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GREEK AND ROMAN MAPS

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with 62 illustrations

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interpret for them. Papers delivered at the London Museum conference on Roman towns and at the Institut Français de Naples have contributed to the understanding of this and other aspects of Graeco-Roman mapping.

The long period of history involved and the changing roles of Greek cities and of Rome over many centuries, as well as the many types of map, presented a difficulty of arrangement. Chapters I–III, V and XI–XII adhere to chronological order, V dealing with the original Ptolemy while XI concerns the tradition of Ptolemaic maps. Chapters VI–X deal with themes rather than periods of mapping. As this book is intended to be on mapping of the earth, only an extremely brief outline is given of celestial cartography, where this is necessary for its implications. Non-mapping but training aspects of the work of land surveyors have been included, and also descriptions marginal to mapping such as geographical writings, itineraries and *periploi*. Greek names have been spelt in Latin form where they are familiar. The aim has been to provide for the interests not only of classicists and historians of cartography but of many other readers.

Special thanks are due to my wife, who has helped my work throughout. The Leverhulme Trust awarded me an Emeritus Fellowship providing for travel and research to complete writings which are now gathered in this book and also in Vol. 1 of *History of Cartography*, edited by Brian Harley and David Woodward for Chicago University Press. I wish particularly to acknowledge access to the contributions to that series of Professors Germaine Aujac and J. Babicz, Dr A. R. Millard, Professor A. F. Shore and Dr Catherine Delano Smith. Acknowledgments are likewise due to Dr Helen Wallis and others at the Map Room of the British Library, and to the Special Collections of the Brotherton Library and the Audio-Visual Service, University of Leeds. The challenge of the Schools Museum Service, Wakefield, which had made models of Roman surveying instruments, to prove with students that these worked, enabled us to see that the Romans had easy and accurate methods for making large-scale plans. The John Carter Brown Library, Brown University, Providence, Rhode Island, where at present I have a research fellowship, has by its rich collection enabled me to appreciate better the rediscovery of Ptolemy's *Geography* and its effects on the later period.

CHAPTER I

THE PREDECESSORS

MESOPOTAMIA

It would seem probable that the concept of maps and plans developed independently in different areas of the world, among both literate and pre-literate peoples. It is now known that China and the Graeco-Roman world were producing maps at about the same period. Some of these had at least one feature in common, the use of co-ordinates, but there are many differences which suggest independent development. The Çatal Hüyük 'town plan' (p. 102 below) is not likely to have influenced Greek plans. In the case, however, of Mesopotamia and Egypt, and perhaps also of Persia, there is some reason to think that map-making may have influenced Greek theory and practice. Greek map-making started at Miletus and other places in western Asia Minor; these Ionian scientists, philosophers and historians had strong links with Egypt and Mesopotamia and needed maps to support them in their plans for a successful revolt from the control of the Persian Empire.

In Mesopotamia the invention by the Sumerians of cuneiform writing in the fourth millennium BC paved the way for the production of maps.[1] Cuneiform tablets of the period between 2500 and 2200 BC include long lists of place-names, rivers and mountains. These may have been used for teaching or perhaps military purposes rather than picked out of a map in the manner of the Ravenna Cosmographer of some 3000 years later, but whether they suggest the existence of maps is uncertain. The fact that King Sargon of Akkad was making military expeditions westwards from about 2330 BC would account for the inclusion of places as far west as the Mediterranean. Later we encounter itineraries, referring either to military or to trading expeditions. They do not go so far as to record distances, but they do mention the number of nights spent at each place, and sometimes include notes or drawings of localities passed through. As in Greek and Roman

inscriptions, some documents record the boundaries of countries or cities.

The earliest large-scale plan from Mesopotamia with an indication of scale is one incised on the robe across the lap of King Gudea of Lagash, Sumer (*c.* 2100 BC), now in the Louvre, Paris.[2] This appears only on one stone statue out of several of Gudea extant. There are traces, on a broken corner, of a scale-bar; this ties up with later plans drawn to scale. The plan seems to represent thick walls with a complicated system of bastions, and with six rather narrow entrances. Although it has been called a temple or palace-hall, it looks more like a fortress. All corners are right angles, but it is obviously accommodated to the contours of the terrain.

Large-scale plans are found on clay tablets from the time of Sargon onwards. Incised lines could indicate rivers, canals, walls or streets, so that some ambiguity is inevitable. Extant examples vary considerably in cartographic exactness, the most precise having parallel lines carefully drawn and recording measurements of rooms. The most interesting is a plan of Nippur, the Sumerian religious city, of *c.* 1000 BC.[3] It shows the Euphrates, two canals, the main temple, two enclosures, and the city wall, with seven named gates. Measurements given for certain buildings are thought to be in units of 12 cubits (about 6 m). This should imply that the whole plan was drawn to scale, but it is difficult to establish from archaeological data whether this was so. Another plan from Nippur, of the same date, shows what are clearly fields, canals and a river bend.[4] This type arises mostly from property sales or disputes, for which a visual record would be simpler than an enumeration of boundaries. Because of the durability of clay tablets, more of these have survived than of comparable documents from Classical antiquity.

Maps covering a wider area of Mesopotamia seem to be confined to two tablets, one of which from Nippur has nine towns or villages linked by a road and canals.[5] In this case the layout of artificial waterways may have been the prime concern. But the best example is a tablet found at Yorghan Tepe near Kirkuk, datable to *c.* 2300 BC.[6] It gives a map of the area round Gazur (later Nuzi), with a plot of 127 ha. (314 acres) in the middle, together with owner's name, but also hills on each side and a river or canal between. Perhaps the most significant feature is the inscribed

orientation, of which this is the earliest extant example, with the words for 'west' at the bottom, 'east' at the top and 'north' to the left.

The Babylonian World Map ('map of the four areas of the world' seems to be its title), which is in the British Museum, is, although small, very famous.[7] Its date is very late in Mesopotamian civilization, about 600 BC, and although some scholars have claimed it as copied from a much earlier map, this cannot be demonstrated. Its identity as a world map is proved by the adjacent text, which mentions seven outer regions beyond the encircling ocean. This is a slightly different concept from that of the early Greeks, for whom the encircling ocean was outside all known lands. Although the interpretation is uncertain, it is thought that one phrase refers to a region where the sun is invisible. If this is correct, it might imply exploration up to very northerly latitudes; such exploration could have been easier at the date of the map than earlier. The seven distant regions were marked with triangles (not all preserved), attached to which are figures thought to refer to distances between them, though nothing definite can be inferred. West seems to be at the top: Babylon is marked in the centre, with lines leading to mountains and the swamp of lower Mesopotamia. Assyria is to the right of Babylon, with what may be Urartu (eastern Turkey and Armenia) above Assyria. Attempts have been made, not very successfully, to identify other place-names. But great accuracy is not to be expected in such a map, whose main purpose was to give an idea of the location of the outer areas of the world, visited by legendary heroes.[8]

The Babylonians were noted mathematicians and astronomers. In the former field, among other things, they attained a remarkably close approximation for $\sqrt{2}$, namely 1.414213.[9] Our divisions into 60 and 360 for minutes, seconds and degrees are a direct inheritance from the Babylonians, who thought in these terms. They had a sexagesimal notation, e.g. 70 was expressed as 1,10. Babylonian lore was passed down to the Greeks by Berosus (*c.* 290 BC) and others.

In so far as astronomy is concerned, Babylonian researches were normally recorded in writing, not in cartographic form. The nearest approach lies in circular tablets which plot the positions of groups of stars. Barely verging on the cartographic are diagrams which divide a circle into twelve segments, corresponding to the

twelve months, each containing an indication of the stars visible from Babylon in the appropriate month. Some of these diagrams were not the result of scientific placing of observations but connected with horoscopes or magic.

PALESTINE

Although we have no Phoenician maps, the influence of Phoenician sailors on Greek cartography should not be ignored.[10] In particular they applied detailed astronomical knowledge to navigation. It is uncertain whether maps were used in ancient Palestine:[11] if they were, they must have been on papyrus and have not survived. A number of Old Testament texts give boundaries of tribes, and in Genesis 10 we find an enumeration of the tribes of the known world based partly on relationship and partly on geographical location.

EGYPT

Egypt was undoubtedly a land of accurate measurement.[12] From earliest times much of the area covered by the annual Nile floods had on their retreat to be re-surveyed in order to establish the exact boundaries of properties. The survey was carried out, mostly in squares, by professional surveyors with knotted ropes. However, the measurement of circular and triangular plots was envisaged: advice on this, and plans, are given in the Rhind Mathematical Papyrus of *c.* 1600 BC (British Museum).[13] The Great Pyramid, on a square ground-plan, was built not only with precise orientation to the four compass points but with very little difference in the dimensions of the sides.

In so far as cartography is concerned, perhaps the greatest extant Egyptian achievement is represented by the Turin papyrus,[14] collected by Bernardino Drovetti before 1824. This is a painted map of *c.* 1300 BC, now in a number of fragments, which shows hills between the Nile and the Red Sea containing gold and silver mines and the roads in the area. An inscription on the map, in hieratic, the cursive form of hieroglyphic, reads: 'The hills from which the gold is brought are drawn red on the plan'. Other inscriptions include: 'peak' (on the red area), 'cistern', 'abode of Amun of the pure mountain', 'houses of the gold-mining

settlement', 'road leads to the sea'. A prominent feature of the plan is what seems to be a winding wadi, of about the same width as the roads. The map was drawn in connection with a statue of a pharaoh which had never been completed. The gold mines have been located at Umm Fawakhir in the Wadi Hammamat. But it is misleading to think of the Turin papyrus as the first geological map. It was not scientifically compiled, and although the use of colour shows originality, its application seems to have been legal.

Nevertheless, we do not possess anything similar from antiquity; indeed from the Graeco-Roman world the only plan of a mine, and that only probable rather than certain, is the incised rock at Thorikos, Attica, mentioned below (p. 26). There is, however, from Egypt, about fourteen hundred years after the Turin papyrus, a theoretical plan of tunnelling. This is in manuscripts of the *Dioptra* of Heron of Alexandria,[15] whose object was to demonstrate the use of geometrical theorems in tunnel surveying. This could have served either for aqueducts or for mine shafts. An early Greek accomplishment in the sphere of aqueduct

THE TURIN PAPYRUS.
The Gold-mine.

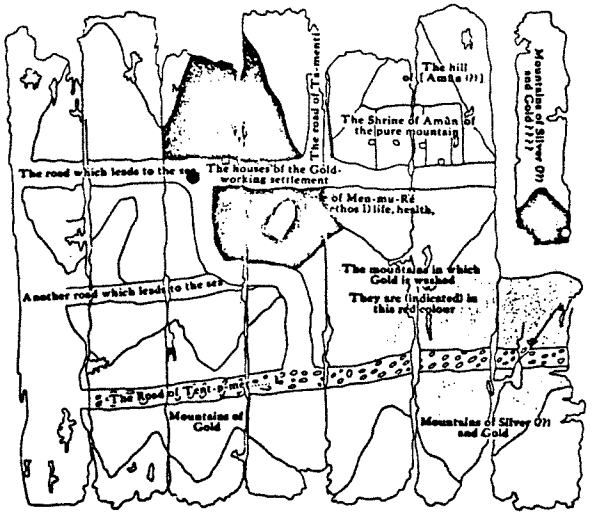

Fig. 1. The Turin Gold Mine Papyrus: fragmentary coloured map in the Museo Egizio, Turin, showing an area of gold-mines between the Nile and the Red Sea. Hieroglyphic captions translated into English: J. Ball, *Egypt in the Classical Geographers* (Cairo, 1942).

engineering is the long tunnel of Eupalinus at Samos commissioned by Polycrates (tyrant *c.* 540–*c.* 522 BC),[16] so that in this field, apart from the resources of the Alexandrian Library, Heron had Greek as well as Roman work on which to base his theory. But it is tempting to think that in mining survey he may have learnt something from dynastic Egypt.

Other topographical maps are mostly drawn in what seems to us a combination of the primitive and the formal, partly in plan and partly in profile. The commonest subject is gardens,[17] which show paths surrounded by date palms and sycamores; there are also pools with ducks and water plants, and outside the garden areas orchards or vineyards. Persons and animals are represented in elevation as on an Egyptian picture, while trees, although also represented in elevation, sometimes appear upright, sometimes, if on a border, turned through an angle of 90°. This combination of plan and elevation may be seen in plans of buildings dating from 1500–1000 BC (one from Deir el Bahri shows a shrine and precinct wall, with measurements), in which the ground-plan of a house may be combined with elevations of porticoes and items in storerooms.[18] Such a combination is also visible in a painting from Egyptian Thebes showing an army drawn up for battle and a town surrounded by moats.[19] A Mesopotamian parallel is a Nineveh bas-relief of the sixth century BC, which shows the city of Madaktu and round it a triumphal procession celebrating its capture by Assurbanipal.

Religious geography results in somewhat similar maps. In the *Book of the Dead* (*c.* 1400 BC) there are representations of the ideal plot of land which the deceased will till in the kingdom of Osiris.[20] This is rectangular and intersected by canals, and the use of colour makes it more vivid. Painted coffins of *c.* 2000 BC from El-Bersha illustrate routes to reach the gateway to the Underworld.[21] The upper route, in blue, is by water, the lower one, in black, by land. This collection of illustrated spells has in modern times been called *The Book of the Two Ways*. Linked with this is the day and night journey of Re, the sun god.

Cosmographical illustrations from Egypt with map-like features are not uncommon.[22] In royal tombs of the eighteenth to twentieth dynasties the goddess Nut is shown bending over to portray the universe; under her is Shu, who occupies the space between earth and sky, and Geb, the earth god. The feet of Nut

touch the east horizon, while her arms hang down to the area of the setting sun. We also find the sun passing through Nut's body, with the names of foreign lands inscribed on the edge of the diagram. This commemorates the legend that Nut swallowed the sun every evening and gave it rebirth every morning.

Celestial cartography is represented by astronomical ceilings from the fifteenth century BC onwards, giving decans (literally 10° of a zodiacal sign, hence timings of appearance and disappearance of stars), constellations and planets.[23] In some of these a diagram shows stars for the purpose of calculating night hours. But this type of ceiling, which at times illustrates a hippopotamus or a crocodile, is not to be thought of as very scientific. In Egyptian celestial mapping the twelve signs of the zodiac appear only late and evidently as an introduction from Babylonia or elsewhere.

It is evident that the Egyptians were very familiar with large-scale cartography and that the makers of these plans treated their subject in a neat and formal way typical of dynastic art. One may hope that more papyri containing such maps and plans may be found in future excavations. Despite the prevalence of re-survey, no survey maps have survived from dynastic Egypt. From Ptolemaic Egypt there is a rough rectangular plan of surveyed land accompanying the text of Lille Papyrus 1, now in Paris;[24] also two from the estate of Apollonius, minister of Ptolemy II: one has a plot, the other a palisade; both contain canals, and each has some means of orientation.[25] Sophisticated survey techniques were introduced by Alexandrian applied mathematicians, but to what extent they were used in practice we do not know.

EARLY QUASI-MAPS

The links of dynastic Egypt with Minoan civilization are well established. Although we have nothing approaching a map or plan from Minoan Crete, there is in the National Museum, Athens, a map-like fresco from the island of Thera (Santorin), which until its destruction through the catastrophic eruption of its volcano about 1500 BC was part of the same well developed civilization.[26] In the so-called 'House of the Admiral' at Akrotiri, Santorin, was discovered this excellently preserved wall-painting of *c.* 1600 BC. It represents, in oblique perspective, views of a seaside community and the adjacent sea. One cannot exactly speak of it as a map, but

there are several map-like elements: a winding river, with palm trees and other vegetation, and a mountain, the areas round both of these also containing animals; a coastal outline, including a small settlement; and the harbour of this settlement, with much shipping out at sea. The fact that many of these landscapes also have groups of human beings, performing different activities in different places, tends to detract from the map-like quality. There has been discussion (a) whether the ships are engaged in battle or not, (b) whether the location is on the coast of Crete or of north Africa.

Whereas the wall-painting described above is thought to have been the product of a literate society, since contemporary Crete, Mycenae and Pylos were literate, we have to turn to non-literate societies for anything similar of early date further west. The most elaborate are the Bronze Age rock incisions in the Val Camonica, northern Italy (p. 102). Whereas the Iron Age incisions stress the pictorial side, these earlier ones are more in the form of plans. Many smaller rock carvings, some of which can be thought to be plans, were observed in the Ligurian Alps in the late nineteenth century by the Rev. C. Bicknell, founder of the Bicknell Museum at Bordighera.[27] Plan-like elements may also be detected in the stele of Novilara, of about the seventh century BC, in the Museo Oliveriano, Pesaro.[28] Although in this there seems no doubt that the largest incisions portray a sailing ship and two smaller vessels, the interpretation of the rest, e.g. river or snake, and how much may be thought to be in plan, are very debatable.

One might have supposed that the Etruscans, a well organized, artistic and religious seafaring people, would have left maps or plans. They were indeed very conscious of orientation, and had at Marzabotto a street grid system in long, narrow rectangles similar to those of Greek colonies in southern Italy and Sicily. On the details of orientation, Roman writers who did not know Etruscan (a non-Indo-European language, written from right to left[29] in an adaptation of Greek lettering) are not very reliable. The elder Pliny says that the Etruscans divided the heavens into sixteen (4 × 4) parts, calling the eight eastern subdivisions 'left' and the eight western 'right'.[30] This implies that the soothsayer would face south in his observation of the heavens. But usage may have varied between celestial and terrestrial observations. Frontinus writes: 'The origin of centuriation, as Varro mentions, is in the Etruscan lore [*disciplina Etrusca*], because their soothsayers divided the earth

into two parts, calling that to the north "right" and that to the south "left".'[31] This implies, as one might expect in such a ritualistic society, that Etruscan surveying was carried out by, or under the guidance of, soothsayers and that they faced west.

The only extant rough plan of Etruscan origin, on the vase from Tragliatella (p. 147 below) showing a maze with a 'game of Troy', throws no light on this problem. But a religious object of about the third century BC, the Piacenza bronze liver, certainly has some bearing on orientation, though perhaps not on mapping.[32] It is a bronze model of a sheep's liver, 12.6 cm long, found in 1877 between Settima and Gossolengo, and now in the Museo Civico, Piacenza. On its top it has projections based on those of a sheep's liver, together with a flat section divided into boxes representing zones, each labelled with the name of an Etruscan deity. The convex base has two sections, labelled with the Etruscan words for 'sun' and 'moon'. The connection with soothsaying from the inspection of livers is obvious, and a parallel may be drawn with a Chaldaean terracotta liver in the British Museum.[33]

Since the section round the part of the liver representing the *processus pyramidalis* is roughly rectangular, some scholars have thought that a rectangular scheme of land division is intended to be shown. This is very uncertain, although the orientation might suit land better than sky as far as Etruscan practice went. An alternative theory is based on an observation by Martianus Capella, writing in the early fifth century AD.[34] After saying that the ancients divided the heavens into favourable and unfavourable areas, he gives Roman names of deities associated with such areas. Some of these

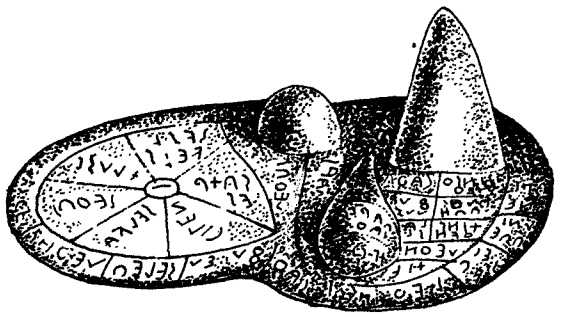

Fig. 2. The Piacenza bronze liver: Etruscan model of a sheep's liver, 3rd century BC, used for divination. To right, the *processus pyramidalis*; round the rim, names of deities, e.g. VNI (right to left) = Juno.

correspond with the names of Etruscan deities on the liver; but no general correspondence can be worked out, and the orientation is less satisfactory. The Piacenza liver, one may infer, is not a map: at best it may be described as a schematic model.

In the Graeco-Roman areas no world maps of the early period, or approximations to them, have been discovered. If they, or even *periploi* (p. 130), had existed then, poets might not have recounted the sea voyages of such heroes as Jason, Odysseus or Aeneas as so circuitous. But something akin to a map is described by Homer in the *Iliad*. It is a well-known feature of Homeric epic that some descriptions mirror in poetic language Mycenaean institutions of many centuries earlier. This may be the case with what seems to us a somewhat unusual description, that of Achilles' shield.[35] It was made for that hero, the poet tells us, by the craftsman god Hephaestus, of golden, tin and bronze plates. On one of the bronze plates he engraved countless subjects:

> Earth, sky and sea, the never-tiring sun,
> The moon when full, all stars that deck the sky:
> Orion's might, Hyades, Pleiades,
> The Bear, known also to us as the Wain,
> Which, circling round, watches Orion close,
> Alone not sinking into Ocean's stream.[36]

After this he is said to have engraved two fine cities, one of peace and one of war. Agricultural scenes, dancing and merry-making are among the aspects of everyday life depicted. Round the whole is the great strength of the river Ocean.[37] We cannot know whether this description reflects actual usage of any kind. The only shield-map known to us, the Dura Europos shield (p. 120), dates from some one thousand years later and served a practical purpose. But the idea of one celestial scene, with the constellations depicted, perhaps to enable one to find one's way at sea, and one terrestrial, with cities surrounded by the Ocean, does suggest early attempts at map-making which may have been partly misunderstood in the Dark Ages that followed the Mycenaean period. Homer is said to have lived either on the west coast of Asia Minor or on an adjacent island. Since Miletus was the birthplace of Greek map-making, and since Homer not only showed a keen awareness of geography but evidently lived not far from there, it is appropriate that many later Greeks should have thought of him as the father of geography.

CHAPTER II

EVIDENCE FROM ANCIENT GREECE

It is unfortunate that so little remains from what was clearly a great early period of the development of mapping. This may be due to the perishable or reusable materials on which maps were drawn. What evidence there is suggests that these were normally either painted on wood or more rarely engraved on bronze. Manuscripts of Greek authors of the Classical and Hellenistic periods, copied mostly from the ninth to the fifteenth century, survive either without maps or, in the case of Aristotle's *Meteorologica*, with medieval maps which may or may not reflect classical sources.

It is from the early philosophers that Greek mapping concepts spring. Although Greek colonization has left conspicuous traces of urban and rural land division, there is no evidence that surveyors of these colonies used maps. Moreover the part played by Greek navigators in map-making is disputable: Greek *periploi* appear to have been verbal instructions. The Ionian philosophers and their successors were interested in theoretical rather than practical cartography; though it will be seen that their researches could have practical effects. Their study of cosmology led a number of them to map the heavens as much as the earth. Although this book is in principle concerned with terrestrial maps, the achievements of the Greeks cannot be completely understood without some recognition of the work of their philosophers and mathematicians on the mapping of the heavens.

CELESTIAL MAPPING

Evidence of early interest in celestial cartography is scanty. When we are told by Diogenes Laertius that Anaximander (see below), the first acknowledged cartographer, was also the first to construct a sphere,[1] we may imagine that this was a sphere of the heavens.