

# 21 · Concluding Remarks

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This first volume of the *History of Cartography* provides an overview of the present state of knowledge of prehistoric, ancient, and medieval maps in Europe and the Mediterranean. It reflects research in progress and points the way to new avenues of research. It also represents a stage in the formulation of durable generalizations, based on the reconstruction of long-term trends and patterns, about the making, use, and historical significance of maps. Certain achievements can be noted. Our concept of what constitutes a map has been expanded. We have acquired a fuller sense of the antiquity and varieties of cartographic thought and expression. Our knowledge of the technical characteristics of the surviving map artifacts has also been greatly strengthened. Similarly, the meaning of these maps within their wider cultural and social context is starting to emerge. Nevertheless, the *History* offers only some tentative steps forward. Many questions remain in the study of early European maps. In these concluding remarks we highlight three problems that permeate the material presented in the individual chapters. They concern how far there has been a continuous history of the making and use of maps; the cognitive transformations involved in the emergence of early cartography; and the social contexts of mapping.

## GAPS AND DISCONTINUITIES

The study of maps from the prehistoric, ancient, and medieval periods in Europe and the Mediterranean is fraught with difficulties arising from the nature of the evidence. In some respects these difficulties are insurmountable, the record being tantalizingly incomplete and often indirect. Lines of inquiry are frequently frustrated not only by a lack of original artifacts from the periods under discussion but also by the fact that the surviving maps are often descendents of earlier prototypes. It thus becomes doubly difficult to arrive at an origin for particular cartographic traditions. Sometimes the gaps in the temporal or geographical record are explained simply in terms of the nonsurvival of evidence; for instance, attention has been drawn in the present essays to the physical vulnerability of Babylonian clay tablet maps,

Egyptian plans on papyri, Roman bronze maps, and those portolan charts actually used on board ship. In other cases, however, the evidence is ambiguous rather than nonexistent. The lack of a specific or exclusive word denoting a map in ancient Greek and Latin, for example, makes the evidence in classical literary sources confusing, since it is often difficult to distinguish references to what may have been textual itineraries from references to graphic images.

There is yet another dimension to the incompleteness of the cartographic evidence. The textual allusions may be to maps that are themselves merely derivatives of a prototype of much earlier and distant origin. Moreover, it is not always clear that a map—rather than a verbal description—ever existed. The *Ora maritima* is a case in point. This is a marine itinerary poem of the fourth century A.D., thought to be based on a periplus of the same period, itself based on the second-century B.C. Pseudo-Scymnus, which in turn is thought to have been derived from a fifth-century B.C. model. The detail of the geographical information provided in the surviving text of the *Ora maritima* suggests that maps accompanied such itineraries, but there is inadequate evidence to be certain about this.

The same problem about the intangibility of each link in the chain of derivatives can apply even where the surviving evidence is a map, since its ancestors need not also have been maps in every case. Thus, while the Peutinger map, which dates from the twelfth or early thirteenth century A.D., may be taken to indicate the strong likelihood that graphic itineraries existed in the Roman period, as a cartographic artifact it is so distant from any demonstrated Roman original that the case for such a tradition must be regarded as not proved. Similarly, even with the Hereford *mappamundi*, whose stemma goes back to the fifth-century A.D. geographical treatise of Orosius, it is still far from clear whether the ultimate ancestor was in textual or graphic form. In short, the convoluted lineage of surviving map images, or references to such images, has so many discontinuities that in most cases it simply does not allow either the divination of the details of their original construction or confident extrapolation across the gaps in the record.

It is equally clear that these gaps cannot be interpreted solely as a result of physical destruction of evidence. In terms of the geographical distribution of recorded cartographic activity, all the periods discussed reveal extensive blank areas. For the later prehistoric period, for example, plan maps appear to be confined not only to those areas where rock art in general was particularly well developed but also to specific districts within those areas, notably Valcamonica and Mont Bègo in the Alps. In the classical world, a formal knowledge of maps was associated primarily with the urban centers of Greek and Roman learning and power, and in the Middle Ages the production of both portolan charts and local and regional maps was concentrated within relatively few areas.

Similar discontinuities can be observed on the time scale. Evidence of cartographic activity during the millennia covered in this volume occurs in relatively few periods. It is not possible to point to many uninterrupted sequences of continuous mapmaking. The exceptions are in the Greek and Roman period and, to a lesser extent, in the later Middle Ages. The Greco-Roman era is preeminent in this respect, and its influence was felt up to modern times: it saw developments as fundamental for the long-term growth of cartography as Eratosthenes' measurements and map, Roman large-scale surveys, and Ptolemy's coordinates (the use of which extended into the Renaissance).

It must, however, be stressed that much remains unknown and many questions of transmission remain unresolved. No direct links have yet been established between maps made in the prehistoric period and maps of the ancient Near East and Egypt, for instance. Nor has it yet been possible to tell how far the early Greeks may have been aware of, or influenced by, Babylonian or dynastic Egyptian mapping (indeed, later Egyptian cartography may have in fact been influenced more by Greek practice than vice versa). Similarly, in western Europe and in Byzantium there is a marked contrast between the number of maps known to us from the thirteenth century onward and the relatively few that survive from earlier centuries. As in the case of the mapless regions, such breaks in the chronological records cannot be attributed solely to loss of originals or even to the obscurity of contemporary references to maps. The likely conclusion is that for long periods—and in probably the greater part of the Mediterranean and European regions—very few maps were being made or used.

It is also evident that cartographic knowledge was sometimes developed and then forgotten. Even in the case of the *mappaemundi*—where the facts of a long-term continuity are much clearer—it cannot be assumed that such a continuity necessarily implied a changing

cartography, adapting to new scientific, social, or religious circumstances. Until very late in the period under consideration, survival of a mapping tradition often meant little more than its fossilized preservation by copyists. The long-delayed rediscovery of Ptolemy should alone be sufficient to highlight the significance of the difference between archival preservation and the active and dynamic continuation of a cartographic tradition that entails the growth of mapmaking skills or an orderly modification of the content of existing maps.

There is probably a limit to how far this fragmented mosaic of cartographic activity will ever be filled out. Traditionally, classicists have sought to compensate for the lack of surviving maps by reconstructing them from the textual sources. While the general validity of these exercises is often accepted, they must be interpreted with caution. Such depictions of the world—as Eratosthenes or Strabo may have seen it—with precise representations of parallels and meridians are clearly no substitute for original map artifacts, and in some respects they must inevitably distort the image of the real classical cartography. A different approach lies in the continuing attempts to expand the corpus of known maps. There is undoubtedly still scope for filling in the factual picture, and individual authors, despite considerable achievements in this direction, have repeatedly made the point that some of the most basic tasks of listing their raw material still need to be done. In the case of prehistoric mapping, the corpus of cartographically relevant material needs to be extended by applying the new criteria to a much larger body of prehistoric art before analysis can proceed. For the history of the cartography of ancient Greece and Rome, systematic lists are still needed of all artifacts, such as coins, frescoes, and mosaics, that may contain maps or maplike representations. Even for the relatively well-worked medieval period, full lists of nautical charts still have to be published and comprehensive searches made for large-scale local maps in Germany, France, Italy, Spain, and Portugal. Such inventories are essential for the future enhancement of our knowledge about the directions, manner, and rate of the dissemination of maps and the concept of the map in the European and Mediterranean worlds before the end of the fifteenth century.

Though such inquiries are likely to yield the most important future discoveries, the significance of the gaps in time and space still needs to be kept under review. An understanding of the nature and cause of these gaps—which vary between different map traditions—would help to clarify, for example, why mapping originated and grew in some areas rather than in others; and more generally, it would also highlight the necessary and sufficient conditions for cartographic development in different cultures. Eventually, greater comprehension

of the nature of these gaps may help establish whether mapmaking originated independently in a number of centers—as seems certain in some cases but remains unclear for other, crucial areas—or whether it was disseminated from ideas and practices developed in a single society. All that can be firmly stated at present is that throughout the period considered in this volume there were large areas of Europe and the Mediterranean that remained devoid of the knowledge and practice of mapmaking.

### COGNITIVE TRANSFORMATIONS

What can also be identified in Europe and the Mediterranean is the apparently independent initiation of a number of sophisticated traditions of mapmaking. These increase our sense of the diverse origins of cartography within a number of cultures and—together with Asia—Europe and the Mediterranean rank as the major hearth for the subsequent development of cartography worldwide. What occurred can essentially be seen as a series of cognitive transformations leading toward an awareness of “the idea of the map” as a basic form of human communication and involving changes in modes of thinking about, and graphic representation of, the world at various scales. The history of cartography is thus a history, at least in part, of the means by which this developing picture of reality—what was actually perceived—was modified with the help of maps. It is a reciprocal process of cognition in which both perception and representation become increasingly structured by different map models. We regard its operation as essential to understanding the nature of the change cartography underwent.

There are two aspects to this cognitive transformation. The first is the recognition, by groups within a number of different societies from prehistoric times onward, that the particular type of image we call the map could record and structure human experience about space. Whether it was intuitive or conscious, a graphic “language of maps” (to use the modern simile) was being developed. Moreover, it was discovered that this language could be applied equally to the representation of cosmographic, celestial, or terrestrial space and that it could be articulated in two or three dimensions.

As a more concrete historical reality, this development can be defined in terms of a growing recognition that maps fulfilled particular functions within these early societies. The essays in this volume have revealed a considerable number of map functions in the prehistoric, ancient, and medieval periods. These can be grouped into four main categories of map purpose: geographical wayfinding and inventory of the real world; sacred and

cosmological representation of the world of the religious mind; the promotion of secular ideology; and an aesthetic function or decoration. Within the time period surveyed, prehistoric maps seem to have been somewhat exceptional in that all those surviving appear to have served largely religious or ceremonial purposes. In the world of the ancients, however, and throughout medieval times, all four functions were represented, sometimes in a single map. The Thera fresco was probably designed for its decorative symbolism. Many of the portolan charts, however, managed to combine some locational accuracy with a highly decorative style. Likewise, whereas the didactic and symbolic *mappaemundi* served to present the faithful with moralized versions of Christian history from the Creation to the Last Judgment, Claudius Ptolemy’s instructions on how to compile a map of the known world were strictly practical. Thus the history of cartography contains several different histories, each associated with these different functions and each relating to man’s attempts to impose order on the external world.

The second cognitive transformation recognized in these essays is inextricable from the first. It involves the complex historical process by which maps have become deliberately designed graphic artifacts with distinctive geometrical structures and arrays of signs recognizable to the intended viewers. To use modern terminology, concepts such as the idea of the map’s frame, its orientation, its centering, its reference lines, and its transformational relation to the earth or heavens in terms of scale and projection, together with the signs that codify its content, all can be seen to have been engaged in the service of cartography during our period. When and by what means such devices crept into the maps of western Europe and the Mediterranean does not lend itself to easy generalization. It cannot be understood in terms of a neat linear progression or seen as a slow accretion of cartographic knowledge and practice. Nor should we be misled by apparent “breakthroughs” in early cartography into thinking of a series of sudden conceptual and technical revolutions in which the mapmaker’s art was abruptly transformed. Neither, for that matter, do any of the evolutionary or developmental models favored by some historians of art and others, whose trajectory is patterned on hypotheses concerning man’s cognitive growth, easily fit the empirical record of mapping. For instance, in the case of map signs there is no evidence to support an evolutionary maturing of the different concepts, from pictorial to abstract signs or from oblique to planimetric angle of view, in any of the maps in the period under review. At one end of the time scale are the images dating from the Upper Paleolithic, in which the idea of plan representation was already present. At

the other end, late medieval *mappaemundi* and local and regional maps tend to use pictorial signs shown in profile or from an oblique viewpoint. Likewise, the adoption of the various geometric structures that are found in maps of different function shows no simple line of unidirectional change. Topological relationships are found in medieval large-scale maps as well as in those of the prehistoric period. Even where the geometries involved formal calculations and instrumental measurement, there is little in this volume to support the notion that development in the mathematical or technological aspects of cartography was straightforward or cumulative in nature.

The distinctive geometrical structures of maps, whether topological or Euclidean, are so crucial in the history of cartography that it is worth elaborating in greater detail on this aspect of the cognitive transformation. All maps share a number of common elements, but the form of each of these not only can vary but is, moreover, often historically quite specific. For example, the space occupied by the map image itself has been bounded in quite fundamentally different ways in different cultures and through time. The apparently simple idea of putting a rectangular border around a map (the so-called neat line) does not routinely appear on maps until the Renaissance. To the modern map user, the bounding frame announces the completeness and consistency of what is within that line and separates the map space from the surrounding space. Thus the frame represents a fundamental concept. The depiction of one feature within that framed space implies that all like features will also be represented therein. No such rectangular frames, however, are found on most classes of maps in the period covered by this volume. Instead, in many cases the confines of the map image were dictated by the shape and dimensions of the medium on which the map was made. The simple rectangular format of the bound codex that was prevalent throughout the first millennium A.D., for example, placed constraints on the design and layout of maps. The well-known example of Matthew Paris's map of the British Isles, which "would have been longer had the page allowed it," is not exceptional. In the case of the Peutinger map, the world known to the Romans was compressed and stretched to fit the format of the scroll on which it was drawn. Distortion of the edges of portolan charts and some of their decorative elements can often be attributed to the draftsman's attempts to make the most economical and elegant use of the vellum. And prehistoric maps were drawn to fit the contours and extent of the rock.

Yet other factors were at work in bounding and shaping maps in the prehistoric, ancient, and medieval world.

To judge from later Greek writers such as Hipparchus and Strabo, the frame of ancient Greek maps was apparently modified over the course of Greek history. The earliest frame was the circular disk of Homer's world as depicted on the shield of Achilles; later there was the rectangular shape of the maps of the *pinaki* (wooden tablets). The latter was supposed to provide a truer depiction of the inhabited world, and for Ptolemy at least, the first step in constructing a map of the world was to draw a rectangle twice as long as it was broad. The idea of a circular map, however, persisted into the Middle Ages, together with other outlines of biblical significance, such as the oval (ark shaped), the mandorla (Christian aura), and the square (the four corners of the earth).

A second geometric feature of some of these maps is the way particular areas were given significantly different weight and map space on a single map, to the extent that any notion of a uniformly scaled image is absent. Two main types of representation are found: there are maps composed of heterogeneous space, and there are maps in which the entire space was treated homogeneously. The former includes maps with a strongly symbolic or didactic function, such as prehistoric maps or *mappaemundi*. Here, certain parts of the map may be endowed with particular meaning and importance. This is clear in the caricaturelike deformation of areas of specific interest on, for example, the "Jerome" map of Asia (in which Asia Minor consumes fully half the map space), while even the strikingly modern *Forma Urbis Romae* emphasizes some buildings at the expense of others. The centering of maps on a particular point of sacred or secular importance—Delos, Rome, Jerusalem—reflects the same sort of manipulation of the geometry of the map to fit a specific perception of the world.

Maps that use space homogeneously result in a more detached and abstract mode of mapping. The underlying concepts are quite different. Each point on the map is, in theory at least, accorded identical importance, thus reducing the power of the center. This was also lessened by the decision of classical geographers to move the reference meridian of their maps of the inhabited world from Alexandria, then the center of mathematical activity, to the Fortunate Isles, an arbitrary and convenient westerly point. In addition, the whole concept of unique pairs of coordinates to describe position—explained in a cartographic context by Ptolemy in the *Geography*—by its very nature implies homogeneous space. So does the development of rectangular reference grids. Such grids may be traced back at least to the division of the inhabited world into northern and southern sections by

the parallel of Athens and Rhodes and by the subsequent addition of a perpendicular reference meridian passing through Rhodes. At a more practical level, the rectangular reference grid of most Roman land division systems also implied a homogeneous treatment of space. Spherical and rectangular coordinates, both transmitted from the classical period through medieval astronomy and mathematics, were to become the basis of the cartographic renaissance of the fifteenth century. The triumph of their elegant logic is still reflected in the structure of our present-day maps.

The final aspect of the geometric structure of maps, again of vital importance in influencing the cognition of the space they represent, is their projection and orientation. This too is already manifest in the ancient as well as the medieval period. The transformation of coordinates from a sphere onto a plane surface involved the development of formal map projections. In this, Hipparchus and Ptolemy were pioneers. By the second century A.D., what we would describe today as resembling rectangular, stereographic, simple conic, and conical equal-area projections were all used for astronomical or geographical purposes. Implicit in the use of parallels and meridians in these projections was the question of the alignment of each map frame with the earth's axis. It is known that the inhabited world was routinely drawn on large globes by the Greeks in the Northern Hemisphere, and this may be why these globes, and hence the flat maps derived from them, should have been oriented to the north. However, there were, once again, other variables at work apart from those of pure mathematical logic. In the medieval period, when maps such as the *mappaemundi* were not drawn on formal graticules, map orientation varied according to religious doctrine. On the other hand, as already noted, the main axis of the early portolan charts may have been fixed with a view to achieving the best fit of the shape of the Mediterranean (the axis of which is about ten degrees off the west-east line) to that of the vellum they were drawn on, with the result that they were not aligned to any specific cardinal direction.

When taken together, these geometric features found in early maps thus serve to define the sum of an important, albeit often tentative, cognitive development in ways of representing, structuring, and thinking about space. They point to the foundations of an awareness of quite sophisticated cartographic concepts. It is clear, from the various geometric manifestations on prehistoric, ancient, and medieval maps that the key elements of "the idea of the map" were already understood in these societies. They were, moreover, translated into practices that imply deliberate decisions about the design and layout of maps while also confirming the piecemeal emergence of appropriate technical skills for their execution and manufacture.

## SOCIAL CONTEXTS

Maps are the product of decisions and actions taken by identifiable members of social groups in particular historical circumstances. More than a mirror of society, maps are a reciprocal part of cultural growth and influence the pattern of its development. In this final section we will suggest that the social contexts and processes relevant to cartography are rooted in the power structures, organization, and group perceptions of those societies. We will also suggest that an insight hitherto often missing from the literature of the history of maps is to be found in these social contexts. The influences that impinge on the making and use of maps have been shown to be very diverse. But if they are cultural, economic, intellectual, political, ideological, technological, ethical, and aesthetic, in the widest sense they are also social. They are integral elements of the fabric of each society. This volume has shown how an understanding of that fabric is essential for interpreting the long-term development of European cartography, just as a knowledge of maps would be central to any history of the social perception and use of space.

Throughout the period covered by this volume, map-making was one of the specialized intellectual weapons by which power could be gained, administered, given legitimacy, and codified. This was almost certainly the case in the oral communities of the prehistoric periods. In societies with writing, the making of maps was both initiated and nurtured by the few literati who were associated with the ruling classes, whether as priests, scholars, or bureaucrats. For example, it has been shown how closely maps were associated with the religious elite of dynastic Egypt and of Christian medieval Europe; with the intellectual elite of Greece and Rome; and with the mercantile elite of the city-states of the Mediterranean world during the later Middle Ages. Whether the focus is on the unidentified creators of prehistoric rock art, the crusading popes and kings of the medieval period who commissioned maps of the Holy Land, or the nobility of fifteenth-century Italy who, as humanists, helped create the conditions for the return to western Europe of Ptolemy's *Geography*, the critical factor in the transmission of cartography and its skills often seems to have been the patronage of mapmaking by such elites.

The links between the character of particular elites, the institutions through which their power in society was exercised, and the types of maps they produced can also be clearly seen throughout the period covered by this volume. These links are helpful in understanding the fundamental contrast between mapping that was practical, and usually geographical in nature, and that which was cosmological in content and motivation. Dealing first with the more practical or utilitarian aspect, it be-

comes evident that the impetus behind geographical mapping was usually the desire for territorial expansion and control, whether the context was colonial, commercial, military, or political and whether it involved cadastral mapping as a means not only of dividing land and levying taxes but also—and especially in the case of centuriation systems—of maintaining tighter political and administrative control. In this way a common thread links certain of the geographical plans of Babylonia with those of the Roman world. Similarly, in fourteenth- and fifteenth-century Europe the portolan charts and an incipient tradition of local and regional mapping are also so linked. Even where maps were deployed as emblems, as on some of the coins and public displays of Rome, they were addressing the same theme of imperial power, and today they can be seen as a reflection of that society's attachment to its territory. It is tempting to go on from such examples, to speculate on the possibility of a link between the development and practical use of geographical maps and the emergence of some of the territorially expanding states of pre-Renaissance Europe. Certainly, maps could be major agents in the geopolitical process of these societies.

Cosmological maps arise from man's endeavor to understand his universe. They represent a different but complementary tradition of cartography. It is likely that they would have been regarded as just as practical, and just as ideally accurate, as any geographical map. In the ancient and medieval periods, when the distinction between the material and the spiritual was not made as in the post-Reformation era, the two traditions of mapping were closely interrelated. Certainly the development of early European mapmaking described in this volume owes as much to cosmological as to scientific-geographical ideas: it was cosmological inquiry, we have been constantly reminded, that provided the underlying thrust of many important developments, as in the design of globes and maps to represent the celestial sphere. This duality of motivation led to two quite different concepts of map "accuracy." In some cases, as with the astronomical globes and maps of the classical period, the integration of the results of sustained empirical observations and their graphic representation by means of scientifically determined map projections should not blind us to the fact that these artifacts were often used primarily in connection with astrological practices and in a society where astrology was still fused with astronomy as one science. That Ptolemy would have been known to ancient and medieval scholars as the author of *Tetrabiblos* (an astrological treatise) as well as of the *Almagest* and the *Geography* reminds us of the social context of such mapping. Thus globes and maps, often illustrating mythological concepts within a world view, are related to the general belief systems and so-

cial values of these early societies as much as, and sometimes more than, to an arcane mathematical learning. In any case, cosmological maps often did not require the geographical and mathematical accuracy that has become the lodestar of so much modern mapping, and their styles of representation are consequently paradigmatic rather than factual. The form of the images used varied widely, ranging from the curious posture of the Egyptian goddess Nut, arching over the universe, and the division of the heavens into segments as in the Bronze Liver of Piacenza, to the epitomization of the Christian world in the Madaba mosaic or the images of the *map-paemundi*. Such maps were the emanations of the power of a clerical elite. They codify an entirely different way of seeing the world and record a different type of interpreted experience. They are also representations of a conception of universal order and of a socially constructed world view, albeit one not requiring the practical terrestrial mapping demanded by an administration, or needed for commerce, or useful in building and maintaining empires.

Social mechanisms were equally a part of the process of the transmission of cartographic knowledge. For the historian, the problem in studying transmission is not so much one of demonstrating the general cultural contacts of those societies that did make maps—and that are perhaps assumed to be linked cartographically in some way—as one of isolating the map from the wider contexts in which it invariably occurs. On the one hand, the volume clearly demonstrates that the pathway of cartography was also the pathway of art, literature, philosophy, science, religion, and much else. On the other hand, the record of explicit cartographic contacts is extremely meager. "Mapmakers," even if we accept the validity of such a generic noun in our period, were always embedded in much wider artisanal or social groups. Throughout the period covered by this volume, very few people who made maps did so either exclusively or to earn their livelihood, and this too complicates the study of transmission. There are exceptions such as the globe makers of ancient Greece, the artisans who made the thousands of maps related to landownership and public works in the Roman Empire, or the chartmakers of medieval Italy or Spain. Even so, it is fair to say that the processes of mapmaking were usually merged with others, such as those of the scholar, the theologian, the painter, the surveyor, the fortifications expert, or the compass maker. A constant and recurring question therefore is to what extent maps were regarded in these days as a special class of artifact. These essays have shown that cartography was often inseparable from didactic or religious art in the prehistoric, the ancient, and the medieval world, that it entered the discourse of drama, poetry, mathematics, or philosophy, that it was

embedded in the Scholastic cultures of the Middle Ages in western Europe and in Byzantium, and that, even with documents as important as the *Corpus Agrimensorum*, diagrams in general were only a minor part of the manuscripts as a whole, and maps in particular constituted only a small fraction of these. Just as no branch of ancient or medieval knowledge existed in isolation, so too was mapmaking rarely regarded as a separate activity. In short, throughout our period the transmission of cartographic ideas—and of map models—can be made sense of as a historical process only when seen as part of the totality of a society's knowledge and when that knowledge is also seen as a manifestation of a socially constructed world.

Questions of social and cultural context thus go to the root of understanding in the history of cartography. The empirical record of the technical changes normally associated with mapmaking in the ancient and medieval periods offers many examples of the way technical innovation alone was insufficient either to initiate or to promote a spontaneous expansion of mapping activity. Such technical landmarks—the invention of a surveying instrument or the design of a new map projection, for example—must be included among conditions for the spread of mapping. In themselves, however, they were not sufficient to account for such changes. In some respects they were as much symptoms as causes of cartographic change, and they should be seen as only one strand in the wider process by which maps developed. Viewed in this way, some of the apparent anomalies in early European cartography as recorded in this volume are better understood. For instance, there is the question of the time lag between many key inventions and their adoption in mapmaking—the magnetic compass is but one example—that highlights the superficiality of explanations for increasing cartographic sophistication couched in terms of simple cause and effect relationships. Another example is the case of dynastic Egypt where, despite the existence of many of the necessary technical conditions for making cadastral maps, such as the means of measuring, calculating, and registering small areas of land, as well as of the skills appropriate to map drawing, there is still no evidence for the systematic development of this type of cartography. Similarly, in medieval Europe, for which it is possible to reconstruct in detail both instruments and techniques of land surveying, the technical developments did not in themselves give rise to a new, well-defined genre of local mapping, divorced from traditions of artistic representation. The decision to make use of available techniques of mapmaking rested within society, so cartographic history becomes a study of needs and wants rather than of just the ability to make maps in the technical sense. Throughout the whole period, cartographic advances were often due as much

to political and ideological factors as to the level of technological progress in surveying or the graphic arts.

The same conclusion holds about how far maps should be regarded as an agent of change or of continuity throughout early European history. Not only has the evidence for the making of maps been reviewed in this volume, but an attempt has also been made to gather complementary evidence for their use, potential impact, and meaning. These aspects are also socially determined, and they raise questions about the nature and role of map users in each period. It can be argued that though mapmaking was an elite activity, and though these elites manipulated maps for their own purposes, those who were ultimately reached and influenced by the knowledge symbolized in the maps must have constituted a very much larger group. Thus the potential impact of any individual map was probably far greater than its isolated occurrence might suggest. It follows that the capacity of cartography to influence human actions or to mold mental worlds must depend not only on the extent to which maps were actually seen but also on the way they, or their messages, were understood.

It is on such questions as these that our understanding of the context of the map user is at its most speculative. Evidence for the level of map consciousness in early societies, for example, is virtually nonexistent. We do not know how often, for how long, in what circumstances, and with what lasting effects (if any) the Bronze Age inhabitants of Valcamonica may have ascended the valley side and contemplated the images on the ice-polished surfaces above their fields. We do not even know how far a publicly displayed *mappamundi* such as the Hereford world map may have been actually used (as is often implied) to instruct the peasants and pilgrims who may have stood before it.

Only for a few periods and places, as in the Greek and Roman world and to a lesser extent in some parts of Europe in the later Middle Ages, do we stand on somewhat surer ground about the population of map users. It can be inferred that by the fifth century B.C. in Athens, not only were celestial globes and maps of the earth already widely used instruments of teaching and research for the educated minority, but ordinary Athenians would have become acquainted with some types of maps through the use of zodiacs and nativity charts in astrology or through allusions to maps in the dramas staged in their theaters. Evidence from the Roman period contains nothing to suggest that the general exposure to maps was any less. The practical, educational, and propagandist uses of maps, some of which were publicly displayed in Rome or depicted on coins, must have made them even more familiar to many ordinary citizens as well as to some of the more progressive landowners of the Italian peninsula or to the tenants of centuriated

areas. Such inferences are derived from literary sources; but for the period after the fall of Rome it is reasonable to suppose that this acquaintance with maps dwindled significantly, that maps passed out of the popular view, and that their influence as graphic knowledge became confined to very limited ecclesiastical or courtly elites. Not until the later Middle Ages can the reemergence of maps as a potentially greater force in history again be traced. But just as the earlier isolated cartographic examples had been scattered, this was a piecemeal reappearance, most evident in the maritime cities of the Mediterranean and of Spain and Portugal, in northern Italy and in southern Germany, and in those parts of northern Europe where local maps were gaining a limited currency among lawyers and the literati. It seems, then, that in the Middle Ages a widespread use of maps and a universal understanding of their meanings was no more than embryonic. Indeed, it is the low level of what can be termed map literacy, as much as the relatively slight record of mapmaking itself, that marks off the early period dealt with in this volume from that of the European Renaissance and helps give it a distinctive place in the larger general history of cartography.

In the final analysis, therefore, maps have always been

a social as well as a technical phenomenon. In these essays we have examined the complexity of maps as graphic artifacts, traced the mutability of their functions, viewed them as monuments to human skill and ingenuity, acknowledged them as sources for the reconstruction of past environments, recognized them as bearers of new mathematical and graphic concepts, and established them as the ideological tools of political, military, and religious power. But the underlying dynamic in the historical process of cartography was the map's ability to fulfill social as well as technical roles. It was this that gave rise to the birth of mapping in different places and in different contexts in the Western world from prehistoric times to the later Middle Ages. Important, if not paramount, has been the capacity of the map as an instrument of knowledge—a way of seeing and of structuring the external world of man—to expand human consciousness and to propel the mind away from its immediate environment into the intangible spaces beyond. Seeing maps in these ways has opened a window, allowing us to glimpse the history of the map through the eyes of those early societies in which it originated and developed.