texts, to extract and classify bits of information, to order them, to translate them according to a common unity of measure. The basic operations were selecting data, cross-checking them, coordinating them and then translating them into orientations and distances in order to project them into the graphic space of the map itself. Such a conception of map-making was an extended pratice of geometry.

Jean-Baptiste d'Anville is one of the best documented examples of such a 'cartographie de cabinet'. This French *érudit* was trained in the Classics and historical geography. His historical maps and dissertations provided him with an intellectual background as well as a corpus of sources, measurements and place names for his mapping projects. As a 'géographe du roi', he produced an impressive amount of treatises and maps of individual countries as well as of the whole earth. In his work, there was a continuity from the regional maps to the maps of continents and to the *mappaemundi* themselves. His world map was first published in 1761 and was a landmark in Enlightenment cartography. It was updated in 1772 and 1777, after Bougainville and Cook's navigations.

D'Anville could be considered as an heir of the Alexandrian geographers: he used identical methods. One of the differences, however, was the larger range of evidence available. D'Anville had many strata of geographical knowledge at his disposal: Greco-Roman sources, medieval and Renaissance sources, Arab sources, as well as modern reports. As a 'géographe du roi', he was at the very centre of a unique network of correspondents, ambassadors and merchants: each of them, through written reports or oral statements, from their own experience or from indirect field testimonies, were as many substitutes and delegates of the cartographer himself, who never travelled in order to draw his maps.

D'Anville's first task was to draw regional maps, and then to recombine these partial drawings in small-scale maps: he was interested in the detail of topographical data and his main concern was, so to speak, filling in the blank spaces enclosed within the outline of the mapped regions. Map-making remained an abstract synthesizing operation, the last step in a complex process relying on scholarship and the philological treatment of evidence. The key word in d'Anville's practice was 'criticism', that is

internal criticism of sources. Comparing data, resolving inconsistencies, finding modern equivalents for ancient place names, translating textual and descriptive information into locations, distances and orientations were some of these operations. For d'Anville, ancient measurements were an inescapable source of topographical information for the modern map-maker and were expected to provide the same exactness as the rare modern astronomically established positions. As a matter of fact, Roman itineraries, in the areas familiar to the Romans, appeared as very exact. For this reason, it was essential to find out the modern equivalents of ancient measurement units: 'Pied Romain et Pied Grec, Palme majeur et mineur, Coudée, Orgye, Mille Romain, Mille Grec, Stades de différentes longueurs, Schène Égyptien, Parasangue Persane, Li chinois etc.'.[27] Such a set of equivalences allowed the modern map-maker to use a wide range of heterogeneous data and to provide historical geography with an instrumental function for modern geography. The final map, resulting from this assembling and combining process, produced a visual cohesiveness which concealed all the calculations, translations and critical adjustments that made it possible.

Luckily enough, we still possess d'Anville's draft notes, his *Papiers géographiques*.[28] These archives allow us to observe the map-maker at work. They are a series of small sheets and fragments of papers, covered with manuscript notes. We find pieces of topographical information gathered from oral testimonies, modern travel reports and ancient sources: place names and their variants, distances, descriptions of a road, quotations from books, quotations from ancient sources, astronomical observations fixing the position of a city, comparisons of ancient sections of itineraries, sketch drawings offering a first visualization of these data, draft versions of dissertations. The accumulation, comparison and addition of such partial data are by themselves heuristic tools: they allow the painstaking construction of local configurations that will be assembled on the map. The *Papiers* display the rough material collected in order to draw maps of Turkey, Greece, Hungary, Africa, Egypt and others. D'Anville cross-checks these data, adds up local measurements, looks for the convergence of sources. This is an infinite process, and new data are added even after the map has been drawn. D'Anville stores this new information in order to correct or to confirm his map. The map of a given country, such as d'Anville's famous *Carte d'Italie* (1743),[29] results from the assembling of local data, from this transformation of written information into a distribution of locations according to a common scale. In such a process, geometry is the principal tool: it allows the transformation into segments

of straight lines and the alignment of points of what was formerly a succession of stopping-places along an itinerary. Further, it helps to interconnect all these segments in a network of places: their relative positions shifted according to an absolute location system.

From Eratosthenes to d'Anville and beyond, geographers faced the same challenge: they knew the way to calculate longitude and latitude. But practical calculations were rare. Several reasons explain this situation. Technically, calculating a longitude position implied a precise measure of the time at which an astronomical phenomenon, such as a solar or a lunar eclipse, was visible in different places located on the same parallel. The theoretical principle had been known since the Greeks, but it was definitely applied only during the eighteenth century, thanks to the manufacturing of precise clockwork.[30] Second, logistic factors: launching systematic field surveys and measurement campaigns implied an institutional frame, economic means, instruments and a trained staff, as well as the possibility to develop international cooperation or to travel freely and systematically through the areas to be mapped. Without such a systematic process, map-makers had to deal with scarce astronomical observations that provided their maps with few positions. The greatest part of topographical data, however, was provided by itinerary and travel reports, while the map relied mainly on geometry.

The production of a world map always implies a centripetal dynamic, collecting data from the periphery at a centre, and translating empirical and field data into a network of measured distances, defining mathematical positions easily handled and combined within the geometrical frame of the map. One of the dynamics in the history of small-scale maps has been the progressive control of the data to be collected, their format, their reliability. Eratosthenes,[31] Ptolemy, al-Idrisi and d'Anville did not have such direct control. Their mapping projects relied on the corpus of currently available evidence, without the possibility of enlarging it through field survey and systematic geodetical campaigns.

These geographers used the map to give a cohesiveness to whatever heterogeneous data they were able to collect. They faced the same difficulty: how to process and organize tiny bits of geographical knowledge, such as place names, tribe-names, distances expressed according to various standards (days of travel, of navigation, indigenous measures), orientations, former maps, descriptions. The map gave a spatial and temporal cohesiveness and homogeneity to data, sometimes pertaining to different historical periods.[32] The way this information was established, collected and translated into cartographic forms became hidden under the drawing

itself, but could be archived in the treatise of the geographer or among his draft papers. D'Anville's notes help us to imagine what might have been Eratosthenes' methods in the Alexandrian Library – although we should remember the specific practical difficulties of working with papyrus rolls, without indexes, page numbers or other devices for a quick retrieval of data.

FUNCTION OF THE MAP

From Eratosthenes to d'Anville, one observes the permanence of a model of map-making, relying on the mediation of various sources and their progressive synthesis through critical operations. We should not, however, underestimate the differences between these cartographers. D'Anville worked at a time when cartography had already a well-established tradition, when a new cartographic project could rely on the many existing maps it had to correct and improve. The difference, however, lies also in the function and efficiency of the maps thus produced. The 'missing link' between Eratosthenes' world map and d'Anville's maps is the new cartographic paradigm developed by another map-maker from ancient Alexandria, Claudius Ptolemy.

Ptolemy's second-century-AD *Geographia* had other purposes than Eratosthenes' work. The treatise provided any new map-maker with the theoretical principles and the technical material necessary to draw regional maps or even a *mappamundi*. His tables listed around eight thousand geographical positions (longitude and latitude). As far as we can judge, Ptolemy's *Geographia* did not have real echoes during the Roman Empire. The text, however, was transmitted through the Arab world and in the Byzantine libraries, and from there, at the end of the fourteenth century, it made its way to the West where it was studied by Italian humanists and European geographers and printers. The nature and the internal organization of Ptolemy's work explained its fortune. Even when they corrected its locations or updated the geographical place names or added new ones and deleted outdated ones, Arab and European geographers still worked within the conceptual frame defined by Ptolemy: the map, regional as well as geographical, was ruled by a graticule, either orthogonal or with the meridians convergent towards the pole. There was coherence and continuity between regional and geographical grids, since they were drawn according to a general partition of the terrestrial globe by regular meridian and parallel lines. An arbitrary decision fixed the primary meridian in relation to which longitude would be calculated.[33] Such a device allowed infinite ways to frame and distribute Ptolemy's eight

thousand positions into large-scale or small-scale maps, without ever losing their position or the relationship of the part to the whole.

On such grids, individual places could be plotted as dots, and a line drawn through them in order to reveal the shape of a coastline, the track of a river or a mountain chain. The basic element in Ptolemy's *Geographia*, however, is not the line but the point, fixed by a set of two geometrical coordinates. But this point is the last step in the processing of data collected from travel reports or from written descriptions. Most of these longitude and latitude positions were not established through astronomical observations, but were drawn from heterogeneous sources, from texts and previous maps. It should be stressed that the precise figures lined up in Polemy's tables are themselves products of mapping, the result of a shift from the relative position of places to their absolute positions, once a grid of numbered parallels and meridians has been drawn in cartographic space.

The regional maps in Ptolemy's *Geographia* are the ultimate encoding and archiving device for bits of geographical information. Such a system articulates various levels and forms of knowledge. Thanks to the coordinate system, places remained unchanged across several frames, producing special intellectual effects, whether appearing in a chorographic map frame, a geographic map frame or within a written catalogue where each entry was given its longitude and latitude and to which was added further information (climatic, historical etc.). These catalogues could be ruled by geographical order or alphabetical order without losing their efficiency.

Understanding Eratosthenes' work within its own categories is more difficult, since we do not have his map and his treatise. From Strabo's quotations and paraphrases, however, we could try to draw a few general inferences about the purpose of Eratosthenes' map.

A first key feature is its abstract nature and purpose. Abstraction is the key word in the process that leads from the empirical vision to the mental schematization, since the map-maker deconstructs the periplus, the land itinerary, the exploration report, in order to extract alignments of places, segments of added distances, orientations, and descriptive data (climate, landscape etc.) and help to determine the location. If Ptolemy's regional maps were a catalogue of positions, Eratosthenes' world map was perhaps more like a relational database: a device wherein a given place was meaningful and relevant only as an element within a system of relations. Ptolemy was interested in the inventory of the world and no limits restricted the continuous addition of new locations. This was to happen during the European Renaissance. Eratosthenes was interested in the

structure rather than the inventory. His map relied on a set of notable points, each defining its unique meridian and parallel. These lines were not organized into a systematic grid, and the aim of the map was not to locate points, but to organize a space of *summetria* (commensurability), wherein measured intervals (*diastèmata*) would build up a frame of non-regular perpendicular lines. Other places could subsequently be located on one of the parallels or meridians thus defined. Since the map was an orthogonal space, it was possible to add new places, to draw new parallel or perpendicular lines, in order to fix the limits of the inhabited world and to measure its greater length and width. Eratosthenes' purpose was thus to build a structure of abstract geometrical lines and shapes which did not represent anything real in the geographical space but made visible mathematical relationships within the orthogonal frame of the map.

The map was ruled by the geometry of Euclid's *Elements*, written in Alexandria at the beginning of the third century BC. It established a set of mathematical correspondences between places that were not interrelated. Such an underlying network of parallel and perpendicular lines allowed the reorganization of empirical data extracted from travel reports and previous geographical descriptions. Thus it allowed new kinds of journeys – analogical and syllogistical ones. A given measured distance between the latitudes of two places could be exported from the western extremity of the map to the eastern one. It remained the same distance and defined two parallel lines, which could themselves be used as starting points for new calculations. It was thus possible to travel through the inhabited world in an abstract and geometrical way, thanks to this network of lines creating non-empirical relationships between remote places.

Eratosthenes' map was thus a computing device. It allowed the mathematical cohesiveness of the step-by-step construction of the picture of the world to be checked by the progressive discovery of new topographical data. It was also a tool, allowing choice between various accounts about the same place. Maps could reveal the absurdity of an incorrect location provided by an imprecise textual source by making immediately visible what such a location implied in terms of landscape, fauna and flora, through analogy with other places on the same parallel. One might say that such a map was a regulated system where any local addition, any local modification should be coherent with the whole structure and had repercussions on it. Such cartographic thinking was ruled by the syllogism.

Eratosthenes' map was not the ultimate result of the geographical work, as in Ptolemy's project. It was the tool of this work, making visible,

step by step, the critical decisions made by the geographer, his choices, his calculations. As such, the map was a communication tool between geographers. There was a complex link between the written treatise and the map (drawn on a sheet of the papyrus roll, perhaps, or a separate tablet). When such a treatise was read, the map offered a background for the discussion, made it possible to check and to correct mistakes. The astronomer Hipparchus and the geographer Strabo used Eratosthenes' map in such a way, as a device for making visible the inferences and conclusions of its maker, the cohesiveness of the sources he chose, the way he used them.

MAP-MAKING AS A TRADITION: BETWEEN RHETORICS AND PHILOLOGY

Strabo's text about the 'cartographic mind' as well as the nature and purpose of Eratosthenes' map pinpoints another key feature. Map-making is no longer possible as a project from the ground, the demiurgic attempt to draw the world as in Anaximander's first map. Between sixth-century Ionia and third-century Alexandria, the map has lost its ontological power. Map-making takes place within a tradition and a particular time frame. First, because the map synthesizes data extracted from previous texts. Second, because map-making is dependent on history, on conquests, on new explorations. Alexander's campaign unveiled the inner and eastern parts of Asia for the Greeks. Polybius and Strabo expressed their conviction that Roman conquests helped to uncover new areas, new tribes. Geographers could map only the part of the world known at their own time. Their work was a step in an ongoing process and they were aware that their successors would bring new improvements, corrections and complements to their map or description. Third, because since Eratosthenes, drawing a new map was possible only if one relied on a previously existing one: map-making was conceived and practised as a complex set of operations and implied a critical work on previous maps – rectification, addition of new data and deletion of incorrect or outdated data.

Such a process calls to mind what happened in Alexandrian philology. The Alexandrian Library played an important part in Eratosthenes' cartographic project and method, not only because he found within its holdings a wide range of sources, but also because these texts and maps displayed ambiguous or incorrect information, discrepancies, outdated features that demanded rectification (*diorthôsis*). In the same way, librarians such as Zenodotus and, after Eratosthenes, Aristophanes of Byzantium and Aristarchus of Samothrace decided they could not keep

unchanged the different versions of the same literary texts (such as Homer's *Iliad* and *Odyssey*), but, instead, chose to process them through the various operations of philology in order to reduce the plurality and the discrepancies of material books into a single and coherent text – rectification here again was the main step.[34]

Strabo, Polybius and Ptolemy followed the model of the cartographic work determined by Eratosthenes. The process was the same for the mapmaker as for the author of a geographical description. First, one had to choose, as a starting point, the work of a forerunner, who provided a general reference frame as well as a corpus of data. This author should be as recent as possible – his geographical information should not be outdated and, more important, he should have already done a critical recension of the sources.[35] Second, this author should display some specific qualities: much of his information is to be correct, and the new geographer may simply repeat it; but he has omitted some points, and new explorations have been made since his work. The new geographer had to fill these gaps. Last, this forerunner made mistakes, errors also to be corrected.[36]

Such criteria define the reference source that a new geographer should use and at the same time the nature of his personal contribution to the progress of geography: perpetuating a corpus of knowledge, completing gaps, correcting errors. Such criteria also help to select the additional sources one will use to correct and update the existing map. They give a good insight into the textual dynamics of ancient geography. A map or a geographical description synthesizes and supersedes previous maps, previous descriptions. It collects and combines in a new device the information checked and deemed trustworthy after the rectification of sources. This process alters the status of information: from individual statements about countries, places and tribes, to objective and granted facts. The map and the description could be considered as the condensed and the mobile library of Greek geographical knowledge.

Source selection is the most crucial step. One should select authors who are reliable and responsible at most for errors, never for lies. This distinction is essential in the tradition of Hellenistic geography.[37] Error is to be an unintentional mistake, and as such may be corrected without harsh polemics. On the contrary, the lie is a deliberate perversion of the truth. A statement might be wrong, but a lie pinpoints the man himself as unreliable. One could never henceforth trust him or any of his statements: some might be true, but this does not matter. Such an author lacks all credibility and should be ignored. One should not even criticize him and thus help to transmit his tales.[38]

We can scarcely overestimate the importance of such a rule in the geographical discussions of Polybius or Strabo. Being deceived by a liar is their common obsession and also the main point on which they reproach their forerunners. Liars introduce fiction and myth, marvels and wonders within the field of geography. The love of incredible stories belongs to another sphere than the sphere of knowledge. The problem, however, is that liars are to be found in a particular category of characters: travellers and tradesmen, coming back from remote countries.[39] 'Anybody giving an account of his own travels is a boaster,' wrote Strabo.[40] Such a preconception had dramatic consequences upon the Greco-Roman reception of geographical innovations.

In order to understand what is at stake, we should recall the epistemological model of Alexandrian cartography as described by Strabo. At the periphery, travellers observe, measure, discover. At the centre is the mind of the map-maker, who listens to these reports or reads them. Truth and reliability are the key issues since the location and sometimes the reality of a place rely on written sources. Two geographical areas focused the fiercest polemics: the island of Thule, at the northern extremity of the inhabited world, and India, at its eastern extremity. They were both representative of the most remote areas of the earth, its confines. New reports and new evidence were becoming available about these areas, rendering necessary the rectification of old maps. For the historian Polybius, it should be remembered that writers about the ends of earth write only myths.[41] Thule offers the best case study. This island in the Northern Ocean was mentioned and described enigmatically by its discoverer, Pytheas of Massalia (c. 325 BC). Nobody else in the ancient world had ever seen this island. Its existence or its imaginary nature, that is, its position on a geographical map, relied entirely on the credibility of Pytheas, on the critical decision to accept or reject his testimony. Eratosthenes accepted it, and the 'parallel of Thule' is the northern limit of the inhabited earth on his map. Polybius and then Strabo denied Pytheas' credibility: he is just a myth-teller, and since he wrote so many lies on known facts, one should ignore his testimony about unknown places.[42] Such were the alternatives within a debate that is not concluded today.[43]

It is the same problem with India. When Eratosthenes decided to change the position of India and locate its northern mountains on the same parallel as the Taurus mountains, actually the main parallel line of his map, he was relying on the testimony of Patrokles, who estimated that from the south to the north of India was a total distance of 15,000 stades, far less than previous measurements. The astronomer Hipparchus, in his

criticism of Eratosthenes' map, condemned the weakness of such evidence. Strabo is our main source for this polemic:[44] Hipparchus opposed one source to another, the credibility of Deimachus and Megasthenes against the credibility of Patrokles, in order to demonstrate the impossibility of choosing between two different locations of the same mountain when the only data available were written reports and not astronomical observations. The striking fact is that, for Strabo, the only way to put an end to the controversy was not by launching a survey expedition to India and making the necessary astronomical observations, but by checking again the credibility of the sources concerned and calling witnesses (for the prosecution as well as for the defence) to enforce or remove their *a priori* reliability. At the end of such a suit, one would decide whether the total length of India was 15,000, 20,000 or even 30,000 stades, and whether one had to correct the old maps or leave them unchanged, that is to stop making geography. Strabo concluded that Eratosthenes was right, since this was the only way to make geography. If Hipparchus was right on the theoretical level (Strabo does not even admit the possibility), Eratosthenes pragmatically chose to adapt geometrical and astronomical principles to the current status of his documentation and to his whole project, that is, mapping the earth from the Alexandrian Library. D'Anville's dilemma in the eighteenth century was not so different.

There remains to be explained the logic behind Polybius' and Strabo's insistence on the lie (*pseûdos*) as a major perversion of travellers. Eratosthenes' attempt to reform Greek cartography and geography led him to draw a major division between literary and mythical geography, on the one hand, and travel reports and previous geographers, on the other hand. The major consequence was to exclude Homer's poetry from the corpus of geographical sources and to deny the geographical reality of Odysseus' navigation. According to Eratosthenes, it took place beyond the Pillars of Hercules, in the Atlantic Ocean, and as such belonged to fiction, not to geography. It aimed at entertaining listeners, not teaching them geography or any other science.[45] One should not forget that, at the Alexandrian Library, Eratosthenes succeeded Apollonius Rhodius whose major work was the *Argonautica*, devoted to the journey of the ship Argo through the inhabited world. As such, it made use of many geographical materials, mostly archaic itineraries and outdated conceptions. This could explain why Eratosthenes decided to separate geography from this literary and antiquarian scholarship. Adopting such a position against Homer's geography allowed Eratosthenes to avoid a set of *vexatae quaestiones*, such as the place of the Cyclops' land or Calypso's islands and so on.

Such a redefinition of geographical knowledge had far reaching consequences and challenged the cultural dogma of Homer's omniscience, developed by the allegorical school of Pergamon and by Stoic philosophers. As Stoics, Polybius and Strabo were obviously shocked by Eratosthenes' expurgation of the geographical field. One of their concerns became to re-establish Homer's authority as a geographical writer and to demonstrate the historical and empirical background of the *Odyssey*. Homer translated his geographical knowledge into the language of poetry and myth, and his readers should look for the core of truth beneath the mythical skin.[46] Polybius and Strabo are thus among the most ancient examples of a hermeneutic trend that led ultimately to Victor Berard and his attempt to map Odysseus' travels in the Mediterranean Sea. They concluded that most of Odysseus' navigational steps were to be located around Sicily and Italy and that Homer was to be considered as a trustworthy geographical source.[47]

This rehabilitation of Homer had a counterpart, that of pinpointing the dangers of error and fiction elsewhere, in the corpus of travellers and explorers who conveyed myths under the form of objective statement and field reports, for the mere pleasure of deceiving their readers. While Homer's mythical adornments are immediately identifiable and don't intentionally cheat the reader, Pytheas, Megasthenes and others lied for the pleasure of lying and as such they should not be used at all by the map-maker. Eratosthenes, the armchair map-maker, was thus caught in his own trap and should rather have relied on Homer's descriptions than accepted the existence of Thule.

Such a distrust for travellers continued until the Enlightenment age of scientific explorations, and explains why armchairs cartographers were sometimes so reluctant to use much of the information provided by merchants and explorers.

FROM THE GEOGRAPHICAL TEXT TO THE MENTAL MAP

Eratosthenes' lost treatise and lost map were landmarks in the history of cartography. First, Eratosthenes conceived and made visible new methodological rules, a self-consciousness that changed the nature of map-making, its links to tradition, to temporality and to progress. Second, he tried to give geography independence from literature and poetry, reorganizing it through the drawing of a geometrical map and translating into mathematical relationships and geometrical shapes the data conveyed by travellers. Along with the map, his treatise encompassed geographical descriptions, but also, in its first two volumes, an account of the history of

geography and a critical discussion and rectification of older maps. This self-reflexive writing was to be shared by most future authors concerned with geography and cartography, including Polybius, Strabo and Ptolemy.

It is striking that such a redefinition founded not one new tradition, but two. Cartography remained a mathematical and astronomical discipline, technical and esoteric, whose aim was the graphic representation of the earth. Hipparchus (*fl.* second century BC), in his treatise *Against Eratosthenes*, emphazised the necessity of more rigorous astronomically founded data in order to 'rectify' the old maps and change the shape of India. This shift towards mathematics and astronomy led to Marinus of Tyre and to Claudius Ptolemy, during the second century BC. In the latter's *Geographia*, the text as a whole was subordinated to the production of maps, and, as a mere list of locations, it was isomorphic to the set of maps.

Polybius, as the author of a universal history, and Strabo, as the author of a geographical description, both made use of Eratosthenes' work. The Alexandrian map beyond doubt influenced them. But Polybius and Strabo reintroduced the literary tradition, the cultural landscape of the Greek Mediterranean world. (We have, however, lost most of Polybius' Book XXXIV devoted to a systematic geographical description.) Strabo's *Geography* displays an odd divide between its two first books, devoted to the discussion of the Alexandrian map and to the rectification of the geographical tradition, and the later fifteen descriptive books. In the latter, Homer's *Catalogue of Ships* (in the second book of *Iliad*) and its Hellenistic commentators were one of the main sources for the topographical description of Greece (Books VIII–X) under the Roman rule, and the fictional accounts – lies – of travellers inspired most of his description of India (Book XV). And how could Strabo do otherwise? One might claim that he was satisfied with a traditional rewriting of the textual sources, travel reports and regional descriptions available in Alexandrian and Roman libraries under Augustus' reign without submitting them to the geometrical encoding and abstract processing linked to Eratosthenes' map-making. His intended readership was supposed to be wider than the few experts able to use Eratosthenes' and Hipparchus' works. Was this partition between the text and the map therefore an irreconcilable one?

During the second century AD, again in Alexandria, Dionysius Periegetes adapted and described the Alexandrian map in a short didactic poem, in which Eratosthenes and the Stoic philosopher Posidonius were merged with Homer and Apollonius Rhodius: the schoolboy travelled

mentally on the map and above the world as a new Odysseus or a new Argonaut. At a time when Claudius Ptolemy was about to write his treatise and perhaps to draw his maps in Alexandria, Dionysius wrote this versified geographical handbook in the sophisticated and artificial language of Alexandrian learned poetry: the text was to be translated into Latin and used in the Byzantine world as well as in the colleges of Renaissance and modern Europe until the nineteenth century.[48] Why did this compilation achieve such a successful reception so quickly? The supremacy of the *logos* over the map it describes, of the literary frame of geography over its visual and mathematical construction, is explained through cultural practices – a written text, a recited poem could reach a far wider audience than any map on a papyrus roll or on a large wooden or stone panel. There was also a well-defined set of scholastic methods that inserted the lesson of geography within the broader frame of a lesson of literature: the key operations were reading, paraphrasing, explaining the erudite allusions, memorizing, reciting. But Dionysius' poem also had visual and imaginary effects of its own. Reading the text was like a methodical travel around and through the earth, organized according to its continents, its countries, its tribes, the catalogue of its place names. This discursive order and the descriptive rhetoric surrounding it, however, were efficient enough to induce visual impressions, to build up a mental map of the world. The poet himself provided his readers with directions for reading his text:[49] 'Now, I shall relate the shape of the whole continental earth, so without having actually seen it, you will get a clear and coherent vision.' How can one look at the world without seeing it, unless through an actual map or an immaterial map in the mind?

Describing geographical shapes though metaphors and geometrical figures, the poet tried to build up, step by step, a verbal map: larger territorial units were outlined first, and then their inner parts were filled in with tribes, rivers, mountains – with names and conventional, sometimes vivid, epithets. An implicit wind rose, the path of the sun, a complex network of contiguities (near, far, beside, above, beyond . . .), as well as a few structural axes drawn from the actual map's meridians and parallels, helped Dionysius' readers to organize the mental picture of the earth. The traditional mnemotechnics involved in the rote recitation of the poem was a dynamic principle: it was a travel as well as a mental drawing process. The reader was the map-maker, following the instructions of the poet. The poetical language allowed the transmission of the cartographical vision, from the poet's mind to those of his readers or listeners. The map, as a whole picture, was the result of a travel, of an evolving

process of assemblage, of juxtaposition of shapes, of approximation and of correction.

Dionysius' textual map was not only a fascinating didactic fiction, but also a challenging synthesis of various trends of Alexandrian culture. The geographical library was reunited again, beyond Eratosthenes' anathema against epic poetry. Homer and geometry coexisted again. The map-maker did not rely any more on an infinite chain of mediations and predecessors, manipulating previous texts and maps in order to collect his information and to build up his whole map through the addition and combination of heterogeneous data, of place names, distances and orientations. Instead, the map-maker relied on his direct gaze upon the surface of the earth. The map revealed itself through the map-maker's autopsy. Seen from above, seen from the memory and the imagination, the earth looked like a map, with its lines, its orientations, its place names, its mosaic of lands and seas clearly defined and assembled.

Eratosthenes, in Strabo's account, had to assemble and synthesize a whole library and to purge the travellers' reports of all their sensory and empirical components in order to reach the abstract level of the cartographic diagram. Dionysius' readers share the aerial and immediate vision of the poet, who probably described a map he had under his eyes. Readers and listeners of the poem were at the same time the travellers and the map-makers, the visual observers of singular places and regions, their minds synthesizing words, epithets, metaphors, topographic markers until the whole shape and organization of the *oecumene* were engraved into the tablets of the memory, mere intellectual contemplation beyond all verbal or graphical rendering.

The rhetorical art of description – the *ekphrasis* – had a far-reaching power over the imagination.[50] Literary pleasure was linked to cognitive efficiency. Vision was the foundation of knowledge, and a text, thanks to a specific rhetoric, allowed the encoding and the transmission of this vision, from the writer to his readers. Thus, Dionysius' readers, through a fanciful didactic experience, could share the abstract and surreal vision of the Alexandrian cartographer. Eratosthenes chose to follow the paths of scholarship, geometry and criticism to ascend mentally to a cartographic vantage-point above a schematic and abstract world, a world deserted by gods and heroes. Dionysius' pupils forgot geometry, measures and mediations, and shared the ecstasy of the Muses, of Icarus and of the soul, while slowly flying over the earth's surface, where Ulysses and the Argonauts were still seen travelling, from one poem to another.

The map was as fragile and impressive as a vision of the mind.

geographicity, Martin Lewis and Karen Wigen, *The Myth of Continents: A Critique of Metageography* (Berkeley, Los Angeles and London, 1997).

13 J. Brian Harley, 'Re-reading the Maps of the Columbian Encounter', *Annals, Association of American Geographers*, 82 (1992), pp. 522–42.

14 Printed editions of *The Divine Comedy* over the course of the sixteenth century sought to illustrate Antonio Manetti's investigations into the site, shape and size of Dante's cosmography, mapping and measuring the underground spaces of Hell in a series of engravings which progress from the crude woodcuts of the Giuntina edition of 1506 to the carefully mensurated, 'scientific' diagram produced by the Accademia della Crusca in 1595 (see http:/www.nd.edu/~italnet/Dante/text/Hell.html).

15 See, for example, the discussion in Phillip Edwards, *Sea Mark: The Metaphorical Voyage, Spenser to Milton* (Liverpool, 1997), pp. 69–98.

16 Jonathan Sawday, *The Body Emblazoned: Dissection and the Human Body in Renaissance Culture* (London, 1995); idem, 'Self and Selfhood in the Sixteenth Century', in Roy Porter, ed., *Rewriting the Self: Histories from the Renaissance to the Present* (London, 1997), pp. 29–48.

17 L. Benevolo, *The European City*, (Oxford, 1994), pp. 85ff.

18 Ola Söderström, 'Paper Cities: Visual Thinking in Urban Planning', *Ecumene*, 3 (1996), pp. 249–81.

19 The continuing settlement of aboriginal land claims since the Mabo judgement overturned the legal assumption of Australia as *terra nullius*, declared at the time of British colonial appropriation, depends upon acceptance of a wide range of 'cartographic' documents, ranging from conventional Western cadastral and property maps to rock markings and oral mappings attested by group memory through storytelling.

20 Frank Lestringant, *Mapping the Renaissance World: The Geographical Imagination in the Age of Discovery* (Oxford, 1994).

1 *Christian Jacob: Mapping in the Mind: The Earth from Ancient Alexandria*

1 Large-scale maps, too, are never mere reproductions of the visible. They render visible a range of information invisible in the real territory. But their limited spatial extent makes possible an empirical control, through observation, through journeys and so on.

2 As defined by J. B. Harley and D. Woodward, 'Preface', and J. B. Harley, 'The Map and the Development of the History Cartography', in *History of Cartography*, vol. 1: *Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*, ed. J. B. Harley and D. Woodward (Chicago and London, 1987), pp. xv–xxi and 1–42.

3 For a general survey of extant evidence and sources and of the history of ancient Greek cartography in English, see O.A.W. Dilke, *Greek and Roman Maps* (London, 1985); also the contributions of O.A.W. Dilke and G. Aujac in Harley and Woodward, eds, *History of Cartography*, vol. 1, pp. 130–279.

4 It is beyond the scope of this paper to give even a general survey of the transmission of Ptolemy's *Geographia*.

5 See C. Jacob, *Géographie et ethnographie en Grèce ancienne* (Paris, 1990); 'Quand les cartes réfléchissent . . .', in *Penser/Figurer: L'espace comme langage dans les sciences sociales, Espaces/Temps*, 62–3 (1996), pp. 36–49; 'Premières géographies. Poésie, cartes et périégèse en Grèce (VIIIe–fin VIe siècle avant J.-C.)', in A. Sérandour, ed., *Des Sumériens aux Romains d'orient: la perception géographique du monde. Espaces et territoires au proche-orient ancien*, Actes de la table ronde du 16 novembre 1996 (Paris, 1997), pp. 157–76.

6 Herodotus, *Histories* V.49–51 and Plutarch, *Life of Nicias* XII.1; *Life of Alcibiades* XVII.3–4 should be used with caution in order to estimate the familiarity of fifth-century BC Greeks with cartography.

7 We should be aware that its form, contents and purposes were different from today. The Alexandrian map-makers excepted, no one in ancient Greece would claim to study 'geography'. There were other words and categories. See F. Prontera, 'Prima di Strabone: materiali per uno studio della geografia antica come genere letterario', in F. Prontera, ed., *Strabone: contributi allo studio della personalità e dell'opera* (Perugia, 1984), pp. 186–259.

8 Such is the case, for instance, with the *Description of the Inhabited Earth* by Dionysius Periegetes (second century AD), a poetical handbook for schoolboys. See C. Jacob, *La description de la terre habitée de Denys d'Alexandrie ou la leçon de géographie* (Paris, 1989).

9 The English reader could use the translation by H. L. Jones (Loeb Classical Library, Harvard and London, 8 volumes).

10 For the cultural frame of Alexandria, see P. M. Fraser, *Ptolemaic Alexandria* (Oxford, 1972, repr. 1998), 3 vols; by the same author, see 'Eratosthenes of Cyrene', *Proceedings of the British Academy*, LVI (1970), pp. 175–207. Eratosthenes' fragments are edited by H. Berger, *Die geographischen Fragmente des Eratosthenes* (Leipzig, 1880; repr. Amsterdam, 1964).

11 See C. H. Kahn, *Anaximander and the Origins of the Greek Cosmology* (New York, 1960).

12 But we know nothing about the way such information was encoded. It was probably only a linear drawing, with shores and main rivers. Nothing suggests that Anaximander wrote a 'geographical treatise' as a 'companion book' to his map.

13 Edited (but not translated) by F. Jacoby, *Die Fragmente der griechischen Historiker* (= FGrHist), 1.

14 Diogenes Laertius V.51.

15 This metaphor appears in Strabo's *Geography* II.5.6 C 113, II.5.9 C 116, II.5.14 C 118–19, II.5.18 C 121–2. It is debatable whether this image should be attributed to Eratosthenes. On Alexandria's shape: Strabo XVII.1.8 C 793.

16 See F. Hartog, *The Mirror of Herodotus: The Representation of the Other in the Writing of History*, transl. J. Lloyd (Berkeley, Los Angeles and London, 1988).

17 Strabo II.5.11 C 117 (transl. Jones).

18 For a general discussion of these effects of the Alexandrian Library, see C. Jacob, 'Navigations alexandrines: lire pour écrire', in M. Baratin and C. Jacob, eds, *Le pouvoir des bibliothèques: la mémoire des livres en occident* (Paris, 1996), pp. 47–83.

19 See B. Latour, *Science in Action* (Cambridge, MA, 1983).

20 The standard way of reading books in the ancient Greek world was to read them aloud.

21 Strabo II.1.5 C 69.

22 Probably not, since what we call 'geography' today did not exist as such in Antiquity, but covered several fields, including history and mathematics. It seems Eratosthenes was the first to use the word 'geographia' in relation to map-making.

23 On the bematists, see P. M. Fraser, *Cities of Alexander the Great* (Oxford, 1996), ch. 4. On the scientific activity linked to Alexander's exploration, see L. Bodson, 'Alexander the Great and the Scientific Exploration of the Oriental Part of his Empire: An Overview of the Background, Trends and Results', *Ancient Society*, XXII (1991), pp. 127–38.

24 *Epitome peripli Menippei*, 3 (*Geographi Graeci minores*, 1, p. 566).

25 See S. Maqbul Ahmad, 'Cartography of al-Sharif al-Idrisi', in J. B. Harley and D. Woodward, eds, *History of Cartography*, vol. II, Book One: *Cartography in the South Traditional Islamic and South Asian Societies* (Chicago and London, 1992), pp. 156–74.

26 See N. Broc, *La géographie des philosophes, géographes et voyageurs français au*

XVIIIe siècle (Paris, 1975), pp. 31–6; A. Godlewska, 'Traditions, Crisis, and New Paradigms in the Rise of the Modern French Discipline of Geography 1760–1850', *Annals of American Geographers*, LXXIX/2 (1989), pp. 192–213.

27 See J. B. d'Anville, *Traité des mesures itinéraires anciennes et modernes*, 1769, reprinted in: *Oeuvres de d'Anville publiées par M. de Manne*, tome 1er (Paris, 1834).

28 Paris, Bibliothèque Nationale de France, Dépt. des Manuscrits, Fr. Nouv. Acq. 6502-03.

29 This map brought major improvements to the shape and the proportions of Italy.

30 In Strabo's *Geography*, we do not find a single longitude established through an astronomical observation. In Ptolemy's *Geographia*, we find confirmation of the scarcity of such data, and only one example: the measure of the distance between Arbeles and Carthage, calculated during a lunar eclipse: I.4.

31 Eratosthenes' measurement of the circumference of earth is one of the rare examples of such a fully controlled scientific process. Observing the shade inclination of a gnomon in Alexandria when the sun was at the zenith above Syene, and, knowing the distance between Syene and Alexandria, it was possible, through a trigonometrical calculation, to calculate the circumference of earth.

32 A systematic description, such as Strabo's *Geography*, had the same effect.

33 Ptolemy's primary meridian was set at the Canary Islands.

34 For a general survey of ancient Greek philology, see R. Pfeiffer, *History of Classical Scholarship from the Beginnings to the End of the Hellenistic Age* (Oxford, 1968).

35 Polybius III.59.3; XXXIV.5.1–6, B–W (= Strabo II.4.1 C 104); Strabo I.2.1 C 14, II.1.11 C 71; Ptolemy, *Geographia* I.5, I.6.1.

36 Strabo I.2.1 C 14, I.3.1 C 47; Polybius III.59.1.

37 Such criteria in the field of epistemology recall the tragical divide between involuntary fault and voluntary crime: see Aristotle, *Poetics* III.53a, 7. It was also an important category of rhetorics and ethics. See Aristotle, *Rhetoric* I.1374b, 7–11; *idem.*, *Rhet. ad Alex.*, 1427a, 30–43. The criticism of sources thus relied on a more general model of the 'fault through ignorance' as opposed to the intentional offence.

38 See Strabo I.2.12 C 22, I.3.1 C 47, I.3.23 C 62.

39 Polybius IV.42.7. See Ptolemy (quoting Marinus of Tyre), *Geographia* I.11.7: lies about distances.

40 Strabo, I.2.23 C 30. See also Polybius III.58.9.

41 Polybius III.38.3.

42 Strabo, I.4.3 C 63, II.4.1–2 C 104.

43 See G. E. Broche, *Pythéas le massaliote* (Marseille, 1936); H. J. Mette, *Pytheas von Massalia* (Berlin, 1952); about the modern tradition, see M. Mund-Dopchie, 'La survie littéraire de la Thulé de Pythéas: un exemple de la permanence de schémas antiques dans la culture européenne', *L'Antiquité Classique*, LIX (1990), pp. 79–97; 'L'"Ultima Thule" de Pythéas dans les textes de la Renaissance et du XVIIe siècle: la réalité et le rêve', *Humanistica Lovaniensia. Journal of Neo-Latin Studies*, XLI (1992), pp. 134–58.

44 Strabo II.1.2–5 C 68–9.

45 *Ibid.* I.1.10 C 6–7, I.2.3 C 5–6, I.2.15 C 24.

46 *Ibid.* I.2.7-8 C 18–19, I.2.11 C 21–2.

47 See the discussion in Strabo I.2.11 C 21–I.2.20 C 27.

48 See Jacob, *La description de la terre.*

49 Dionysius Periegetes, *Description of the Earth*, vv. 170–71.

50 *Ekphrasis* was a key feature of Imperial Greek culture. Handbooks of rhetoric explained the technical principles of this kind of description, while such writers as Philostratus, Lucianus, Ps.-Longinus and Pausanias provide us with vivid examples of such developments.