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Mapping New Worlds: Culture and Cartography in Sixteenth-Century Venice

By DENIS COSGROVE

'Maps are graphic representations that facilitate a spatial understanding of things, concepts, conditions, processes or events in the human world'.¹ Rather than emphasizing the content of maps, or the technical processes by which they are produced, this definition emphasizes the cognitive and conceptual aspects of the act of 'mapping.' The irreducible features of mapping are graphic representation: the production of a pictorial artifact, and spatial coordination: an emphasis on geometrical ordering of distance, direction, scale and shape. Seen in this way, mapping has affinities to planning: formulating idealized representations of the world which gesture towards action. Less definitively fixed is the content of such representations: maps may represent concepts as well as things, events and processes as well as conditions; the human world represented by maps may be terrestrial or celestial, imaginary or real, sacred or profane. Commenting on the history of cartography, J. B. Harley points to its distortion in the past by an over-emphasis on 'scientific frontiers and the revolutions of mapping, on landmarks and innovations, on the saga of how the unmappable was finally mapped.' He pleads for the history of maps to be related also 'to the social implications of their varied form and subject matter'.² Venetian cartography has rightly claimed a significant place in the history of European cartography and Harley's argument may legitimately be applied to much of the literature on the development of Venetian mapping, especially to the pioneering work of Roberto Almagia³ and his student Eugenia Bevilacqua,⁴ although among art historians there have been notable contributions to our understanding of the role of cartographic representation in promoting and sustaining Venetian civic and political myths.⁵ We still lack a detailed critical survey of the broad range Venetian Renaissance cartography and its place in the culture of the sixteenth century Republic, although David Woodward's detailed scholarly studies of Paolo Forlani offer a necessary foundation for such a work.⁶

Such a study would of necessity go well beyond mapping alone, relating cartographic production not only to the sophisticated geographical culture of Venice in the sixteenth-century but to its literary, artistic and scientific cultures and to significant debates about the destiny of the Republic, its physical form, its political and commercial relations to an expanded European world and its responses to religious reform.⁷ The purpose of this paper is to sketch a prolegomenon to such a study. It addresses Harley's plea in the case of Venetian sixteenth century mapping, first by examining the socio-economic and environmental context in which Venetian cinquecento maps were produced; second by outlining the major contributions made by Venetian cartography between the still strongly medieval Venetian *mappae mundi* of Fra Mauro and Giovanni Leardo of the 1440s and the end of the sixteenth century which witnessed the publication of Livio Sanuto's *Geography* illustrated by his brother Giulio's engraved maps, Ruscelli's *Ptolemy*, and Giuseppe Rosaccio's great wall map: *Universale descrizione di tutto il mondo*, first published in 1597.⁸ Finally, I shall discuss the broader cultural discourse with which Venetian mapping at this time was immersed. This should allow us in conclusion to recognize not only that maps held a place in Venetian patrician culture close to the heart of a number of its central concerns, but equally that mapping as a mode of representation was intimately connected to other, much more widely recognized, modes of graphic representation: painting, etching, engraving and drawing, particularly when they took landscape as a subject matter, a genre to which sixteenth century Venice was a key contributor.⁹ Before turning to Venice, however, it is

pertinent to make some comments on the *Geographia* of Claudius Ptolemy whose introduction into the West in the opening years of the fifteenth century was of such significance for the later development of terrestrial mapping in Europe.

Not only did Ptolemy revolutionize the modes of global and large-scale geographical representation available to Europeans, but the divergence between his geographical claims and the direct experience of the world reported by Renaissance navigators and others raised a host of conceptual and practical questions that occupied geographers and others, not least in Venice, throughout the sixteenth century.¹⁰

Brought to Florence about 1400 from Byzantium, the eight books of Ptolemy's *Geographia*, seven of which consist mainly of locational coordinates for toponyms across the known world, were translated into Latin by 1410 and published for the first time in Vicenza in 1475 and Bologna in 1477. The revolutionary feature of Ptolemy's cartography was its theoretical linking of terrestrial locations to astronomical observations, thereby generating a theoretical spatial grid and locational coordinates for any place on earth. Over the following century more than a dozen translations in 30 published editions appeared, many containing woodcut and copper engraved maps, and commentaries indicating not only the profound significance of this Classical work for the Renaissance *furor geographicus* but equally the speed and depth of revisions to Ptolemy made necessary by new geographical knowledge. I shall reserve discussion of the specifically Venetian contributions to this Ptolemeic science for a later section. I do not intend to discuss the revolutionary implications of the spatial grid for European conceptions of space. These have been outlined elsewhere.¹¹ Rather I shall comment on that brief section of his first book where Ptolemy defines the structure of geographical knowledge and its graphic representation. This structure was widely understood and frequently quoted in Renaissance cartography; not only did it have the authority of a Classical text, it appealed to the Renaissance love of hierarchy as a foundation of cosmic and intellectual order.¹² It allows us to locate Ptolemy's science within a broader cultural debate of considerable significance in Venice. In the opening paragraphs of Book 1 Ptolemy distinguishes geography and chorography:

La ove proprio della geografia e di mostrar tutta in uno, & continua della Terra cognita, com'ella stia di natura & di sito, & si stende solamente fino alle cose più principali . . . Il fine della corografia e di rappresentare una sola parte, si come chi imitasse o dipingere un'orecchia alla guisa di coloro, i quali descrivono, o dipingono tutto un capo . . . il fine della Geografia e di considerare il tutto in universale.

*La corografia poi più attende alla qualità de'luoghi, che alla quantità, o grandezza loro. Consocia cosa, che ella procur per tutto di rappresentar con figure la vera forma, o simiglianza de'luoghi, & non così parimente la simmetria, o misure, o disposizione, che hanno fra loro, e con cielo, o con mondo tutto.*¹³

The purpose of Geography is to represent the unity and continuity of the known world in its true nature and location, and restricts itself to the principal elements [of the world]. The aim of Chorography is to represent only a part, as those who render or depict an ear, as opposed to those describing or depicting the whole head . . . the purpose of Geography is to consider the whole, universally.

Chorography therefore concentrates more on the quality of places than on their quantity or scale, aware that it should use all means to sketch the true form or likeness of places and not so much their correspondence, measure or disposition amongst themselves or with the heavens or with the whole of the world.

Ptolemy's distinction between a *geography* which accurately represents the whole known world and its parts according to astronomical observations and fixed geometrical principles, and *chorography* which gives a pictorial 'impression' of a local area without regard to quantitative accuracy was widely noted by Renaissance translators and commentators.¹⁴ It formed the basis for a distinction between the types of mapping activity distinguished not only by scale but by technique and skill. A third element in this hierarchy, implicit in Ptolemy's text, was also widely recognized. This was *cosmography*, which while locating the terrestrial sphere accurately within the celestial spheres of fixed and moving stars, considers the form and pattern of the whole celestial scheme. Through cosmography Ptolemeic cartography was related to astronomy, the body of knowledge in Ptolemy's *Almagest* and necessary for accurately determining terrestrial coordinates and constructing global and large-scale maps. This three-fold hierarchy of Ptolemeic science became established during the early sixteenth century as celestial cosmography was separated from terrestrial geography. The hierarchy is made quite clear by Peter Apian, and, using Apian's illustrations, was graphically demonstrated in Antonio Campi's 1571 map of the province of Cremona where the chorographic map is decorated by a global azimuthal insert showing latitude and longitude with human figures fixing coordinates by use of the cross-

staff, and a geocentric diagram of the celestial spheres.¹⁵ The tripartite hierarchy formed the structure of Giacomo Gastaldi's *Universale descrittione del mondo* of 1561–1565 which we shall discuss below. The link with cosmography is significant not only because astronomical science itself underwent the profound reevaluation of Copernicus' *De revolutionibus* of 1543, but also because it relates Renaissance cartography to the dense discourse of cosmology with all its Neoplatonic and Hermetic accretions, so central to tradition of humanist philosophy and theology from Ficino, Pomponazzi and Pico.¹⁶ The Ptolemaic hierarchy of cosmography, geography, and chorography offers a useful classification of cartographic and associated scientific culture in Renaissance Venice and will be used to structure subsequent discussion, always remembering that holism and synthesis were critical aims of a Renaissance enquiry in which both God and Man acted as points of unity transcending the hierarchical division of nature.

The environmental and socio-economic foundations of Venetian mapping

It is easy to understand why mapping should hold a particularly significant place in the daily life of early modern Venice. A commercial centre of the first order that depended for its economic life on maritime trade and boasted the largest merchant fleet in Europe had an enduring need for accurate and up-to-date charts of its trading sphere. From the late thirteenth century these had been produced in Genoa and later in Venice, where Pietro Vesconte is recorded as the first professional cartographer in the early fourteenth century. These portolan charts showed with ever-increasing accuracy the Mediterranean coasts and islands, with rhumb-lines for directional finding. While they indicated distance and direction the maps were unrelated to astronomical coordinates, although indication of these begins to appear in marginal scales on some of them from the early sixteenth century. Venetian workshops vied with those of Genoa and the Catalan ports in the quality of their charts, collecting them together in atlases.¹⁷ But Venice had a further need for cartographic skills. Its own immediate environment of the lagoon was unstable and subject to alteration of channels, banks and *lidi*. A rich documentation from the late thirteenth century onwards testifies to growing intervention on the part of the Republic in protecting the marine defenses, dredging channels in the lagoon, diverting fresh water away from it to prevent silting.¹⁸ The scale of this work increased radically from the later fifteenth century, especially with diversion of the river Brenta at Dolo in the 1480s, leading to the establishment in 1501 of the Savi alle Acque, later the Savi ed Esecutori alle Acque. Such large-scale environmental intervention required careful survey, levelling and mapping from the micro-scale of individual channels to whole river systems and the open aquatic spaces of the lagoon, as we see for example in the watercolored parchment map dating also from 1501 and showing Torcello and the marshlands and *valli* around Tessera al Dese.¹⁹ As we shall see, sixteenth century Venice benefitted from a succession of highly skilled engineer-cartographers acting as *proti* and *periti* for this work, using mapping as a key tool of environmental planning.

Closely related to the hydrographic mapping was the demand for resource and military maps for the exploitation and defense of Venetian territories. This demand increased greatly with the amassing of a land empire during the fifteenth century. In 1470, for example, the Council of Ten demanded an inventory of all oaks in its territories²⁰ recording their numbers, size, maturity and accessibility to a navigable channel. Records of feudal investitures, communal lands, mills and weirs on rivers and water offtakes for irrigation purposes were also kept. Such information gathering became regularized under various *magistrature* from the mid-sixteenth century.²¹ Quite obviously one of the most systematic ways of recording and storing such spatial information was by means of maps, and the archives of these *magistrature* offer one of the richest sources for the study of Venetian cartography. Commonly, the same men who are recorded as *periti* for these agencies appear as major figures in the history of formal geographical map design.

Defense too required the skills of the cartographer; indeed the history of the topographic map is deeply entangled with the history of warfare, especially in the years following the invention of gunpowder. John Hale has commented that cartographic advances in Europe whetted the appetite of rulers for territorial conquest and certainly made it easier.²² Cinquecento Venice was more concerned with defense after the Cambrai Wars, but Cristoforo Sorte's boundary

surveys and provincial maps for the Ducal Palace²³ reveal that such a strategy depended equally upon accurate cartography. Fortifications were reconstructed in the sixteenth century around most of the mainland cities and maritime enclaves like Candia in response to the fire-power of new forms of artillery. These demanded complex ground plans so that military engineers like Fra Giocondo, Michele Sanmichele and Francesco Tensini deployed skills of survey and levelling which overlapped with those of the cartographers. The work of Francesco Maria della Rovere, Governor General of the Republic's militia who coordinated terraferma defenses in the late 1520s, indicates the relationship between mapping and planning. Tafuri has pointed out that 'his work was based on an interpretation that envisioned the territory as an *articulated organism* ... above all capable of overcoming the traditional paratactic representation of space',²⁴ that is, a perspective which while based on local cartographic knowledge, anticipates the synthetic vision achieved technically rather later in cartography through triangulation.

If Venice had specific practical needs for maps, the Republic was also singularly placed to develop as a European centre for cartographic developments from the Ptolemeic tradition. Its close ties to Byzantium placed it in contact with the main intellectual point of transfer of Arab knowledge to the West. It was in Byzantium that the Ptolemeic texts had been preserved and a number of versions of the *Geography* were circulating and being actively copied there in the thirteenth and fourteenth centuries.²⁵ With the Fall of Byzantium in 1453 Venice became the main inheritor of its intellectual traditions. Equally significant was Venice's role as a major European publishing centre in the sixteenth century, and the relative freedom with which information circulated there. In the crucial early years of New World discovery when Spain and Portugal competed for territorial dominance and thus placed heavy constraints upon the diffusion of information, Venice, whose commercial interest in the consequences of Atlantic navigations was intense, became a critical centre for the collection and diffusion of information and the publication of maps to represent it.²⁶

Venetian cartography to 1500

The world map produced in Fra Mauro's workshop on Murano dated 26 August 1460 represents the culmination of a great medieval tradition of *mappae mundi*. These maps vary significantly in their form and content²⁷ and were capable of accreting new knowledge gained from travellers and navigational charts to their basic synthesis of Classical and Biblical conceptions of the world. Generally centered implicitly or explicitly on Jerusalem they represented in Schulz's words a 'moralized geography' and were meant to be interpreted like scripture as much as to be read or used as an instrument of geographical science. Venice had developed as a center of the production of such maps: Fra Mauro's work was complemented by that of Giovanni Leardo and Antonio Leonardi, while an example on public display at Rialto was restored in 1549.²⁸ But their makers recognized that this mode of mapping was undermined by the rediscovery of Ptolemy. Andrea Bianco, a colleague of Fra Mauro, is recorded as having produced a world map of Ptolemy's coordinates using parallel meridians in 1436²⁹ and indeed Fra Mauro himself 'felt it necessary to apologize for not following the parallels, meridians and degrees of the *Geography*'.³⁰ The Ptolemeic ecumene was elongated east-west rather than circular, and it took the Canary Islands (Fortunate Islands) as its prime meridian, the mid-point of its 180 degree hemisphere passing well to the east of the Holy Land, thus it ill-fitted with the circular *mappa mundi*.

While the 'moral' cartography of the *mappa mundi* with its contours declining with distance from Jerusalem may have been ceding place to the secular grid which privileged no single point of its surface,³¹ Schulz has argued for a continued influence of the ideas associated with it in the construction of the woodcut bird's eye view of Venice produced by Jacopo de'Barbari in 1500.³² While remarkable for its empirical accuracy, elements like the structure of its ground plan, the scalar distortion of the city and its key symbolic areas, and the decorative elements all suggest that its subject is 'the commonwealth of Venice rather than the physical city: Venice, the premier trading and maritime power of Europe. Her physical features are exhibited as the material manifestation of this state, just as the figures of Mercury and Neptune are the incarnations of its numen. Jacopo's print is a visual metaphor for the Venetian state ...'.³³

The tradition of *mappae mundi* upon which Jacopo drew emphasizes spatial stasis, an achieved harmony and perfection. But the exigencies of the real world meant that topographic mapping for political and administrative purposes was equally significant for the Venetian state. Maps of Asia illustrating the Polo discoveries decorated the Sala di Scudo in the Ducal Palace on its redecoration after the fire of 1483, painted over by Giacomo Gastaldi in the later sixteenth century and again in 1762; while in 1460 the Council of Ten ordered local governors in the *terraferma* and *Stato da Mar* to have maps drawn of their areas for submission to Venice, a policy which has left some of the most sophisticated regional maps of the early Renaissance and which has prompted one writer to claim that Venice was 'the only state in fifteenth century Europe to make regular use of maps in the work of government'.³⁴

Late fifteenth century Venice thus had a tradition of both geographic and chorographic map production upon which to draw. To this we must add the mariners' portolan charts, many of their makers anonymous, with their increasingly accurate outline of coasts, coastal places and dense network of navigational rhumb-lines.³⁵ By the turn of the sixteenth century map publishing in Venice was highly organized.³⁶ Workshop production consisted of four functions in the creation of the map: compilation/design which involved collecting information and plotting it on a plan, engraving in wood or copper, printing and the publishing. Throughout the century it is difficult to differentiate these functions in terms of the individuals involved although a number of distinct workshops can be recognized from their imprints: Camocio, Bertelli, Forlani, Pagano and Tramezzino.³⁷ Certainly their activity meant that maps probably circulated more easily and widely in this city than any other in Europe, forming one foundation for what we may call 'cartographic literacy' among the Venetian patrician and citizen classes. At the same time, the growing numbers of unpublished maps and *disegni* emerging from the demands for survey: hydrographic, military, legal and administrative further encouraged this familiarity with maps in Venice and underpinned the broader role of cartography in its sixteenth century cultural life.

This cartographic literacy may be seen as part of a broader familiarity with the mathematics and geometry of spatial representations for which there is ample evidence in the later fifteenth century. It is well established that Italian merchant cities enjoyed a high level of visual literacy as a result of geometrical training in the *abacco* which involved the recognition of simple spatial and volumetric relations together with mathematical and proportional calculations.³⁸ Such schools flourished in Venice which was also a center for publication of many of the mathematical handbooks which popularized this knowledge for the merchant and artisan classes. Among these were Luca Pacioli's *Summa di arithmetica* . . . (1494) and Francesco Feliciano's *Scala Grimaldella: Libro d'aritmetica* . . . of 1518.³⁹ Such books continued to be published in Venice throughout the sixteenth century, by practicing surveyors like Cosimo Bartoli and Silvio Belli, while Nicolo Tartaglia published the first Italian translation of Euclid's *Elements* in Venice in 1543 and his work on gunnery, *La nova scienza*, in 1550.⁴⁰ We need hardly add that the Euclidian techniques which underlay practical survey and mapping were also central to the visual arts and recognize that the ability both to produce and 'read' a map are closely related to the ability to read the spatially extensive townscape paintings that flourished in late fifteenth century Venice. The works of Carpaccio, Gentile Bellini, Lazzaro Bastiani and Giovanni Mansueti that decorated the walls of Scuole chambers combined complex perspectives with topographical detail of an almost cartographic accuracy. As in the great Barbari map itself, in these works 'topographical exactitude in attributes as in narrative settings should be understood as a manifestation of the Renaissance interest in natural appearances and fidelity of representation, grafted onto an ideal significance, but not replacing it'.⁴¹ We shall return below to the significance of practical and speculative mathematics in the representation and manipulation of nature.

Sixteenth century Venetian mapping

To the structural circumstances encouraging a cartographic culture in late fifteenth century Venice we must add the conjuncture of events in the early years of the new century both within and beyond the Republic which radically increased the practical and theoretical significance of

tography in the daily affairs of the Republic. For the most part these maps are highly local, dealing with individual streams or groups of fields. But larger drainage schemes gave rise to more sophisticated regional maps of the lagoon or whole provinces, for example, the Polesine.

While the Republic did not participate directly in the navigations and discoveries, Venice took an intense interest in their progress and they had a powerful impact on Venetian cartography. The new knowledge challenged Ptolemeic orthodoxies on the size of the globe, the distribution of lands and seas and the habitability of the earth, requiring the frequent re-drawing of globes and world maps.⁴² Information flowed into Venice from its embassies and agents in Iberia, especially from Gasparo Contarini, ambassador to Spain, who was responsible too for securing the Vicentine Antonio Pigafetta's place on the Magellan circumnavigation of 1519–21. We may observe the influence of the discoveries in the portolan maps which continued to be produced throughout the century, for example, the world atlas of nine maps by Battista Agnese which included a Ptolemeic world map, repeating many of Ptolemy's errors for Eurasian coasts and islands, but showing with some accuracy the eastern coastline of the New World and the route taken by Magellan as recorded by Pigafetta (Fig. 2).⁴³

It was above all in published editions of Ptolemy's *Geography* and in Gianbattista Ramusio's three volumes of *Navigazioni et Viaggi*⁴⁴ that we see the impact of discovery on Venetian cartography. Ptolemy's *Geography* achieved wider access by its translation into the vernacular, and two such translations appeared in Venice during the course of the century: that by Andrea Mattioli in 1548, and Girolamo Ruscelli's, to which we shall return, which appeared in 1561 with later editions in 1564 and 1573.⁴⁵ The former contained 60 copperplate maps, 26 of them the original Ptolemeic *tabulae*, and 34 modern, all of them the work of Giacomo Gastaldi, while the latter has again the 26 ancient maps but 36 new ones, many of them reprinted or copied from the Mattioli edition. These new illustrations included a double-hemisphere map which Ruscelli discusses at length, pointing out that Ptolemy was able to represent the oecumene on one hemisphere because he knew only a quarter of the globe. Today, in order to grasp the true sphericity of the earth, Ruscelli claims we require a new mode of representation: the double-hemisphere map, '*Questo adunque è certamente il più ragionevole, il più vero, & il miglior modo di rappresentare il nostro mondo moderno, cioè tutto il globo della terra abitata in piano*'.⁴⁶ Ruscelli also included a *carta marina* with rhumb-lines and his work represents a synthesis of advanced geographic knowledge of the changed globe.

Geographical understanding was diffused to an even broader audience by the cartographic workshops we have already mentioned which, by the mid-sixteenth century, were binding printed maps of various kinds into commercial collections (essentially atlases) for sale in the Merceria. Ferrando Bertelli particularly was active in this field, owning plates garnered (and frequently re-engraved) from a wide range of sources in Rome and beyond Italy for binding the prints into single volumes of up to 150 maps.⁴⁷ Similar collections contained city views (*veduti*) and plans, for example, the 1568 publication by Zaltieri with 50 plates by Guilio Ballino. The previous year Domenico Zenoi had obtained a privilege to 'print or have printed for sale devotional figures, portraits and *geographies* of Europe, Asia, Africa'.⁴⁸

In terms of the Ptolemeic mapping hierarchy, events on land encouraged chorographic and local mapping in Venice while maritime matters stimulated production of geographical maps. Sustaining this distinction, two figures dominated the Republic's map-making in the middle years of the century: Cristoforo Sorte and Giacomo Gastaldi. They were known to each other and closely linked by their various activities to key events and figures in the cultural life of sixteenth-century Venice. Both wrote short but significant cartographic-scientific texts. Cristoforo Sorte, born in Verona in 1506/10, trained as a painter in Mantua under Giulio Romano.⁴⁹ He was employed for two periods as *perito ordinario* for the reclamation ministry in 1556–64 and 1589–93, producing large numbers of drawings for irrigation and drainage, and in the 1570s for the Camera ai Confini, surveying boundaries in the Alps. His most important cartographic commission for the Republic came in 1578 with the request for a 31 foot long map of the *terraferma* to be painted on the inside wall of the Sala del Senato in the Ducal Palace. In the 1580s this was altered to a set of six maps, five of them large-scale representations of the Venetian mainland provinces and the other a general map of the whole land empire.⁵⁰ While other car-

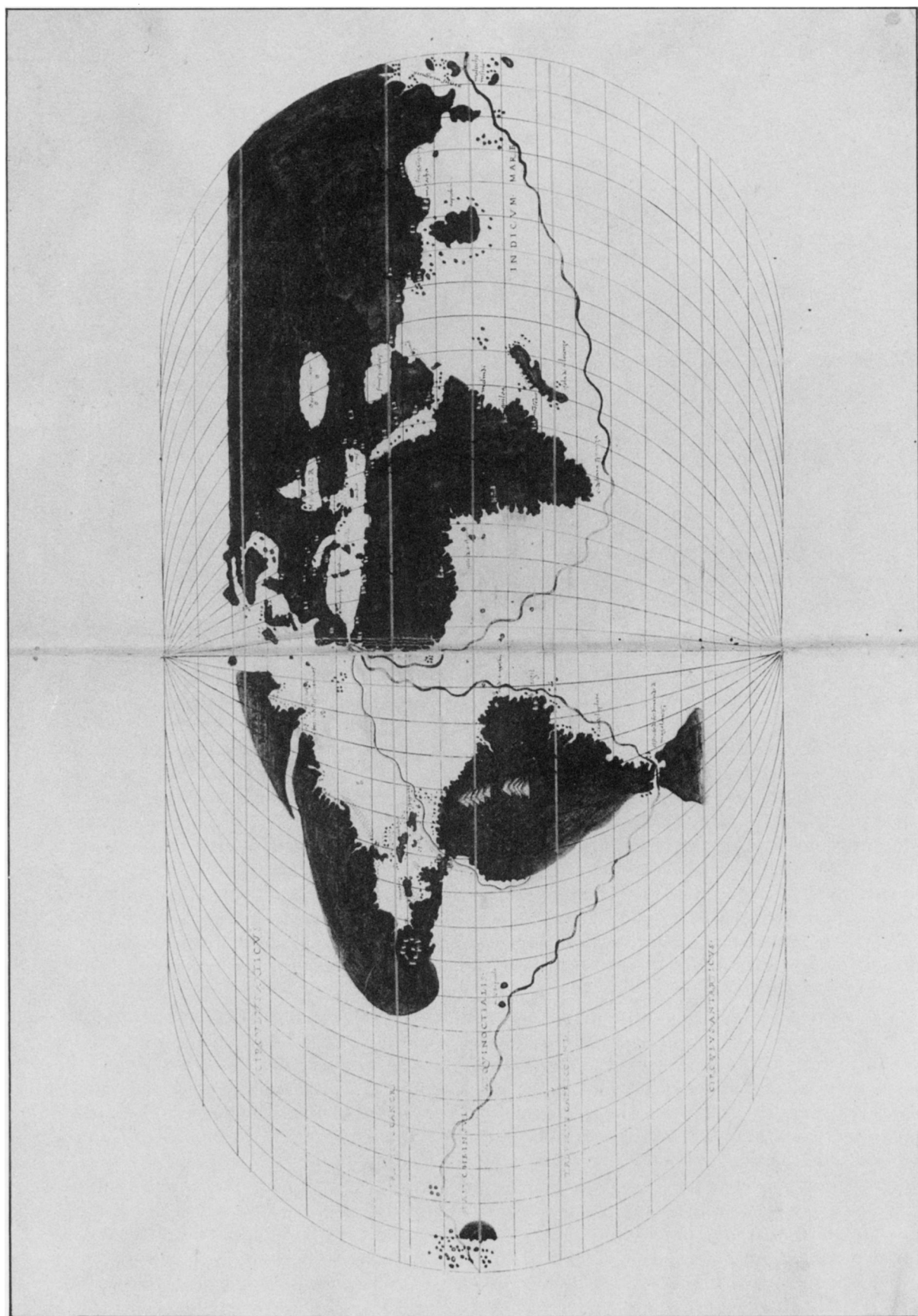


Fig. 2. Planisphere in oval projection by Battista Agnese, showing Magellan's route, the passage from Seville to Peru via Panama and Timitistan [Tenochtitlan], 1536.
By courtesy of the Museo Civico Correr, Venice.



Fig. 3. Map of Island of Sumatra by Giacomo Gastaldi in G. B. Ramusio, *Navigazioni et Viaggi*, 3 (1556).
By courtesy of the Biblioteca Marciana, Venice.

topographers, notably Sabbadino, produced similar scale maps, Sorte's are characterized by their greater artistry and adoption of an oblique bird's eye perspective. Even a map like that prepared to illustrate irrigation in the province of Treviso takes on something of the quality of a landscape painting, with individual fields and hedges identified and its relief representation adopting conventions taken from Flemish landscapists. While a highly-skilled engineer, capable of proposing large-scale reclamation schemes,⁵¹ Sorte was familiar with both Ptolemaic and artistic culture. His 1580 text *Osservazioni nella pittura* is a technical guide to the making of chorographic maps, not in terms of survey and drafting, but, following Ptolemy's claim in Book 1 of the *Geography* that chorography deals with qualitative matters and is related to painting, in terms of design and coloring. The work has properly been seen as one of the earliest treatises on landscape painting.⁵²

Giacomo Gastaldi, born in Piemonte, was active in Venice by the late 1530s and died there in 1566. He worked with Sorte at the reclamation ministry in the 1550s, having conducted a levelling survey of the Adige river in 1556 and was named Cosmographer to the Republic. Like Sorte, he was commissioned to work in the Ducal Palace (in Gastaldi's case, in the Sala di Scudo) during the 1540s, where he repainted the world regional maps dating from the late fifteenth century. But his key contributions lie in the geographical maps he produced for engraving and reproduction. We have already mentioned his contribution to the Mattiolo Ptolemy which included seven of the New World; equally significant are his contributions to Ramusio's *Navigazioni* in which twelve of his plans and maps are printed: three of Africa in Volume 1 and nine (seven of America) in Volume 3 (Fig. 3). A large number of individual maps were produced, some engraved, for individual patrons, including the magnificent nine-sheet world map in the British Museum, probably related to his text *Cosmographia universalis* (c. 1561).⁵³ With Gastaldi, the nautical orientation of large-scale geographical maps gave way to a continental

focus as his representations made use of the fullest possible contemporary knowledge (much of it gained from Ramusio) of the size and interior of the great land masses. If Sorte fulfilled the Ptolemeic definition of chorography, Gastaldi fulfilled that of geography as a mathematical science of quantity as his own brief text of 1565 bears testimony. Opening with a discussion of the elements as they combine to make a perfect sphere, it continues with a reference to the Ptolemeic hierarchy before concentrating on the problems of representing the sphere on a flat surface and describing the habitability and parts of the known world. Taken together with his world maps, Gastaldi's books represent concise world geographies seeking to make available to mid-sixteenth century Venice accurate and up-to-date geographical knowledge of the four parts of the inhabited world.

By concentrating on Sorte and Gastaldi I do not wish to imply that they define the limits of Venetian cinquecento cartography. Sabbadino's maps of the lagoon and Giulio Sanuto's engraved global gores and regional maps of Africa both testify to the existence of a wide range of cartographic skills and interests throughout the century. Indeed, the final years of the sixteenth century were marked in Venice by a new Italian translation and commentary on Ptolemy's *Geography* by the Paduan Gio. Antonio Magrini in 1596 which would be re-published up to 1621, and by the decorated splendor of Giuseppe Rosaccio's wall map of 1597: *Universale Descrittione di tutto il Mondo* which seeks to incorporate the latest material on discovery and settlement with illustrated ethnological narratives of the New World taken from De Bry's *Americae* (Volumes 1 and 2) and allegorical figures of the four continents (Fig. 4).⁵⁴ This Venetian cartography anticipates the Baroque world maps and globes of Bleau and Coronelli in the next century. However, Sorte and Gastaldi allow us to make some of the most direct links to broader questions of artistic and scientific culture and practice in Venice during this period, and it is to these that I now turn.

Mapping and culture in sixteenth century Venice

So far, we have focused on the chorographic and geographic levels in the Ptolemeic hierarchy. If we are to place Venetian sixteenth century mapping in a broader cultural context, we must consider the third level: *cosmography*, the description of the cosmos or the universe. The articulation of astronomical observation and terrestrial location was, as we have noted, the most revolutionary technical aspect of Ptolemy's work for cartographic representation in the Renaissance. Since Ptolemy's work represented the summary of a Classical tradition of learning that originated in the Pythagorean concept of a spherical earth,⁵⁵ it is little wonder that his cosmography also appealed strongly to the cosmological strain in Renaissance Venetian thought, a concern with the meanings of space and time which fed into political, religious and historical debate, affecting both humanist speculation and technical practice.

Cosmography, humanist speculation and renovatio in Venice

In Fra Luca Pacioli's *Suma di arithmetica, geometria, proportioni et proportionalità* (1494),⁵⁶ we find reference to the centrality of number, geometry and proportion as the measure of all things, from the greatest to the least:

Whoever will speak of cosmography will see the necessity of number, measure and proportion, as is demonstrated by all the ancients: Eratosthenes, Strabo, Marinus, Ptolemy and other excellent cosmometers. When all the universal world duly proportioned is graded in a small map, provinces, cities, castles, maritime places and seas are represented.⁵⁷

The greatest things in creation, however, go beyond the 'universal world,' they are metaphysical. But even here the reason of mathematics applies: 'in his metaphysics [Euclid] affirms the mathematical sciences as being in the first rank of certainty'.⁵⁸ Like so many of his contemporaries, Pacioli embraced a Pythagorean-Platonic view of the mathematical and geometrical structure of the universe. Mathematical reason allows us to understand the *harmonia mundi* in the created universe and further, to grasp metaphysical concepts like the Trinity: 'through the wonderful correspondence between God and the world, created on the model of divine harmony, number becomes the means and criterion to elevate oneself from the sensible world to the invisible and ineffable truth of God'.⁵⁹ This was the theme of Pacioli's *De divina proportione* (1509) and his famous lecture at San Bartolomeo di Rialto in 1508, attended by the intellectual



Fig. 4. From Giuseppe Rosaccio's *Univerale descrizione di tutto il mondo . . .*, 1597. (This edition, c. 1645). Detail showing North America using illustrations from De Bry.
By courtesy of Harry Ransom Research Center, University of Texas at Austin.

world of early sixteenth century Venice. The Neoplatonic tradition, developed in Florence by Ficino and Pico was sustained in Venetian mathematical science throughout the century: by Francesco Giorgi, Nicolo Tartaglia, Silvio Belli and others.⁶⁰ One of its consistent themes was that of 'seeing' mathematics, and through them God's immanence in the Universe. This placed considerable significance on graphic representation, whether in the visual arts or in mapping and survey which depended on visual measurement:⁶¹ the most powerful and immediate graphic representation of the Universe or nature (*natura*) and the proportioned harmony running through them. Mapping at the descending scales of the Ptolemaic hierarchy served to reveal proportion and harmony at all levels of creation, an idea most familiar in concepts of macrocosm and microcosm.⁶²

Ideas of celestial harmony in the macrocosm and its recovery on earth in the microcosm of man or human society are to be found not only in the arts and literature where they have been extensively studied, but equally in Venetian political discourse where the utopian theme of Venice as the constitutional (and indeed physical) manifestation of divine harmonies was strongly articulated during the sixteenth century. As the divergent visions of Gasparo Con-

tarini and Domenico Morosini reveal, this theme could be deployed on both sides of political debates about the future of the Republic in the troubled years of the century,⁶³ entering into practical matters of architecture, engineering and land drainage.

Manfredo Tafuri has recently examined these competing visions of Venetian destiny as they were debated and articulated in various cultural fields.⁶⁴ The debate originated with the conquest of the land empire which had challenged Venice's traditional maritime orientation. It turned critical with the crises of Cambrai and the joint threats to commerce from Iberian navigations and Turkish advance.⁶⁵ Thenceforth it resonated throughout the sixteenth century. Our interest is not so much to comment on the different positions adopted but to recognize that both centered on the idea of the enduring and universal features of the Republic's myth of harmony and how they should be respected within a strategy of renewal (*renovatio*); in the language of the debate, how the absolutes of *prudencia*, which implied justice, good government, *origine* and universal time, could be reconciled with *novitas*.⁶⁶ The popular emblem of *prudencia* in Venetian culture was the *tricipitium*, or three ages of man, which embodied both the cyclical quality of natural time and the specific rebirth assured by Christ. The *tricipitium* spoke to those traditions of justice and good government which allowed Venice to live in 'uninterrupted cosmic time.' Equally, Tafuri argues, through its origin myths—so strongly re-articulated and represented in the years after Agnadello—Venice identified the Christian age of redemption or re-naissance with Venetian time.⁶⁷ In what he acknowledges is an unorthodox reading of Giorgione's *Three Philosophers* (Fig. 5), Tafuri suggests that its three figures, obviously the *tricipitium*, represent the harmony of origin, novelty and universal or cosmic time:

His [the youth's] eyes are fixed on an *origin*, a cave that he has reduced to reason, having 'measured' it geometrically. The 'new'—youth with its compass and square—studies, contemplates and 'measures' nature, which is represented as a source; next to him maturity—philosophy or Arab mathematics?—and the cosmic wisdom of the 'old man' confirm his *ratio* on other levels. The 'three philosophers' do not stand in opposition: in a silent and serious dialogue, they clearly form an indissoluble whole in which the 'youth' reads the book of nature, showing he is playing close attention to the lesson of the first word, confirmed and universalized by the 'old man,' the sage who is custodian of tradition.⁶⁸

Despite its unorthodoxy, Tafuri claims that this reading has the merit of inserting Giorgione's painting into the context of the debate over the historical destiny of the Venetian Republic. I believe it is possible, at least *prima facie*, similarly to locate the Ptolemaic conception of cartographic representation into this reading.

The compositional center of *The Three Philosophers* is arguably the geometrical instrument in the hands of the youth. If, as Tafuri suggests, he is 'measuring' the cave,⁶⁹ then he is engaged in a form of terrestrial survey. He could equally be taking a celestial bearing, in which case the object of observation must be the secondary light source of a star or the moon.⁷⁰ It cannot be the sun, for that is visible as a secondary compositional center, shown either rising or setting—both moments where the moon could easily be visible low on the horizon. In this case at least three planets are significant in the painting: earth, sun, and either moon or moving star; thus, a form of cosmography or celestial survey is implied and we are reminded of the standard iconography of both the cosmographer and the geographer, as for example in the later frontispiece of Mattioli's translation of the *Geography* (reproduced in the 1564 and 1574 editions of Ruscelli) where Ptolemy himself is shown similarly engaged in fixing terrestrial locations (Fig. 6). It is further significant to note that as a landscape painting, which in part it is, the work incorporates all four seasons (indicated by the variable state of the vegetation), seasons dependent upon the relative movements of sun and earth which determine major parallels on the Ptolomeic map: equator and tropics. The ability to paint the seasons was a significant part of the chorographer's art as Sorte's long discussion in *Osservazioni* indicates.⁷¹ I am suggesting then that the tripartite hierarchy of Ptolomeic representation: cosmography, geography and chorography may be read into this painting, as it may be read into other representations of astronomy (or astrology) in sixteenth century Venice, for example Giulio Campagnola's 1509 engraving titled *The Astrologer*, or Titian's pen and ink drawing of *Satyrs in a landscape* in which the student of the celestial map is located in a pastoral setting appropriate to the observation of terrestrial nature and its cyclical changes.

Cartography, practicality and Venetian renovatio

Giorgione's understanding of the concepts that gathered around the mathematical arts is indicated by his fresco at the Casa Pellizzari at Castelfranco which depicts the liberal arts. Among



Fig. 5. Giorgione's *Three Philosophers*.
By courtesy of the Kunsthistorisches Museum, Vienna.

these we may observe the instruments of square and compass and two spheres, one showing the celestial map, the other an armillary *sphaera mundi*. Both indicate the zodiacal band which relates the two worlds. In terms of the liberal arts, these figures represent astronomy, geometry and arithmetic, which together with music (in which Giorgione was especially skilled) formed the four elements of the medieval Quadrivium. But Giorgione's frieze depicts more than the traditional liberal arts, it includes representations of armour, weapons, painting, weights and pulleys, that is, representations of *armatura*, one of the seven mechanical arts classified by Hugo of

CLAVDIO TOLOMEO
 PRINCIPE DE GLI ASTROLOGI,
 ET DE' GEOGRAFI,
 Di che patria fosse, non è ben noto.



Fig. 6. Claudius Ptolemaeus, Engraving from Girolamo Ruscelli's *La geographia di Claudio Ptolomeo Alessandrino . . .* (Venetia, 1574).
 By courtesy of the Harry Ransom Research Center, University of Texas at Austin.

St. Victor, which also included navigation, agriculture, medicine, theater, hunting and weaving.⁷² *Armatura* extended to architecture and sculpture. A number of these mechanical or practical arts were the subject of intense interest in sixteenth century Venice because they were essential to the process of *renovatio*, whether by sea (*navigatio*) or on land (*agricultura*) or in the city itself (*architettura*), to which in their different ways both factions in the debate over Venice's destiny were committed.⁷³ The parallel debate over the social significance of liberal and mechanical arts need not detain us,⁷⁴ except to recognize that the liberal arts came to be associated with discovery of the true causes of things, often occult, and the mechanical arts with empirical observation and practicality. While 'mapping' or cartography does not appear as a distinct 'art' in either classification, in the discussion quoted earlier from Ptolemy's First Book they are related both to the liberal arts of astronomy, mathematics and geometry and to the mechanical art of painting. As we have seen, in Venice the demands made on mapping also related it precisely to those other mechanical arts: navigation, agriculture and architecture. A Ptolemaic conception of the hierarchy of cartographic representation thus placed it on the boundary of liberal and mechanical arts and also of the speculative and the practical. When we turn to those Venetians who collected and studied maps and who translated, updated and commented on

Ptolemy in the light of new discoveries, we observe them engaged in both sets of activities as they relate to the destiny of the Republic.

Pietro Bembo (1470–1547) is one such figure. His interests relate him in his early years to Giorgione and in later life to Gastaldi and Ramusio. Bembo's adherence to neoplatonic ideas of the *harmonia mundi* is well-known,⁷⁵ his geographical and cartographic interests perhaps less so. His Latin treatise, *De Aetna* (1495), contains a chorographic description of the landscape around Mt. Etna, including carefully recorded observations on climate and soil fertility.⁷⁶ The work is structured as a debate between Bembo and his father: youth and age, classical authority and contemporary experience. In the theoretical discussion on the reasons for Etna's eruptions, Bembo's father refers to the continuous renewal of the earth as envisaged by Pythagoras and Hesiod, while his son subjects the cyclical conception to experience and reason, seeking to explain the *process* of renewal by reference to terrestrial physics.⁷⁷ In a later poem, the *Benacus* of 1525, Bembo offers a chorographic description of the landscapes of the Val Padana. Bembo's centrality in the cultural life of Venice during the first half of the century does not need to be reassessed here, but his cartographic and geographical interests provided a constant stimulus to his later thought and work. He was a collector of globes and maps and an intimate correspondent of cartographers and geographers. It is not surprising to find Francesco Sanuto approaching Bembo about the geographical education of his son.⁷⁸ Through this group Bembo was in direct correspondence with the Spanish geographer of American discovery, Oviedo, and in his *Della historia Vinitiana*, written during the period of the Doge Gritti's *renovatio*, Bembo devoted Book 6 to the discovery of the New World. The significance of this text lies not only in Bembo's recognition of the New World's implications for Venetian trade, but equally in his linking of a critique of Ptolemy to the idea of renewal. If Ptolemy's geography was correct, 'it would be almost necessary to believe that God was imprudent, having made (*fabricato*) the world in such a way that the far greater part of the earth should by the surpassing foulness of its climate be rendered uninhabitable (*vacua d'huomini*), contributing nothing of use'.⁷⁹ Such a conclusion would undermine Bembo's belief in the universal harmony of creation. However, the navigations had revealed the New World not only to be habitable, but to offer a return to the perfection in the Age of Gold. The very rivers of the New World are flowing with gold and its aboriginal inhabitants live in the golden age of mankind's youth, as Rosaccio's selection of images from De Bry was later to imply.⁸⁰ In Renaissance terms such a claim may be related precisely to the idea of a social and environmental renewal consistent with universal origins. Bembo supported Gritti's renewal plans for Venice and participated directly through his links with Vettor Fausto's schemes for renovating shipbuilding at the Arsenal.⁸¹

Bembo's interest in concepts of cycle and renewal were common to the group with whom, from 1525 to his death, he shared an extended scientific correspondence concerning geographical and cosmographic issues: Giacomo Gastaldi, whom we have already met; Gianbattista Ramusio, Secretary to the Senate and editor of reports on the discoveries; and Girolamo Fracastoro, physician, mathematician and cosmologist whose *Omocentrici* of 1538 'clearly demonstrated the inadequacy of eccentric orbits and epicycles in the Ptolomeic theory'.⁸² Ramusio dedicated the third volume of his *Navigazioni*, dealing appropriately with the New World, to Fracastoro; its maps were drawn by Gastaldi and its text published the reports on America upon which Bembo had drawn in his *Historia*.⁸³ Involved too was Gasparo Contarini whose contribution to the myth of Venetian constitutional perfection in *De magistratibus et republica Venetorum* 'was an essential part of the Grittiian renewal'.⁸⁴ The fruits of their discussions are seen in the commentaries written by Ramusio in the *Navigazioni*, some of which, like the debate on the inhabitability of the earth, we have already found in Bembo's writing. Among the issues that particularly fascinated the group were the sources and explanation of the Nile's annual flood, a question occasioned in part by Ptolemy's location of the Nile's sources in the Mountains of the Moon south of the equatorial line and the simultaneity of tidal movements in different locations across the globe.⁸⁵ The scientific conclusions are of less immediate interest than the fact that in both cases the concern was with cyclical renewal at a continental or global scale, evidence of harmonies at the intermediate Ptolomeic level. The issue of tidal movement also directly affected the nature and balance of the Venetian lagoon, a matter of considerable con-

cern in debates over *renovatio* and the subject in part of the polemic between Sabbadino and Cornaro at mid century.⁸⁶

After Bembo's death both Ramusio (together with his son Paolo) and Gastaldi, at this time sharing the same house in Venice, belonged to the Accademia della Fama (1557–61).⁸⁷ Tafuri has pointed to the critical significance of this short-lived Academy in the debates over *renovatio*.⁸⁸ The academy was a private affair, dominated by Frederico Badoer, whose declared aim was nothing less than 'to restore the golden age to the world: an objective that was pursued through a precise classification of subject matter and an almost obsessive concern for the thoroughness and universality of materials, above all for the definitive ordering'.⁸⁹ Among the 300 learned volumes published in fulfilment of this encyclopaedic vision was Ruscelli's Ptolemy, as well as Strabo's *Geography* and the planned Italian translation of a key Venetian Neoplatonic work, Francesco Giorgio's *De harmonia mundi*. These works and the presence of the Ramusios, Gastaldi, and the 'exquisite Tiepolo the Geographer/who knows every shape and place in the world'⁹⁰ served to locate geography and cartography at the heart of learned discourse among the political elite of Venice. Girolamo Ruscelli himself testifies to the close bond of humanist interest and geographical representation. In addition to his work on Ptolemy, which included detailed instructions on making terrestrial globes, he wrote extensively on Italian language and rhetoric, published Daniele Barbaro's *De eloquenza* as well as commentaries on Ovid, Boccaccio and Ariosto. His text of Ariosto's *Orlando Furioso* is illustrated with woodcuts which are often cartographic in nature, adopting the style of contemporary 'news maps' which illustrated battles and sieges against cartographic outlines of their locations (Fig. 7). The plate for Canto 15, for example, covers the whole of Africa and Southern Asia and is clearly based on Ptolemy's *tabulae*, updated by Renaissance discoveries.⁹¹ Ruscelli's Emblem book of 1580, *Le imprese illustri*, gives more specific evidence of his academic neoplatonic interpretation of geography and cartography. A number of the emblems he discusses contain terrestrial globes and celestial bodies. In discussing that of Henry II of France, Ruscelli represents man on the terrestrial globe looking towards the emperian and comments that man is placed in the middle point between the two spheres observing creation from a position close to the angels. Our bodies are on earth but our spirits are intended to rise through the circles of the heavens: '*di Cielo en Cielo, & di grado en grado fin a Dio, oltre il quale no si da progresso, & nel quale la mente nostra, & tutti gli Angeli, & Intelligenze si resposano perfettamente*'.⁹² It is a metaphysical vision familiar in Renaissance Neo-platonism and Hermeticism from Pico to Fludd.

Another member of the Accademia della Fama, the Sicilian mathematician Giuseppe Moletto (1531–88), teacher of Galileo, wrote a 'discorso universale' for Ruscelli's Ptolemy. Moletto's theme is the universal application of mathematical sciences to practical interventions in the world. His close friend was Nicolo Zen,⁹³ first *provveditore* of the Reclamation ministry. Zen himself exerted a powerful influence on the Grittian programme of renewal and in the first year of the Academy's life based his proposal for the great scheme of land reclamation at Monselice on the laws of the original creation of nature:

in the plan we should proceed in three stages in imitation of Almighty God, who in the construction of the world [*fabrica del mondo*] separated first the heavens from undifferentiated matter, then separated the earth from water and finally made the earth bear particular things: animals, trees and plants . . . Therefore in three divisions we may carry this scheme forward to completion.⁹⁴

Among the technical means to achieve this cosmogonic aim were maps and *disegni*, revealing the closeness of mapping to idealized planning based on cosmological principles.

The motto of the Accademia della Fama was '*Io volo al cielo per riposarmi in Dio*,' reminding us again that 'the scientific tendency, in the heart of the Accademia Venetiana, was accompanied by a revival of Hermetic and Neoplatonic studies proposed in translations into the vernacular'.⁹⁵ Through this characteristically Venetian association of the practical with the speculative we may see Venetian geography and cartography directly related to those cosmological themes which played so central a role in Venetian artistic culture throughout the sixteenth century.

Cartography, Venice: the universal and the local

The two great cartographers of sixteenth century Venice, Cristoforo Sorte and Giacomo Gastaldi, were essentially practical men. But they were by no means unaffected by the powerful

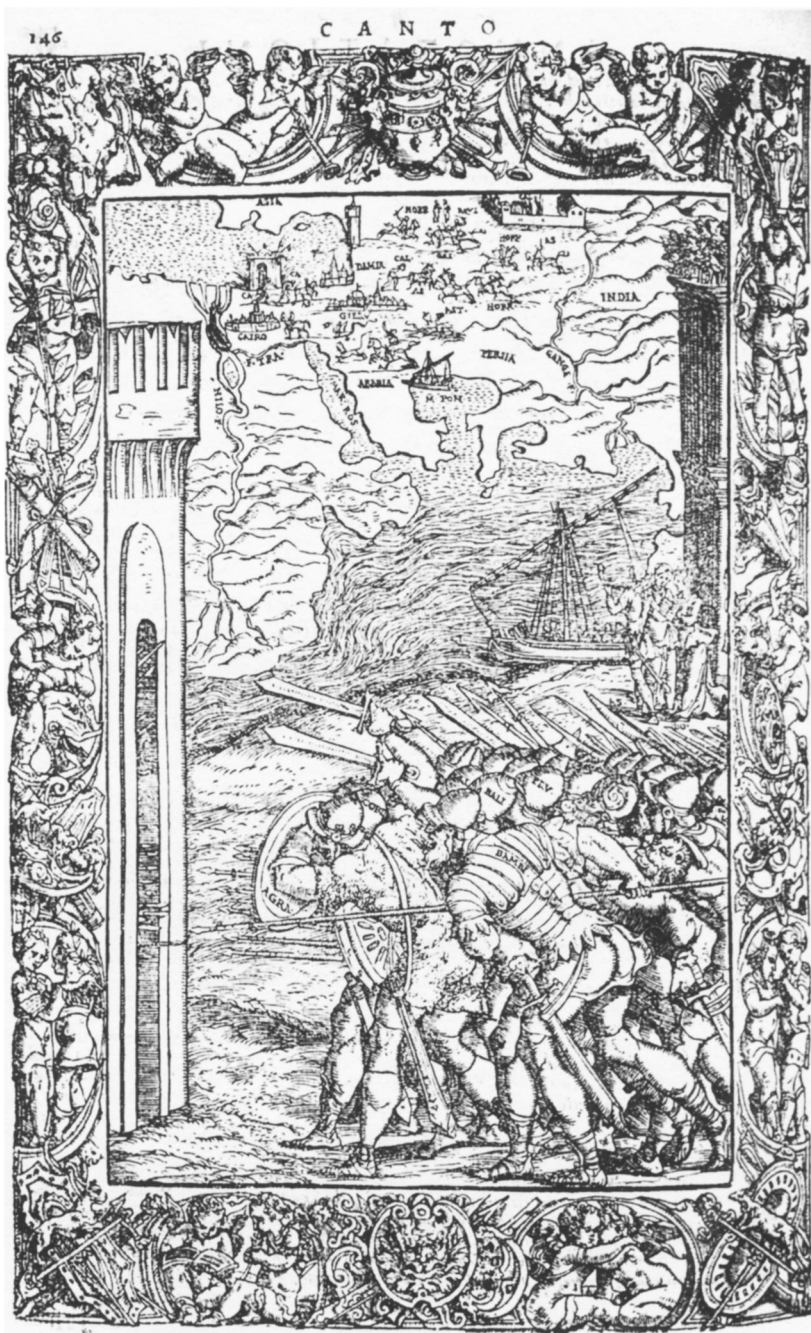


Fig. 7. Map of the Mediterranean, Africa and southern Asia (according to Ptolemy) by Girolamo Ruscelli. Engraving for Canto 15 in Ariosto's *Orlando Furioso* (Venetia, 1556), p. 146.

By courtesy of the Harry Ransom Research Center, University of Texas at Austin.

strain of speculation which informed cultural debate in sixteenth century Venetian culture. This is best observed in their two short texts: Sorte's *Osservazioni nella pittura* and Gastaldi's *Universale descrizione del mondo* which we have already related to chorography and geography respectively. In their different ways each reaches towards the idea of universal or cosmic perfection, linking it to the concept of cyclical renewal. Sorte's essay opens with an explanation of the origin of rivers which he argues that the sun's heat raises vapors from the earth which, as they rise, cool and condense into water which is deposited as rain and snow in the higher, cooler

regions of the mountains, thence flowing back to the sea.⁹⁶ Effectively he describes the hydrological cycle as we understand it today, challenging the Aristotelian notion of underground passages from the sea as the source of rivers which, in Sorte's words is 'against nature'.⁹⁷ The idea of cyclical renewal is picked up later in his lyrical description of the seasons, the clearest terrestrial evidence of harmony in nature.⁹⁸ In Gastaldi, too, the universal perfection of nature is underlined. His text opens with a description of how the elements combine to produce a perfect sphere:

The universal machine of earth and water, dense and heavy elements, in themselves are inferior to air and fire, rarer and lighter elements, and by their weight and density naturally gather at the centre of the world . . .⁹⁹

Because the waters fill the deep clefts and valleys of earth (the ocean beds) they serve to make a perfect sphere which in its passage with the sun produces the renewal of the seasons.¹⁰⁰ Gastaldi explains mathematically and scientifically what Sorte describes poetically, but in both texts the emphasis is on those notions of original cosmic perfection and cyclical renewal in nature which formed so strong an element in Venetian thought of the time.

Shifting from the universal to the local, we might also consider the shared fascination among both Venetian cartographers and thinkers with Mexico City, named Tenochtitlan or Temistan. Cortez's report of taking the Aztec capital was well known and the city's location at the center of a lake, supplied with fresh water by aqueducts, fascinated Venetians who saw this New World metropolis as a paradigm for Venice itself. On Agnese's world map of 1536 it is the largest city shown, occupying most of northern Mexico; on the *Carta Ramusio* (1534) and on Gastaldi's *Universale della parte del mondo nuovamente ritrovata* (1556) it achieves an almost equal prominence. Equally indicative are the idealized ground plans of Tenochtitlan. The earliest appears in Benedetto Bordone's *Isolario* of 1528 (four years after the original was printed in Nuremberg from Cortez's report to Charles V) and it forms the model for the plan published in the third volume of Ramusio's *Navigazioni* which clearly distinguishes two lakes, one fresh water, the larger salt water in which the city is built (Fig. 8). In a letter to Alvise Cornaro supporting his ideas for removing salt water from the lagoon Fracastoro proposed the transformation of Venice into a new 'Themestitan' isolated in a river-fed fresh water lake.¹⁰¹ Such renewal went beyond the limits imposed by nature which had made Venice originally perfect—as Sabbadino's criticism of Cornaro would make clear—but the proposal indicates the power of cartographic images in the Venetian discourse of *renovatio*. In the past Venice had variously been imagined as a second Rome, or Byzantium, or even Jerusalem: each of them sacred and eternal cities, *axes mundi* of the Old World around which the *harmonia mundi* turned: now it was to be imaged as a future Tenochtitlan, great city of the *New World*.

Conclusion

In the opening part of this paper I drew attention to Harley and Woodward's plea that we study the social implications of the varied form and matter of maps, defined as graphic representations facilitating spatial understanding of things, concepts, conditions, processes and events in the human world. The Ptolemaic conception of mapping may be regarded as one dimension of the greater Renaissance intellectual and representational revolution whose impact was working through Venetian culture in the early modern age. Environment, economy and historical experience meant that mapping was a form of representational discourse that Venetians understood and manipulated with ease in the interlocking spheres of practicality and philosophical speculation. From the universe as a whole, through the geographical spaces of a terrestrial globe dramatically opened up by navigation, to the specificity of individual places and landscapes, mapping offered a unified representational field for Venetian reflections on space, time and nature. Philosophically, the Ptolemaic hierarchy may be seen as the spatial equivalent of the temporal classification: *prudencia*, *novitas* and *origine*. This tripartite reading of space and time structured a central debate of sixteenth century Venetian culture: how to relate the unique place and history that was sixteenth century Venice to a universal space and time that spoke of God's immanence in the world.¹⁰² At each scale the practice of cartography represented nature (*Natura*) which, for Venetians, 'in its several senses essentially meant the materialization of God's creative power—the sacred quality inherent in the real, profane world'.¹⁰³ At the chorographic scale mapping overlapped with landscape painting in repre-



Fig. 8. City of Temistitan from G. B. Ramusio's *Navigazioni et Viaggi*, 3 (Venezia, 1556).
By courtesy of the Biblioteca Marciana, Venice.

senting the natural world and its rhythms, as we have seen in Sorte's work. At the global scale, the unity as well as the environmental and anthropological variety of the habitable world was being revealed by Gastaldi's, Sanuto's and Rosaccio's geographical maps. In the world of Fracastoro and others the perfection of the cosmos itself was being interrogated. Put another way, in sixteenth century Venice the universality of the *harmonia mundi* was made visible through concepts of mapping, and carried towards the discovery and creation of new, more perfect worlds partly through the ideal of planning implicit in cartographic practice.

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17. Campbell, T., 'Portolan charts from the late thirteenth century to 1500,' in *The History of Cartography*, I, pp. 371–463; Biadene, S., (ed) *Carte da navigar: portolani e carte nautiche del Museo Correr 1318–1732* (Venezia: Marsilio, 1990).
18. *Laguna, lidi, fiumi: cinque secoli di gestione delle acque* (exhibition catalogue), Archivio di Stato di Venezia (henceforth ASV), (Venezia, 1983).
19. ASV Misc. mappe 912, reproduced and discussed in Romanelli, F. C., and Moresschi, E. C., *Laguna, lidi, fiumi: esempi di cartografia storica commentata*, ASV, Venezia, nd., 67–69. See also the parchment map of the Polesine water course system dating from c1600 now in the Humanities Research Center at Austin, Texas, (Krauss, M. P., *Monumenta cartographica*, Catalogue 124, New York, No. 20).
20. Caniato, G., and Dal Borgo, M., (eds), *Dai monti alla laguna*, La Stamperia; Venezia (1988).
21. From the point of view of cartographic collections, the most important of these ministries (*magistratura*) were the *Savi ed esecutori alle acque*, *Provveditori sopra i beni inculti*, *Provveditori sopra i beni comunali*, *Camera ai Confini*, *Provveditori sopra la fortezza*, and the *Provveditori sopra boschi*.
22. Hale, J., *War and Society in Renaissance Europe 1450–1620*, (London: Fontana, 1985). Actual battles were frequently recorded on 'news maps' showing the disposition of forces against a cartographic background. Many are bound into the print atlases discussed below.
23. Schulz, J., 'Cristoforo Sorte and the ducal palace of Venice,' in *Mitteilungen des kunsthistorischen institutes in Florenz*, 3 (1962), pp. 193–208; 'New maps and landscape drawings by Cristoforo Sorte,' *Mitteilungen des kunsthistorischen institutes in Florenz*, 20 (1976), pp. 107–26.
24. Tafuri, *Venice and the Renaissance*, p. 109.
25. Dilke, O. A. W., 'Cartography in the Byzantine empire' in *The History of Cartography*, I, p. 269.
26. Milanese: *Ptolomeo sostituito*, 33. A key figure in diffusing information on the Atlantic navigations was Gianbattista Ramusio, whose work is discussed below.
27. Woodward, D., 'Medieval *mappaemundi*,' in *The History of Cartography*, I, pp. 286–370.
28. Schulz, 'Jacopo de'Barbari's view of Venice,' pp. 448–53.
29. Bevilacqua 'Geografi e cosmografi,' p. 359.
30. Woodward, 'Medieval *mappaemundi*,' p. 316.
31. Edgerton, 'From *mappa mundi* . . .'
32. De 'Barbari was an early example of the Venetian engraver who produced not only cartographic images but mythological and religious images also. See for example his representation of Apollo astride the celestial globe, adopting that Olympian perspective that the world map according to Ptolemy required of the cartographer, famously celebrated in the dedicating verse to Ortelius' *Teatrum Orbis Terrarum*: 'Ortelius, quem quadrijugo super aera corru Phoebeus Apollo vehi secum dedit, unde iacentes Lustaret terras circumfuseumque profundum.'
33. Schulz, 'Jacopo de'Barbari's view of Venice,' p. 468. The concept of a 'moralized geography'

- did not die away with the apparently secular grid of the Ptolemeic map. It continued explicitly in the cartographic association of the continents with the sons of Noah, the location of the earthly Paradise in E. Asia, and of the Kingdom of Prester John in Africa. More subtly, a moralized geography is implicit in the syncretist cosmology which so closely associated with the Ptolemeic hierarchy discussed throughout this paper.
34. Harvey, P. D. A. 'Local and regional cartography in medieval Europe,' in *The History of Cartography*, I, pp. 464–501, quote on 480.
 35. Biadene (ed), *Carte da navigar*.
 36. Bevilacqua, 'Geografi e cosmografi,' pp. 364–65.
 37. Woodward, *Paolo Forlani*, the distinction between workshops is itself difficult to make since plates changed hands and were re-engraved so that more than one name frequently appears on a single print.
 38. Baxandall, M., *Painting and Experience in Fifteenth Century Italy: A Primer in the Social History of Pictorial Style*, (Oxford: Oxford University Press, 1972); M. Kemp; *The Science of Art: Optical Themes in Western Art from Brunelleschi to Seurat*, (Cambridge, Cambridge University Press, 1990).
 39. Pacioi, L. *Summa di arithmetica, geometria, proportion et proportionalità* (Venezia, 1494); Feliciano, F., *Libro d'arithmetica, e geometria speculativa, e practice* ('Scala grimaldelli') (Venice, 1518). See also Lepori, F., 'La scuola di Rialto dalla fondazione alla metà del cinquecento,' *SCV*, 3/II, pp. 539–605.
 40. Bartoli, C., *Del modo di misurare le distantie, le superficie, i corpi, le piante, le provincie, le prospettive, e tutte le altre cose terrene, che possono occorrere a gli huomini. Seconda le vere regole d'Euclide, e de gli altri più lodati scrittori*, (Venezia: Sebastiano Combi, 1564); Belli, S., *Libro di misurar con la vista . . .* (Venezia: Domenico Nicolai, 1565); idem: *Della proportion, e proportionalità, Communi passione del quanto libri tre*, (Venezia: Elefanta, 1573); Tartaglia, N., *La nova scienza, con un giunta al terzo libro*, (Venezia: Bascari, 1543).
 41. Schulz, 'Jacopo de'Barbari's view of Venice,' 462; P. Fortini-Brown: *Venetian Narrative Painting in the Age of Carpaccio*, (New Haven and London: Yale University Press, 1988). As we shall see, the ideal significance underlying the Barbari map remained powerful throughout Venetian sixteenth century cartography and the discourse surrounding it.
 42. Milanese, *Ptolomeo sostituito*, takes as her main theme the dialogue between the classical authority of Ptolemy and the new evidence emerging from the navigations.
 43. Reproduced in Biadene, *Carte da navigar*.
 44. Ramusio, G. B., *Navigazione et viaggi*, 3 Vols., (Venezia: Giunti, 1550, 1559, 1553).
 45. See fn. 13, 14 above.
 46. Ruscelli, *La geografia di Claudio Ptolemeo*, 1574 edn., text accompanying the 'Tavola universal nova, con discriptione di tutto il mondo.'
 47. Referred to as 'Lafreri' atlases after the name of a Roman print publisher, a number of these 'atlases' are known. See Ronald Vere Tooley: 'Maps in Italian atlases of the sixteenth century, being a comparative list of the Italian maps issued by Lafreri, Forlani, Duchetti, Bertelli and others, found in atlases,' *Imago Mundi*, 3, (1939), pp. 12–47.
 48. Bevilacqua, 'Geografi e cosmografi,' 365.
 49. See fn 22 above; L. Pagani: 'La tecnica cartografica di Cristoforo Sorte,' *Geografia*, 2, 2, 1972, 82–93.
 50. Schulz, 'New Maps.'
 51. Sorte, C., *Modo di irrigar la campagna di Verona e d'introdur più navigazione per lo corpo del fedelissimo stato di Venezia*, (Verona: Girolamo Discepolo, 1593).
 52. Sorte, C., 'Osservazioni nella pittura' (1580), in P. Barrochi, *Trattati d'arte del cinquecento: fra manierismo e contrariforma*, Vol. I, (Bari: Laterza, 1960); Gombrich, E. H., 'The Renaissance theory of art and the rise of landscape' in idem, *Norm and Form: Studies in the Art of the Renaissance*, (London: Phaidon), pp. 107–21, ref. on p. 118.
 53. A number of maps carrying the title *Totius orbis descriptio* are attributed to Gastaldi and he wrote more than one text describing world geography: *La universale descrizione del mondo*. Two copies of this booklet are in the Marciana library at Venice (1561 and 1562) and a later, modified text in the British library (1565) which is used for quotation here. A similar text appears on the larger wall map of America now in the collection of The University of Texas at Austin, one of a set of four continental maps published by Bertelli from Gastaldi's and Abraham Ortelius' cartography (Kraus, *Monumenta Cartographica*, No. 12).
 54. Rosaccio Guisepppe, *Universale descrizione di tutto il mondo*. Venice: Mazza, 1597) and reprinted with variations regularly until c1650. The earliest copy is in Harvard (Kraus: *Monumenta Cartographica*, No. 24).
 55. Harley, J. B., and Woodward, D. (from materials supplied by G. Aujac): 'The foundations of theoretical cartography in archaic and ancient Greece,' *The History of Cartography*, I, pp. 130–47, ref. on 136.
 56. See fn. 39 above. Pacioi's book was dedicated to Marco Sanuto, uncle of Giulio Sanuto's father.
 57. Pacioi, *Summa d' arithmetica*, 2v.
 58. Pacioi, *Summa d'arithmetica*, 2r.
 59. Lepori, 'La scuola di Rialto dalla fondazione alla metà del cinquecento,' *SCV*, 3/II, pp. 598–600; Tafuri, *Venice and the Renaissance*, pp. 62–65, regards the concept of the *harmonia mundi* to be a consistent and central theme in Venetian intellectual culture in the sixteenth century. Of the platonist group surrounding Achille Bochi at Bologna, including Sabastiano Serlio and Giulio Camillo, and its influence in Venice, he says 'the theme is God's immanence in the entire universe' which could lead to a pantheism which dictated the religious duty of mystical union with God in the firmament, leaving behind the world of illusion and thus of sin. In the syncretic philosophy of neoplatonism, hermeticism and cabbalistic thought such transcendence was often thought to be achieved through contem-

- plation of numbers and sacred geometry, thus closely associated with techniques essential to Ptolemeic cartography. We should also remember the motto of the Accademia della Fama, of which major Venetian cartographers were members, quoted below: 'Io volo al cielo resposarmi in Dio.'
60. 'The enthusiasm with which the patrician public received the Neoplatonism of Fra Luca should be emphasized.' Tafuri, *Venice and the Renaissance*, p. 27. See also fn. 16 above.
 61. The theme of Silvio Belli's work, *Libro di misurare* is precisely the use of direct sight in a range of geometrical arts.
 62. Kristeller, *Renaissance Thought and the Arts*; Panofsky, E., 'The neoplatonic movement in Florence and north Italy, in *Studies in Iconology: Humanistic Themes in the Art of the Renaissance* (New York: Harper and Row, 1972), pp. 129–69.
 63. Tafuri, *Venice and the Renaissance*, 102ff.
 64. Tafuri concentrates mainly on architecture or, more broadly the *res aedificatoria* which included survey, civil engineering, etc., extending the Vitruvian concept of architecture to promote it as a liberal art concerned with establishing fundamental causes: 'the *res aedificatoria* acquired a symbolic meaning that went beyond the praxis of building: it sought to mediate between a branch of knowledge that concerned the 'reasons' of the divine *harmonia mundi* and a mode of action that emphasized the human environment, with the aim of rationalizing or 'restoring' the Rule' (Tafuri, *Venice and the Renaissance*, p. 103). My argument here is that mapping could be regarded in very much the same way. In large measure of course cartography was itself necessary to the *res aedificatoria*.
 65. Gaeta, F., 'L'idea di Venezia' in *SCV*, 3/III, pp. 565–641.
 66. Tafuri, *Venice and the Renaissance*, 10ff. Significantly in terms of the idea of renewal the opposing camps in this debate termed themselves *vecchi* and *giovani*.
 67. Tafuri, *Venice and the Renaissance*, 11; Tenenti, A., 'The sense of space and time in the Venetian world of the fifteenth and sixteenth centuries,' in Hale, J., (ed), *Renaissance Venice*, (London: Faber and Faber, 1973), pp. 17–46.
 68. Tafuri, *Venice and the Renaissance*, p. 12.
 69. The cave may be seen as an origin point either by reference to Plato's famous image of the cave in which the shadows of the phenomenal world are seen, or because of the possible location of Christ's nativity in a cave, a reading which fits better with the interpretation of the three figures as the Magi. In the painting the cave has a fig branch shooting new leaf, another symbol of Christ's birth. Of course, in a Hermetic context the union of Platonic and Christological symbolism is not contradictory.
 70. That the young man should be taking a celestial bearing would fit better with the astrological chart held by the oldest of the figures and again with group as the Magi.
 71. Sorte, 'Osservazioni,' pp. 288–89; Cosgrove, 'The geometry of landscape,' pp. 265–68.
 72. Kristeller, *Renaissance Thought and the Arts*, pp. 174–75.
 73. Tafuri, *Venice and the Renaissance*, pp. 108–109.
 74. Kristeller, *Renaissance Thought and the Arts*, pp. 178–89.
 75. Mazzacurati, G., 'Pietro Bembo,' in *SCV*, 3/II, 1–59; Pietro Bembo: *De Aetna, il testo di Pietro Bembo tradotto e presentato da Victoria Enzo Alferi* (Palermo, 1981).
 76. Grande, S., 'Le relazioni geografiche fra P. Bembo, G. Fracastoro, G. B. Ramusio, G. Gastaldi,' *Società geografica italiana, memorie*, 12, (1905), pp. 93–197, esp. pp. 169–71.
 77. Bembo's explanation of the eruption of Etna and the different materials emerging from the main crater and subsidiary vents is based upon a theory of underground passages and caverns within the earth through which sea water and air penetrate, their mixture heating the sulphur and producing pressures which are variously released. This is based on Aristotelian science and may be compared with Sorte's more 'modern' explanation of the hydrological cycle (see below, fn. 86).
 78. Bury, M., *Giulio Sanuto: a Venetian Engraver of the Sixteenth Century*, p. 7.
 79. Bembo, P., *Della historia vinitiana libri XII* (Venetia, Giordani Ziletti, 1570), Book 6, 73r.
 80. Bembo, P., *Della historia vinitiana*, Book 6, 76r.
 81. Tafuri, *Venice and the Renaissance*, p. 110.
 82. Grande 'Le relazioni geografiche,' p. 99. Fracastoro was in correspondence with Copernicus, although he did not accept the Copernican theory. He was also author of the most comprehensive sixteenth century treatise on the new malady so closely associated with the New World: syphilis, whose scourge represented the dark side of American utopia. See Crosby, Jr., A. W., *The Columbian Exchange: Biological and Cultural Consequences of 1492*, Westport, Conn.: Greenwood Press, 1972), 125ff.
 83. Grande, 'Le relazioni geografiche,' 105–106; see also Milanese: *Ptolomeo sostituito*, p. 209ff.
 84. Tafuri, *Venice and the Renaissance*, 108; Bouwsma: *Venice and the Defense of Republican Liberty*, pp. 144–53.
 85. Grande, 'Le relazioni geografiche,' 120–22, 125–31.
 86. Tafuri, *Venice and the Renaissance*, 139–60.
 87. Grande, S., *Le carte d'America di Giacomo Gastaldi*, (Torino: Carlo Clausen, 1905), p. 69.
 88. Tafuri, *Venice and the Renaissance*, p. 114ff.
 89. Tafuri, *Venice and the Renaissance*, p. 117.
 90. The lines are taken from *Amadigi* by Bernado Tasso which outlines the membership of the Accademia della Fama, quoted in Tafuri: *Venice and the Renaissance*, pp. 120–21.
 91. Ruscelli, Girolamo, *Della eloquenza Dialogo del Reverendis. Monsignor Daniel Barbaro*, (Venezia: Vincenzo Valgrisi, 1557); idem. *Annotationi et avvertimenti di Girolamo Ruscelli sopra i luoghi difficili et importanti del Furioso* (Venetia: Vincenzo Valgrisi, 1558).

92. Ruscelli, Girolamo, *De imprese imprese illustrati con espositioni, et discorsi . . .*, (Venetia: Francesco di Francesci, 1580), 29v.
93. Nicolo Zen was a key figure in the debate over the destiny of the Republic in the mid-sixteenth century. Moletto refers to Zen's collection of globes and maps, dedicating his commentaries in the Ruscelli Ptolemy to Zen's daughter and leaving to her in his will 'il mio Teatro del mondo colorito che mi fu lassato dal Sig.^r Nicolo.' See Tafuri, *Venice and the Renaissance*, pp. 7–8, 121 and 247, fn. 97. In his Ptolemy of 1574 Ruscelli published a *carta di navigare* of the North Atlantic derived from the navigation of Nicolo and Antonio Zen in 1380 which he claims to have received from their direct descendent Nicolo whom he praises as a geographer and a cartographer.
94. Zen, N., 'Termine del ritratto di Monseliche' (1557), reprinted in *Il summario di tutte le legge et parti ottenute nel illustratissimo et serenissimo senato in materia delle beni inculti*, (Venezia: Griffio, 1558).
95. Tafuri, *Venice and the Renaissance*, p. 119.
96. Sorte, 'Osservazioni,' pp. 279–81.
97. Sorte, 'Osservazioni,' p. 281; it is interesting to note Sorte's caution in challenging Aristotle at this time of post-Tridentine intellectual repression: 'Nulladimeno, essendo commune parere () che i fiumi principalmente derivino da esso mare, tutto che nelle caverne e spelunche degli altissimi monti e lontano da' liti incomincino a dimostrarsi sopra della terra e correre ad esso mare, et essendo noi christiani e catolici, debbiamo accostarsi a quella opinione che più piace ai santi teologi di nostra Chiesa . . .'
98. Sorte, 'Osservazioni,' pp. 288–89.
99. Gastaldi, *Universale descrittione del mondo* (1565), Alv.
100. The similarity to Copernicus' view of the spherical perfection of the elements is clear here. On the impact of new maps, especially of the New World on Copernicus' thinking which is remarkably close to Gastaldi's, see W. Voise: 'The great Renaissance scholar' in Bienkowska, B. (ed), *The Scientific World of Copernicus* Dordrecht-Boston: Riedel, 1973) pp. 84–94, esp. p. 89: 'Other maps that began to appear with the beginning of that century represented a different picture of that world. They took account of other continents, including Africa and the just discovered America. It was now more difficult to think of our continent as an 'Earth Island' occupying a special position in the hydrous sphere and surrounded by heterogenous spheres. With this picture of the universe in mind, Copernicus was able to imagine the Earth as a homogeneous spherical heavenly body composed of two fundamental elements (water and land). In support of this thesis he pointed to the new geographical discoveries.' We should recall Fracastoro's correspondance with Copernicus as well as his (Fracastoro's) closeness to Gastaldi. As with Sorte, the Aristotelian universe is challenged by Gastaldi's adoption of a similar thesis to Copernicus.
101. Tafuri, *Venice and the Renaissance*, p. 152.
102. Tafuri, *Venice and the Renaissance*, p. 65.
103. Steinberg and Wylie, 'Counterfeiting nature,' p. 81.