



cartographic perspectives

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Letter from the Editor

Dear NACIS Member:

This issue, *CP46* marks the 9th issue under my guidance as editor. It is also the 3rd and final issue for 2003. And, it is the punctuation mark defining my first three-year term as editor of *CP*. I have been invited by the NACIS Board to serve at least one more year as editor of *CP*, a task that I am delighted to continue, especially considering that all three issues for 2004 are planned and are at various stages of production. *CP* is back on publication schedule, a fact that should continue into the near future.

There are a number of changes that have taken place over the past three years that have helped *Cartographic Perspectives* arrive at this desired destination. First is the awesome support of a strong and capable editorial board. Manuscripts are now being reviewed within 4 weeks of their receipt.

(continued on page 3)

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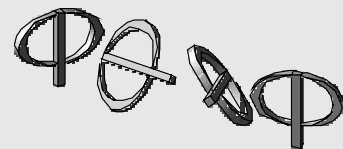
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about the cover



The cover image was created by Matt Knutzen, artist, cartographer and Assistant Chief Librarian of the Map Division of the New York Public Library.

Reviews are rigorous, with plenty of insightful commentary. Article submissions have increased—there were 20 submissions this past year! With increased article submissions, *CP* is able to be more selective as to the papers that grace its pages. For this, I thank my editorial board.

I also thank my fellow editors Ren Vasiliev, Charlie Frye, Jeremy Crampton, Mathew McGranaghan and Melissa Lamont. Their timely contributions have helped *CP* to prosper. The critical cog in this publication process, though, is Jim Anderson (and Lou Cross). Jim has weathered my constant emails, my continual requests for progress reports, my predilection to deviate from “how we typically do things”, and my drive to get *CP* on publication schedule. Thank you Jim!

This issue also marks the end of several appointments on the editorial board, as well as the tenure of three section editors. Leaving the editorial board are Gary Allen, Aileen Buckley and Matthew McGranaghan who served one three-

year term, Carolyn Weiss and Jeremy Crampton who served two three-year terms, and Mike Peterson who not only served the past three years on the board, but also was the past editor of *CP*. Matthew McGranaghan is also leaving his post as Opinion Column Editor, as is Jeremy Crampton who served as Online Mapping Editor for two terms. And finally, Melissa Lamont is leaving her post as Map Library Bulletin Board Editor for which she served for two terms. I thank each of you for your unique contributions to *CP*.

In addition to these accomplishments, *CP* obtained an official copyright with the Library of Congress beginning with the 2002 volumes of *CP*. In 2003 the beautiful “carto” artwork of Matt Knutzen from the New York Public Library began to grace the cover of our journal...a change that very much sets our journal apart from all others. During the past year, *CP* also entered into a relationship with a printing company that enables us to publish in color in every issue of *Cartographic*

Perspectives and remain under budget.

A change that is on the horizon for *CP* concerns indexing. *Cartographic Perspectives* is currently indexed in *Current Geographical Publications* of the AGS in Milwaukee, and in *GEOREF*, which is maintained by the American Geological Institute. Indexing, of course, provides greater exposure of published work. The editors of *CP* are looking into having *CP* indexed by *GEOBASE* at Elsevier, which would be the most effective indexing database for *CP*.

All of these changes increase the profile of *Cartographic Perspectives*, helping to build a more prestigious journal that has a broad and diverse readership. I look forward to another year as editor of *CP*, and as always, welcome comments and suggestions about your journal.

Warmest Regards,

Scott Freunds Schuh, Editor

Barrington Atlas of the Greek and Roman World: the Cartographic Fundamentals in Retrospect

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Background

In time, space or purpose, the prospect of any close link between the *Barrington Atlas of the Greek and Roman World* [1] and the *Historical Atlas of Canada* [2] might seem remote indeed. As editor of the former, however, I instantly realized otherwise when first encountering the reflections of the director (Dean) and two editors of the latter (Cole Harris, Holdsworth) on their experience published in *Editing Early and Historical Atlases: Papers given at the 29th annual conference on editorial problems, University of Toronto, 5-6 November 1993*. [3] Naturally, to learn that in a quite different field others before you had wrestled with similar dilemmas, and had chosen to resolve them in broadly similar ways, is not enough to place your own choices beyond reproach. But such a discovery does offer reassurance; it acts to relieve a depressing sense of isolation, and demonstrates that your own painful choices need no longer be regarded as merely idiosyncratic.

At first glance, to be sure, when set against the *Historical Atlas of Canada* and most other modern atlases, the *Barrington Atlas* may well seem out of step with current trends: it emerges from a historical field where for decades there had been no more than scant regard for cartography, [4] and it presents maps of physical and cultural landscape rather than of themes. Among scholars of classical antiquity worldwide, it was in fact the leading North American professional organization in the field, the American Philological Association, which first specifically articulated the need to reintroduce the cartographic dimension to the study of ancient history. The recommendation dates to 1980, and stems from a specially commissioned effort to identify research tools of outstanding potential value to the discipline, but lacking at that date:

“... an area of extremely great importance, where the state of our tools is utterly disastrous, cartography.”

“We come, finally, to an area of extremely great importance, where the state of our tools is utterly disastrous, cartography. There is hardly anything more important to understanding ancient history than a clear conception of the terrain on which its events took place. But the best available maps, the old Kiepert ones, are virtually unavailable, and nothing really useful has become available for most areas in the last few decades. The *Tabula Imperii Romani* proceeds at a snail's pace, parcelled out among the modern countries its sheets cover (not always those where the best scholars for the purpose are found) and appearing, when it does, in different styles everywhere. A concerted attempt to produce a uniform series of maps which show both the topography – with all the sophistication of modern cartography – and the ancient toponyms – with the accumulated knowledge of classical scholarship – would be immensely valuable.” [5]

Heinrich Kiepert (1818-1899), to whom the recommendation refers, had been the most active cartographer of the Greek and Roman world in the nineteenth century, and the production of the great atlas, *Formae Orbis Antiqui*, which he intended to be the climax of his life's work was even

continued after his death by his devoted son and fellow cartographer, Richard (1846-1915). Nonetheless, only just over two-thirds of its planned comprehensive coverage had been completed on the latter's death; nothing more was issued. [6] The maps never achieved wide circulation, and by 1980 they were hopelessly outdated in many key respects. A wealth of new discoveries and advances in scholarship had occurred during the intervening sixty-five years. Moreover even at the small scales typically adopted, the grasp of physical landscape reflected for many regions – especially elevations inland – was limited, indeed sometimes non-existent (aerial mapping lay in the future). For production, the strong preference was still for printing from an engraved copperplate rather than resorting to lithography.

Between World War I and 1980, fresh initiatives for mapping the Greek and Roman world were badly lacking, so that in fact the last completed major classical atlas remained the even older *Atlas of Ancient Geography Biblical and Classical*, edited by William Smith (1813-1893) and published by John Murray, London, in 1872-1874. This remarkable work, however, was so rare as to be all but forgotten after World War I. [7]

The one initiative to hold out some promise was that cited in APA's recommendation, the *Tabula Imperii Romani* (TIR), an international project to map the Roman empire. Proposed by O.G.S. Crawford in England at the end of the 1920s, it was a visionary scheme to mark Roman cultural data on physical bases furnished by the relevant fifty-six sheets of the (then developing) International Map of the World series at 1:1,000,000 scale (IMW). This TIR project is still ongoing in fact, [8] and it has unquestionably done some excellent work, albeit sporadically. However, the scholarly community worldwide was slow to recognize that it suffered from some fundamental flaws which even today have yet to achieve resolution. In consequence, therefore, the hope that TIR would furnish an adequate series of maps for the classical world persisted for too long, and discouraged efforts by others, when in reality all such hope was unjustified. In particular, clear editorial policies for the maps were never established, so that the categories of data to be marked on them, and the precise conventions to be adopted, were never defined, let alone adequately regulated by a coordinator. At the same time, the project's structure has always required that only a committee appointed by the modern nation whose territory occupies the major part of the requisite IMW sheet possesses the authority to issue it in the TIR series. If, therefore – as all too often occurs – the nation concerned shows no interest in sponsoring the sheet, even when others with territory there are willing to proceed, a lock is placed on progress in that region. Predictably enough, ever since the 1920s modern nations – for all kinds of reasons – have varied in the degree of their willingness to sponsor TIR sheets. As a result, even today, the coverage achieved is patchy (no more than approximately one-third complete), lacking in uniformity, and unlikely ever to attain the project's final goal without radical change.

APA's recommendation in 1980, with its firm rejection of any further reliance on the hope that TIR might soon furnish adequate maps of the classical world, was a bold and vital step forward. Even so, for some years thereafter, progress on the fresh initiatives that APA set in motion was disappointing. A bibliographic survey *Map Resources for the Greek and Roman Worlds*, with fifteen regional sections, was commissioned, but never achieved completion and publication. Meantime, for a range of reasons – conceptual, organizational, financial, personal – a project to plan and produce a major atlas was wound up in 1987, with nothing attained.

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“. . . clear editorial policies for the [TIR] maps were never established, so that the categories of data to be marked on them, and the precise conventions to be adopted, were never defined, let alone adequately regulated by a coordinator.”

“... APA’s committee . . . and other interested colleagues still had no agreed vision of precisely what mapping should be attempted, how it should be undertaken and within what timeframe, what it was likely to cost, where the funding would be found . . . and how the results should best be disseminated.”

“In short, what I needed to address, to use Dean’s term, was ‘atlas structure’ . . .”

It was against this somber background that I was approached by APA’s Vice-President for Research in December 1987 and was asked to launch a complete fresh start on the planning and production of an atlas. From APA’s perspective, the approach made sound sense. I had gained some unique relevant experience from the production of a modest textbook *Atlas of Classical History*, involving twenty-five collaborators (all in the British Isles) and published in 1985. [9] It was only in the same year that I emigrated to North America, so that I had no prior engagement with, or even knowledge of, APA’s failed ventures into cartography to date. From my perspective, APA’s invitation was daunting, yet both intriguing and timely. On the one hand, it so happened that within the previous three years I had finished both the textbook atlas and another short book, as well as a third very long one, and I had not yet settled upon a further major project. I was keenly aware of the lack of a major classical atlas, and the urgent need for one. On the other hand, what APA envisaged was clearly something far larger, more ambitious and more costly than the textbook atlas; many of its maps consisted just of outlines, and all had been limited by a minuscule budget.

Personal considerations aside, at this point the prospects of providing APA with the successful outcome it sought could hardly have seemed bleaker. Some manifestly idealistic and impractical ideas were aired at our initial meetings. But the fact was that, even by now after several years, APA’s committee members and other interested colleagues still had no agreed vision of precisely what mapping should be attempted, how it should be undertaken and within what timeframe, what it was likely to cost, where the funding would be found (although APA did pledge support in the search), and how the results should best be disseminated. If nothing else, then, I was being offered an extraordinarily open opportunity to create and develop a major work of lasting value. To be sure, there were immense risks of every kind in prospect, and naturally APA’s approval would be essential for whatever plan was formulated; but for a reasonably practical proposal such approval might now be easier to secure while the memory of recent failures was still vivid. So all in all it seemed that I had little to lose by agreeing to work for APA – another failure would be no surprise either; indeed, many expected just that – and hence I succumbed to the temptation. In retrospect I could echo Cole Harris’ reflections on agreeing to edit Volume 1 of the HAC:

“The lesson, presumably, is not to underestimate the work in a major atlas, and yet, had I not been optimistic, I would never have agreed to edit this volume, while SSHRCC, had it known what lay ahead, probably would never have funded us. A measure of naïveté may be necessary to launch historical atlases.” [10]

Framework

The initial year and a half (early 1988-mid 1989) I spent trying to determine the most satisfactory solution to the network of fundamental unresolved questions outlined in the previous paragraph – the entire network, let it be stressed, because the questions were inextricably linked, and adoption of the most desirable solutions to some might simply not take adequate account of others. In short, what I needed to address, to use Dean’s term, was ‘atlas structure’, “those elements which give an atlas direction, purpose, and appearance. In other words, [‘atlas structure’] is the framework whereby atlas maps are selected, designed, drawn, and arranged.” [11]

During this initial phase the full force of what was lacking struck me. Altogether, the part of the globe over which Greeks and Romans had settled, fought and traded was vast, stretching from the British Isles to North Africa and eastwards to Sri Lanka. Detailed maps of large segments of this total area as they were during classical antiquity (however its timeframe was to be defined, another key issue) had never even been attempted, east of the Mediterranean especially. Elsewhere the coverage, such as it was, remained most unsatisfactory. For most of the Iberian peninsula and Gaul, as likewise for Italy and Greece – the heartlands of classical civilization – the only detailed maps predated World War I, and many adopted very small scales. It was this realization of how shockingly poor a grasp our discipline had of the geography of its world – an aspect never in doubt, naturally, for the planners of the HAC – which determined me to make physical and cultural landscape the main focus of my effort for APA. I was aware that an ongoing project of tangential significance – the *Tübinger Atlas des Vorderen Orients* (TAVO) – had chosen differently. [12] The maps in its most relevant sections (B IV, V and VI) are primarily thematic, and valuable as such. But by definition anywhere west of the Aegean falls outside TAVO's scope, and more generally my view was that the establishment of a clear overall sense of geography ought to precede a major effort at thematic mapping. Rather, the latter can, and should, build on the former.

I formed the view, therefore, that the appropriate goal for what would become the *Barrington Atlas* [13] was coverage of the physical and cultural landscape across the *entire* vast span of territory encompassed by Greek and Roman civilization. Even at this preliminary stage it was obvious that much other mapping could usefully be attempted, but it was also self-evident that such efforts might prove over-ambitious. The main goal alone, I estimated, would take perhaps a decade to achieve, and would in all likelihood suffice to exhaust the energy and enthusiasm of all those involved (myself included), not to mention sources of funding. Further initiatives were better kept separate and subsequent to achievement of the main goal, especially in view of the urgent need for such basic maps.

The longterm mapping projects best known to me – Kiepert's *Formae*, *TIR* and its equivalent *Tabula Imperii Byzantini* for the Byzantine world, [14] as well as TAVO – all issued their maps in loose sheet form, either individually or in fascicles, as they proceeded. Inevitably, this practice leads to some inconsistency in presentation, deters private buyers, and requires libraries to limit access to items that are so fragile (the more so when issued folded) and easily removed. My wish for the *Barrington Atlas*, by contrast, was for it to be a sturdy single volume, large in size although not unwieldy, and available at a price within the range of private buyers, high though the cost would have to be. The presentation must be attractive, in a contemporary style, and aimed at a circle of users and purchasers extending well beyond a narrow, introverted specialist group. To charge, say, upwards of U.S. \$1,000, therefore (the level of pricing set by TIB and TAVO, for example), would so restrict circulation of the project's results as to undermine its very purpose.

A single volume would unmistakably highlight the sheer span and diversity of the Greek and Roman world. Moreover it could incorporate the comprehensive gazetteer that none of the other projects mentioned was at that date in a position to furnish. This said, the wish for a single volume created additional risk because so long as even a single map for it remained unfinished, the work could not proceed to press; meantime the completed components would simply have to be suspended in limbo, to the intense frustration of those colleagues who had contributed them.

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Partners

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At this initial stage it was far from clear to me how an atlas of this scope and nature was actually to be created. What quickly did become evident, however, was that I should not even attempt to proceed further without engaging two key partners, a publisher and a cartographer. Both APA and any potential contributor of major funding had to be satisfied from the outset that publication of the project's results was assured. In addition, there is no means of laying out the maps for an atlas until the basic format of the volume is securely established, and this of course must be an initial step that cannot be postponed till later (as it typically is with a work that is primarily text). I approached four leading North American university presses, and was in turn approached by a fifth. Since all showed interest, the choice was a difficult one. In the end it fell upon Princeton in view of the quality and visibility of its list, especially in the classical field, and of my own favorable previous experience of working with the outstanding Classics editor, Joanna Hitchcock. Princeton was willing to permit the atlas format to be folio – in other words, the largest format that is both reasonably economical for production and convenient for the individual user to handle. Princeton also affirmed that the binding for the volume could be handsewn so as to permit a doublespread map to run across seamlessly without a central gutter becoming visible or any map data at each page's edge disappearing into it. [15] Consequently, a framed map occupying an entire single page could measure 17 ins. tall by 11.75 wide, and a doublespread could extend for 24.5. 'Bleeds' of up to approximately half an inch beyond the map frame could also be accommodated. [16]

“... it was vital that the cartographic partner have experience of, and sympathy for, the creation of a major historical atlas, along with the ability to take a prominent role in designing absolutely every feature of a new one from scratch.”

The search for a suitable cartographic partner posed a far tougher challenge. It clearly had to be one capable of handling a very substantial volume of work without long delays; this ruled out small companies, for example, as well as cartographic units within universities. At the same time, it was vital that the cartographic partner have experience of, and sympathy for, the creation of a major historical atlas, along with the ability to take a prominent role in designing absolutely every feature of a new one from scratch. A partner that would require, for example, the use of its existing 'house style' for presentation of the maps was ruled out. I cannot better Dean's summary of the need: "In atlases, besides the usual decisions having to do with texts of various kinds there are innumerable decisions regarding the maps and any other illustrative materials. Every bit of line work, every space, every symbol, every colour or shade, every piece of type, every typeface, every legend on a map, requires thousands of precise decisions." [17]

Among the very few recommendations that the Association of American Geographers was able to make for potential partners capable of meeting such taxing requirements, only one stood out – the Cartographic Services unit in Lancaster, Pa., of the prominent Chicago printers R.R. Donnelley and Sons. Here the lead was taken by Barbara Petchenik, who had been cartographic editor for the great *Atlas of Early American History: the Revolutionary Era 1760-1790*, [18] and had continued to publish widely on many aspects of cartography. To my immense relief, she soon demonstrated that Donnelley Cartographic Services were ideally, perhaps uniquely, qualified to serve as the cartographic partner; time was to prove her right. Had I but known it then, I had unwittingly fulfilled Cole Harris' recommendation stemming from his experience with the HAC: "I suspect this is a rule-of-thumb for most atlases: find, then rely on, one outstanding cartographic designer." [19] What I had found, to be sure, was a team rather than the HAC's individual (Geoff Matthews). Thankfully, despite

the company's successive changes of ownership and office removals between 1988 and 2000, [20] the team personnel were to remain very stable throughout. After Barbara Petchenik's premature death in 1992, Keith Winters took over the management of the account until completion of the project. There was a succession of no more than three cartographic managers – Jeannine Schonta to 1993, Janet Kelly to 1998, and thereafter David Stong. [21]

From the outset I wanted the role of Donnelley's team to be far more than a merely subordinate one. Donnelley, after all, could contribute vital cartographic knowledge, experience and perspective that I as a historian and academic lacked. My impression of TIR, TIB and TAVO maps was that their cartographers either lacked talent or (more probably) that the scholars in charge had not offered them adequate opportunity to contribute their expertise. By contrast, I was eager to invite recommendations from Donnelley. [22] There were many fundamental issues to discuss.

"From the outset I wanted the role of Donnelley's team to be far more than a merely subordinate one."

Scale and Landscape

Scale was perhaps the most basic of them. In the expectation that many users of the atlas would not be expert map-readers, there was good reason to keep the number of scales employed to a minimum, ideally perhaps to no more than one. Without doubt, a conspicuous merit of the TIR and TIB series was their adoption of a uniform scale – a marked advance on the nineteenth century classical atlases, which had never done likewise. The disappointment, however, was that both choices were so modest – 1:1,000,000 in the case of TIR, and 1:800,000 in that of TIB. By the end of the 1980s, scales as small as these simply could not do justice to our accumulated knowledge of many of the more populated and well explored regions of the Greek and Roman world. For these in particular, some more generous scale was essential. At the same time, however, the larger this scale was, the more space it would require, and the correspondingly less justifiable it might prove for thinly populated or little explored regions.

A minimum of two scales seemed unavoidable, therefore. What each should be depended in turn upon how the rendering of physical landscape was to be generated. It would be necessary to start from today's landscape, but whether to rest content there, or to attempt to restore it to its ancient aspect where sufficient data for the purpose survives, was a further fundamental concern. Earlier approaches had differed. When TIR was initiated at the end of the 1920s, the question of restoring the modern physical landscape back to its ancient aspect was seemingly not even raised. Nor was modern landscape created afresh for TIR maps. Instead, Crawford devised a brilliantly simple and economical scheme whereby the layout of TIR would replicate that of the (then new and ongoing) International Map of the World (IMW, 1:1,000,000). The elements created in the compilation of each IMW sheet would simply be reused for TIR, "except that for the black detail plate is substituted a black archaeological plate, and the red road plate is omitted altogether." [23] By the 1960s, when TIB was initiated, there was keener awareness of the need to allow for landscape change over the centuries, but at the same time this project was particularly concerned to enable the users of its maps to relate Byzantine features to their modern setting. Hence the first stage in the preparation of each TIB sheet is the creation of a new map of the relevant area today at 1:800,000, incorporating modern place-names and even such features as highways, railroads and airports. Purchasers of TIB receive two versions of this map: one, exclusively modern as described, printed in clear inks; the other reproduced as a subdued background in

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“... if we seriously wish to engage with any past civilization we should strive to do so within their landscape, not ours, however unfamiliar it may appear.”

pale inks, over which are printed Byzantine names, features and road linework.

My view was that the *Barrington Atlas* should endeavor to show the ancient landscape so far as possible, not the modern, and this attempt was undertaken. The fact is that a high proportion of identifiable man-made landscape changes postdate World War II, and are not so difficult to adjust for. Even the most extensive area affected thus – now covered by Lake Nasser in southern Egypt (see Map 81) – could be redrawn from earlier maps. Where nature has changed the landscape, and over a much longer span, the attempt to restore its ancient aspect must inevitably often prove more delicate and problematic. In extreme cases we can only acknowledge that, while we know the ancient landscape of an area to have differed markedly from today’s, sufficient data with which to restore it no longer exist; in these instances, more of today’s landscape must perforce be left in place than would otherwise be justified. The Nile Delta, for example, offers an acute illustration of this problem. [24] It is true that where extensive restoration of a familiar landscape has been possible, certain users of the atlas are liable to be disoriented by the result. Lovers of Venice have complained to me about its ‘disappearance’ from Map 40, and Spaniards living north of Cadiz have taken me to task for rendering where they live today as open water on Map 26. Such upsets are to be regretted, but they can hardly justify abandonment of the attempt to set ancient cultural data so far as possible within the ancient physical landscape. To place these data against the modern landscape instead – as do TIB and the latest editions of the Ordnance Survey *Roman Britain* map, [25] for example – was in my view not an approach to imitate. Time and again, after all, ancient writers’ geographical references are meaningful only in relation to the ancient landscape, and if we seriously wish to engage with any past civilization we should strive to do so within their landscape, not ours, however unfamiliar it may appear.

Base materials

“This search [for map bases] . . . turned out to be prolonged and frustrating.”

No less undesirable and unnecessary a model, it seemed, was TIB’s costly and time-consuming practice of commissioning the creation of entire new landscape bases. Rather, it would be better to follow TIR’s example and identify appropriate modern map series from which the required physical landscape elements could be adapted. This search, however, turned out to be prolonged and frustrating. National map series in all their variety were far from serviceable. Instead, whatever series were to be adopted had to relate satisfactorily to one another, to offer uniform presentation across modern national boundaries, and to be the product of makers willing to supply elements for reuse in the *Barrington Atlas*. For many reasons the IMW series originally adopted by TIR, and its corresponding “1404” series at 1:500,000, were not suitable. Neither series was still in production at the end of the 1980s, and elements in good condition could no longer be obtained. Other practical obstacles were, first, the inconsistency produced by conversion of the contour-interval figures on some sheets, but not all, from feet to metres. Second, the series sheet-size, while far from immense, was still too unwieldy a format for the atlas volume I had in mind. In addition, the series sheet-lines had an unfortunate knack of dividing areas that ought at all costs to appear entire on any historical map: south-east England, for example, was split between four sheets, and the islands of Sardinia, Euboea and Crete were all bisected. Altogether, there was no means here to create a satisfactory group of geographically and culturally meaningful map bases without

resorting to the expensive and awkward expedient of making almost every base a 'mosaic' of two or more IMW sheets.

Gradually it became clear that the required transnational uniformity could in fact only be furnished by Soviet or U.S. world map series. For all the high quality of much of the Soviet mapping, from a practical point of view the end of 1980s was no time to start relying upon this source of base materials. U.S. series, by contrast, had much to recommend them. In particular, the (then) Defense Mapping Agency's Operational Navigation Chart (1:1,000,000) and corresponding Tactical Pilotage Chart (1:500,000) series both offered all but complete coverage of the entire span to be covered by the atlas [26]. Although in the case of both series some of the sheets required are produced by the British Directorate-General of Military Survey, these adhere to U.S. specifications, so that uniformity is maintained. Thus, among other vital concerns, style of presentation is consistent, all contour intervals are in feet, [27] and the same orientation (North) and projection (Lambert Conformal Conic) are adopted.

Moreover, sheets of both these DMA world series – and two related ones at the smaller scales of 1:2,000,000 (Jet Navigation Chart) and 1:5,000,000 (Global Navigation and Planning Chart) – circulate widely (and cheaply) and are not protected by any copyright. If they were to form the basis for a restoration of the modern physical landscape back to its ancient aspect, users of the atlas wishing to make a direct comparison between ancient and modern for any region should find it relatively easy to acquire the relevant DMA sheet for the purpose. [Fig. 1] Most important of all, even the individual elements comprising any DMA sheet at 1:500,000 scale or smaller were in the public domain and available for purchase and reuse. This remarkable openness did not extend to any scale larger than 1:500,000, however. In particular, for some countries the actual printed sheets of the 1:250,000 series (Joint Operations Graphics; also oriented North, with Lambert Conformal Conic projection) remained classified, and hopes of obtaining any elements at this scale would be quite unrealistic.

So it emerged that the one practical way forward was to rely principally upon the ONC and TPC series for the provision of map bases. At the point when I took the decision to do this, there remained a single identifiable major drawback, although another gradually revealed itself. The former was that the ONC series incorporates only the most rudimentary elevation tinting. For consistent presentation within the atlas, it was highly desirable that all the maps with this base have such tinting added to match the TPC series style of presentation. However, to make that enhancement by means of the film-based technology then in use (peeling, creating 'open windows', etc.) would without doubt prove exceptionally laborious and costly; yet it was at least feasible, and had to be budgeted for. There was the prospect that the Digital Chart of the World (the first digitized version of the ONC series) might be released before this enhancement actually needed to be made, and in all likelihood its use could then simplify the task. In the event, it did prove possible to tap the DCW for the purpose, but that was far from predictable at the end of the 1980s.

The unanticipated drawback was the sluggish, uneven pace at which the DMA turned out to deliver the elements ordered. To be sure, the amount of material was large (forty-one sets of elements), [28] and in a military agency priority was rightly given to fulfillment of military needs. Even so, the delays became sufficiently extreme to make me fear that the progress of the project would be jeopardized. That it was not is due above all to the consummate diplomacy of Luis Freile at Donnelley, who ultimately was able to secure the full complement of elements ordered.

"So it emerged that the one practical way forward was to rely principally upon the ONC and TPC series for the provision of map bases."

". . . [DMA's] delays became sufficiently extreme to make me fear that the progress of the project would be jeopardized."

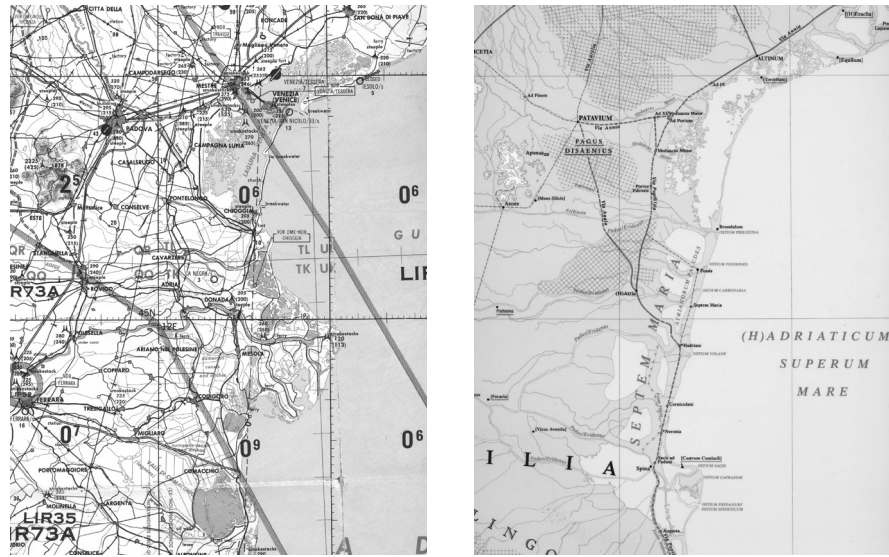


Fig. 1 Part of Map 40 (right) showing the Po delta in antiquity and the corresponding part of TPC F-2B (left) on which the map is based. As Map 40 clearly illustrates, the Barrington Atlas uses two lineweights to distinguish major roads from minor (the recommendation of a road specialist that as many as seven different weights be distinguished was hardly practical!). Solid linework of any kind (be it for a road, wall, aqueduct, etc) signifies that the course of the feature is known for certain in this location; where linework is dashed, by contrast, it can only be traced approximately. The checkerboard patterns denote 'centuriated' areas – land surveyed, divided and assigned by the Roman authorities. (see page 72 for larger color version)

Release of the final set caused extraordinary difficulty because it fell just after the date (October 1, 1996) on which the DMA became the National Imagery and Mapping Agency. NIMA from its inception was not authorized to fulfill any civilian requests for purchase of elements. So altogether, in retrospect, there is reason to feel hugely relieved at the fortuitous timing of the request for these vital materials that underpin the atlas. Frankly, I doubt if it would have been practical for the project – in the form I had conceived it – to proceed without them or (perhaps an even more frustrating plight in practice) with only some, but not others.

“... I embraced Donnelley’s principles that the maps must be of uniform sizes and that each must extend to fill the size of frame permitted by the volume’s format.”

Coverage, layout, timespan [Figs. 2-4]

For laying out the atlas, the sheer immensity of the ONC and TPC sheets (normally 37 ins. tall by 50 wide) seemed a further advantage insofar as it might help to limit the frequency with which mosaicing was required. I deliberately sought to keep this to a minimum, and in the end relatively few maps at 1:1,000,000 or 1:500,000 had to be mosaiced; of those that are, only a handful call for the more delicate north-south joins. [29]

Even so, establishment of the atlas layout on the basis of ONC and TPC sheets meant reconciling a perplexing array of ideals, principles and limitations. The map sizes were of course immutably fixed. I strove for ‘horizontal’ doublespreads where possible, but was also ready to resort to ‘horizontal’ single pages, and even to ‘vertical’ single and double turn-pages (with North to the left) where they seemed the most effective layout. To save space and contain costs, I determined to omit open water beyond what was needed of it to complete a mainland map; this could not be an atlas where coverage of the sea would match that of the land. Equally in this regard, I embraced Donnelley’s principles that the maps must be of uniform sizes and that each must extend to fill the size of frame permitted by the volume’s format. Otherwise there was to be no



Figure 2.



Figure 3.

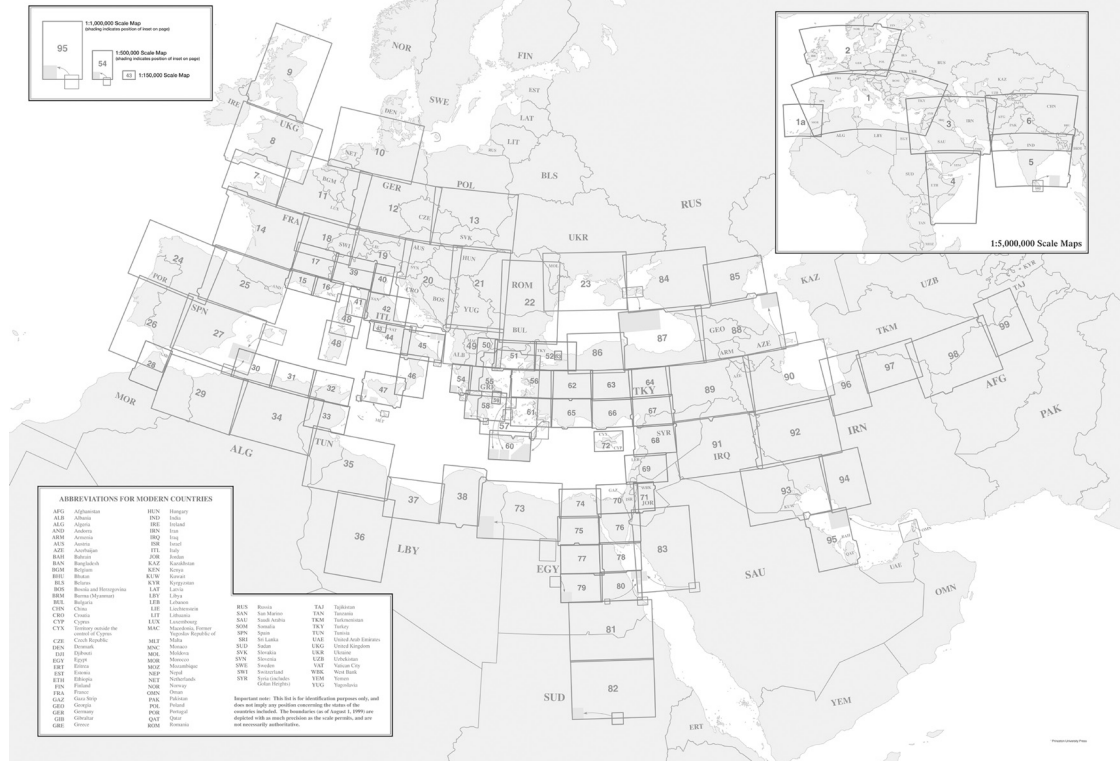


Figure 4. (see page 73 for color version)

Figs. 2-4 The locator outline map at three successive stages of the project's development – in 1990 (Fig. 2), in 1994 (Fig. 3), and in the published atlas, 2000 (Fig. 4). While the framework of the initial layout is maintained throughout, after 1990 many part-maps and insets become better integrated (such as 26 a and b, and the insets between 30 and 31, in Fig. 2), and excessive overlaps eliminated (in eastern Asia Minor, for example). More overviews at 1:5,000,000 are added, and eventually coverage at 1:1,000,000 is extended so that the map planned from the outset to show Greek settlement in Bactria (85 in Fig. 2, 94 in Fig. 3) no longer remains an isolated one at this scale.

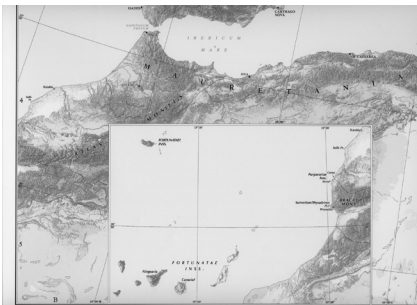


Fig. 5 In order to extend coverage as far as ancient Cerne (off the coast of West Africa) and the Fortunate Islands, no more than an inset was designed initially, for placement in the lower-left desert area of Map 1. But despite its economy, such an arrangement – with an extensive expanse of open water seemingly deep inside the Sahara, as shown here – was felt to create too incongruous an impression. Instead, a separate Map 1a (also at 1:5,000,000) was created. (see page 74 for larger color version)

variation or reduction in shape and size, and none was made except in the special case of Map 1a. [Fig. 5] At the same time, where land covered by the atlas continues beyond the edge of a map, overlap – however minimal – must be incorporated between the first map and the next (sometimes more than one) to assist users in following the continuation.

Establishment of the layout naturally demanded that the scope of the atlas be defined. There was no question, for example, that mainland Britain should be shown, likewise North Africa for some distance south of the Straits of Gibraltar, as well as the Persian Gulf, Sri Lanka, and the Indian sub-continent at least as far as the Ganges mouth. But whether these limits extended far enough was debatable. Ptolemy's *Geography*, for example, certainly lists places further east than the Ganges, as well as down the east coast of Africa possibly even as far as Madagascar. Equally, we possess an account (if it is not fiction) of a long voyage down the west coast of Africa. My eventual conclusion was that the effort of attempting to extend so far in these various directions would not be reflected in the amount of data that could be marked here with any confidence. I did, however, accept the recommendation made at a later stage by Prof. A. Bursche that the southern Baltic region be added because it is archaeologically well documented, especially in respect to its trade in amber with the Roman empire; hence the addition of what became Map 2. Also at a later stage I should have liked to extend coverage for some distance both westwards and eastwards

of Map 36 in Libya, but was unable to devise any means of doing so economically, even by resorting to a smaller scale. [30]

Even with the limits just described, the extremities of the coverage were very far flung. To show them at 1:1,000,000 scale would occupy a formidable amount of space, and once again – in the present state of our knowledge – the effort (and expense) would seldom be justified. Consequently, I decided that 1:5,000,000 would have to suffice for these extensive ‘remote’ areas, and I also maintained coverage at this scale to create overview maps of almost everywhere shown at a larger scale. Once Map 2 had been added in, [31] there were twelve pages in all at this scale. [32] [Fig. 6]

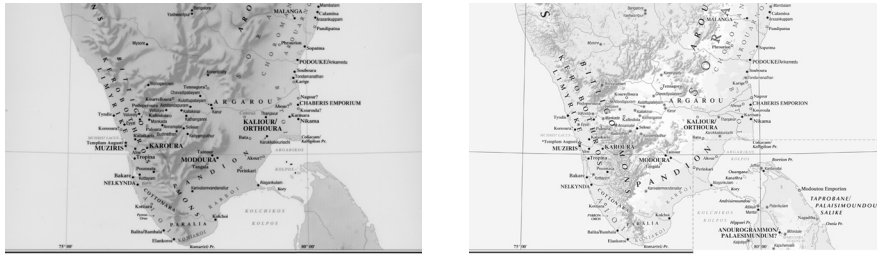


Fig. 6 Part of Map 5 India, first in an early draft (left) incorporating only the physical elevation offered by the GNC 12 base sheet, and then as published in 2000 (right) incorporating custom-designed digital elevation modeling by Donnelley (with use of GTOPO30, as described in Barrington Atlas, xxviii) which was adopted for all twelve maps at the 1:5,000,000 scale. (see page 75 for larger color version)

Naturally enough, all areas settled or controlled by Greeks or Romans should be shown at no less than 1:1,000,000. Acute difficulty arose in determining which parts of this expanse merited showing four times larger at 1:500,000. I would maintain that the parts chosen are broadly speaking the right ones – southern France, Italy, North Africa to the west and south of Carthage, Greece and the Aegean, the Straits of Kertch, much of Asia Minor and the Mediterranean’s eastern seaboard, and the Nile valley. This said, the constraints imposed by the layout and by the need to mesh two map base series make some unevenness unavoidable. Parts of central Asia Minor, for example, or of the Egyptian desert, could justifiably be reduced to 1:1,000,000. By the same token, much of southern Spain ought ideally to have been shown at the larger scale, but it simply proved impossible to incorporate the necessary shift of scale at all tidily into the layout here. The Aegean Sea, by contrast, presented the opposite problem. It could and should be shown at 1:500,000, but the page-size made it impossible to do this neatly; hence the resort to substantial insets for the islands in the center and south-east (all on Map 60). Moreover an overview was vital, and one could only be devised at 1:1,000,000, with considerable ingenuity at that; hence the exceptional number of bleeds off this ‘turned’ doublespread (Map 57).

I was keenly aware that three areas in particular – the environs of Athens, Rome and Constantinople – merited showing at considerably larger than 1:500,000. Ideally, DMA’s 1:250,000 scale Joint Operations Graphics series seemed the obvious recourse for a base in these instances, and with varying degrees of difficulty it was eventually possible to secure the relevant sheets (one in the case of Rome, two for Constantinople, and as many as four for Athens). The only way to create elements from these, however, was for Janet Kelly at Donnelley to trace each re-

“... all areas settled or controlled by Greeks or Romans should be shown at no less than 1:1,000,000. Acute difficulty arose in determining which parts . . . merited showing four times larger at 1:500,000.”

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quired landscape feature separately in turn from the printed material. In the course of this painstaking labor she also accomplished the necessary complex mosaicing in the cases of Constantinople and Athens, and then enlarged the scale of all three maps by 166.7% to bring it to 1:150,000. By this ingenious means doublespread bases were created for the environs of Athens and Rome, and a single page for those of Constantinople.

Altogether, therefore, this layout for the atlas came to use as many as four different scales, although each may be related to the others with comparative ease, and two (1:5,000,000 and 1:150,000) are only used minimally. In fact all but nine of the ninety-nine maps are at either 1:1,000,000 (forty-seven of them) or 1:500,000 (forty-three of them); every map's scale is stated clearly alongside its title (printed twice for doublespreads), and the scale is naturally reflected by the scalebar placed at the bottom of each map or alongside it.

“ . . . to arrange the ninety-nine [maps] in order presented an intriguing challenge . . . ”

How then to arrange the ninety-nine in order presented an intriguing challenge when in principle there are so many possibilities. It seemed logical to proceed, broadly speaking, west-east and north-south. However, to develop a satisfying sequence of so large a mix of sixty-six doublespreads and twenty-four single pages without any breaks proved downright impossible, and perhaps it would be undesirable in any case. The most attractive expedient was to place all six overview maps (1:5,000,000 scale) first, and then to create six loose regional groupings each prefaced by a diagram sketch of the region on a righthand page; the corresponding lefthand page can either remain blank, or be used for a final (single page) map in the preceding grouping, if required (as with 48 and 99). Undeniably, the regional groupings are somewhat arbitrary, but their creation does facilitate a rational ordering of the maps and serves to make the atlas less overwhelming to users.

I hardly need to repeat that there was much other mapping of the Greek and Roman world which in principle could have been undertaken for the atlas. I am as regretful as anyone at having excluded it. The only maps I was willing to incorporate in addition to the ninety-nine already mentioned were three outlines at 1:10,000,000 (two doublespreads and one single page) which sketch the boundaries of Roman provinces at three successive stages of the Roman empire's growth and decline. These apart, my view was that the ninety-nine maps, spread over 175 folio pages, comprised a cohesive set which supplied an essential basis – otherwise missing to date – for further mapping initiatives of all kinds. Moreover it was starkly clear from the outset that the successful completion and publication of this set alone was a hugely ambitious goal, fraught with the risk of failure. Dozens of expert scholars would need to be recruited for compilation of the maps, and thereafter encouraged to deliver the work they had committed to in timely fashion. The amount of editing, checking, adjusting, proofreading and associated tasks would be colossal. Map production costs were well-nigh impossible to gauge, although it was obvious that they might easily run to a couple of million dollars or more. Meantime the prospects for securing the necessary funding support were hazy.

“In these circumstances, to commit to further mapping would have been irresponsible, not to say suicidal.”

In these circumstances, to commit to further mapping would have been irresponsible, not to say suicidal. I should dearly have liked to commission a series of city-plans at very large scales, since these are in principle feasible and without doubt badly needed, but the scope and nature of such a different type of mapping initiative would have been too much to accommodate. [33] Equally, the limitless potential range and variety of possible thematic maps – another distinctly different type of

mapping – cast serious doubt on whether an acceptable and appropriate selection could be made. [34]

I had resolved that the timespan encompassed by the atlas should be from the end of the Bronze Age (therefore no earlier than 1000 B.C. approximately) to the emergence of Islam in mid-seventh century A.D. The exclusion of the Bronze Age was a bitter disappointment to some, but data relating to it would not integrate well onto maps that had to cater for a further millennium and a half in addition. My own deeper disappointment was that it was not practical to offer even, say, two successive maps of each region so as to furnish a sharper sense of the physical and cultural change that occurred over time, very strikingly in some instances. Even to double the map pages at the two standard scales, however, would have brought their total alone to 312, and the extra burdens imposed at every stage in the volume's production (not to mention its marketing at an affordable price) would have been crushing. At least there was one modest indicator of change that could practicably be introduced to the maps. This was a range of five distinctive colors for five successive periods – Archaic, Classical, Hellenistic, Roman, Late Antique – within the full timespan of the atlas. Accordingly, names and features which occur in only one of the five are marked out in the relevant color. The possibility of extending this indicator to accommodate two or more periods was considered but rejected. The potential variants were too many, the color palette would soon be over-taxed [35], and many users were likely to be left bewildered. For such enquiries, it would be better that they consult instead the Directory which each expert map compiler was instructed to prepare for every name and feature marked on the map base. Among the data in each concise Directory entry [36] is a record of which among the five periods the name or feature is attested for.

Map compilation

By mid-1989 the fundamentals were in place: my vision for the scope and nature of the atlas was in broad measure determined, along with its base materials and a layout. The next vital step had to be the compilation, design and production of a specimen map. Funding applications would hardly be competitive without such tangible testimony that the broader vision could be implemented effectively. At the same time the exercise would resolve a great array of design issues; it would also clarify in detail what the regional experts who compiled the maps needed to supply to Donnelley's team, and in what format. For this purpose, Clive Foss (then at the University of Massachusetts, Boston) courageously volunteered to undertake the compilation of the 1:500,000 scale doublespread that appears (revised) in the published atlas as Map 52 *Byzantium*. Jeannine Schonta at Donnelley designed it with sensitivity and insight. It was completed along with a key, then printed by Meriden Stinehour, Lunenburg, Vermont, and delivered just in time to accompany the first major funding application made by the project, to the National Endowment for the Humanities, on September 1, 1990. [Fig. 7]

The funding awarded in mid-1991 as the result of that application made it possible for APA to issue contracts to the expert map compilers [37], for base materials to be ordered, and for a project office to be set up in Chapel Hill, NC. [38] Without question, the inspiring impression created by the specimen map played a decisive role in launching work on the atlas proper. In addition, as anticipated, the making of this map provided sharp lessons for refining the relationship between compiler, editor and cartographic team. The two former both had to recognize that the team

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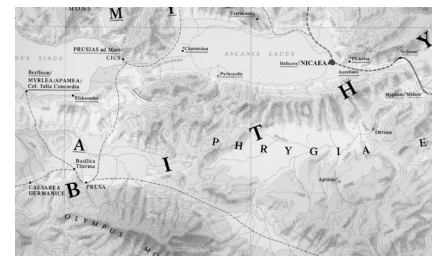


Fig. 7 Part of the specimen map at 1:500,000 as printed in 1990 (a revised version of which appears in the published atlas as 52 *Byzantium*). The colors developed to differentiate single-period features stand out distinctively. Note that physical elevations are enhanced by incorporation of the TPC series shaded relief element. However, its incorporation in the next map at this scale to go into production (54 *Epirus-Acarnania*) proved far less satisfactory, because in this more mountainous region it overwhelmed the elevation tints and single-period colors. Consequently, after much fruitless experimentation, the decision was taken to drop the use of the shaded relief element throughout. (see page 76 for larger color version)

“ . . . I soon gained respect for cartographers’ unwavering attention to accurate detail of every kind, and grasped the need to convey this to my unsuspecting fellow scholar-compilers.”

“ . . . spreading the work so widely acted to limit the damage liable to be inflicted by compilers who sooner or later defaulted on their commitment, or proved unable to furnish materials of acceptable standard.”

would not presume to contribute in any way to the map’s content; rather, it would just reproduce precisely and exclusively whatever was supplied to it through the editor. I applaud this as a sound and practical form of working relationship, but adjustment to it inevitably took practice. So, if the linework drawn for a road by the compiler was meant to continue until it touched a settlement symbol, but actually stopped a little short on the herculene (frosted mylar overlay) supplied to Donnelley, then on the proof it would duly stop short. Consequently, as editor, I soon gained respect for cartographers’ unwavering attention to accurate detail of every kind, and grasped the need to convey this to my unsuspecting fellow scholar-compilers.

It must be appreciated that few of these eighty and more scholars had ever compiled a definitive map before, so that it was imperative to furnish them with full, precise instructions for every aspect of how they were expected to proceed – in particular, which type of data was to be marked on each of the eight pin-registered herculenes (on the correct, frosted side!), and with which color pencil, when superimposed on the four or more physical landscape elements (film positives) comprising a map’s base. [39] Equally important was the compiler’s organization of a potential sheaf of type lists, which had to accommodate, for example, five possible sizes for settlement names, as well as single-period colors and other variants. Discrepancies between a compiler’s overlays and type lists (and Directory entries too) always had to be of concern to the map editor in the project office.

It was no surprise that the need to accustom so many experts to the novel requirements of mapmaking turned out to be laborious and sometimes inefficient, but the best knowledge of the classical world’s many different regions could only be tapped in this way. In addition, spreading the work so widely acted to limit the damage liable to be inflicted by compilers who sooner or later defaulted on their commitment, or proved unable to furnish materials of acceptable standard. As it turned out, instances of both types of embarrassment did occur, but thankfully in small numbers and early enough to remedy. Over the years I organized several group meetings of compilers on both sides of the Atlantic to demonstrate techniques and discuss problems; these occasions were invaluable for identifying difficulties and overcoming them.

More generally, there is no question that completion of the atlas was speeded by the unprecedented ease of communication that the 1990s offered – not only telephone and express courier services, but also fax, email and ‘floppy disks.’ [40] Even so, it remained a constant cause of concern that original herculenes marked up by compilers would be lost through theft, fire or other damage. To xerox them was impractical. Despite the expense, the only recourse was for Donnelley to reproduce them photographically as plastic positives. As a vital precaution, this was always done without delay; thereafter no set of original herculenes and all the copies made of it were ever kept in the same building overnight. So when a set of original herculenes later undergoing independent evaluation was left inadvertently in a Paris telephone box and never recovered, it proved possible to rely instead on the plastic copies that had been made. Throughout the project, as it turned out, loss of materials, or damage to them, were miraculously slight.

In practice, compilers’ submissions varied in the degree to which they fulfilled every requirement in the instructions. This was hardly remarkable, however, given that the instructions grew to fill twenty pages single-spaced, and that it is typical for hundreds of names in different categories and sizes to be marked on a single map, quite apart from linework that

often included complex deletions and additions called for by landscape changes. Most slips and inconsistencies in type lists were readily enough caught by the map editor and her assistants in the course of the extensive checking to which all material was subjected on arrival. Imprecisely or incompletely drawn linework posed tougher challenges, however, and many herculeses were redrawn before being forwarded to Donnelley.

Several compilers chafed at not being permitted to mark categories of data to which they attached importance for their areas, but which I had determined (reluctantly in some instances) that the atlas should exclude throughout. Even so, extreme frustration with compilers' departure from the instructions was rare, because most had the prudence to consult the project office before proceeding too far. Just one compiler, fortunately, was cavalier enough first to set aside the map base supplied and then to mark a great quantity of data on a different base instead (albeit at the same scale); only at a very advanced stage did this scholar contact the project office with a complaint that the two bases would not match. It is true that another compiler had been intending to mark all his data on bases of his own at 1:250,000 before transferring it to the base supplied at 1:500,000; but mercifully he articulated this intention before proceeding with it. A third compiler insisted that every site marked on maps for his area at 1:50,000 must be shown on the one he was preparing for the atlas at 1:500,000. Repeated warnings that he would need to be more selective for the latter scale did not deter him until his draft compilation for the atlas had all but disappeared under a blizzard of point symbols; he then finally acknowledged the need to begin all over again with a different approach. [41]

The overlap between maps where land coverage continues did more to hamper map production than anticipated. At the planning stage, it seemed essential to assist users of the atlas by incorporating it, and I remain convinced of its value. Even so, a stream of difficulties arose in implementing it. Ideally, production of any map requiring overlap at the same or a greater scale on any side should not begin until the compilations for all those adjacent maps are ready for production too. In practice, of course, it was impossible to wait so long in every case; to pay project office staff to do nothing for a period would be counterproductive, and if Donnelley's experienced team were to be sent no work, then they would be dispersed and assigned elsewhere. In some instances, predictably, an overlap area was slim and the amount of work it demanded minimal; the same compiler might even be responsible for one or more of the adjacent maps. After due consultation, therefore, it could seem safe enough to authorize production without having yet received all the adjacent compilations.

Much had to depend on how closely compilers adhered to the dates by which they had initially agreed to submit their work. Broadly speaking, the plan was to produce the larger-scale (1:500,000) maps in a first phase (1993-95), followed by a second one (1995-97) for the maps at 1:1,000,000. In practice, as was only to be expected, frequent adjustment was called for as time went on because compilers delivered late, and in a few instances very late. [42] Such delays could be compounded in the case of maps where the compilation had to be divided between two or more scholars – typically along modern national boundaries, because survey, exploration and publication of their results are organized thus. So Map 89, for example, called for scholars with expertise on Turkey, Syria, Iraq and Iran all to co-ordinate and deliver their work, even before the matter of this map's overlap with several others could be addressed. In a few instances the compilers of adjacent overlapping maps were actually unable to agree on what should be marked in the area they shared, so for the sake of main-

“... extreme frustration with compilers' departure from the instructions was rare . . .”

“The overlap between maps where land coverage continues did more to hamper map production than anticipated.”

taining consistency it then fell to me to make the final determination. Such disagreements aside, it was often a severe trial for both the project office and Donnelley to ensure that consistency was maintained in an overlap, especially if more than two maps were involved (as at the conjunction of Maps 24, 25, 26 and 27, for instance), and if there were linework continuations.

The case of Maps 44 and 45 was the most exacting one in almost all respects, not because the compilers disagreed (on the contrary, they collaborated well), but simply because the overlap area here is so extensive and 'busy'. Had I been more wary of the potential pitfall, I might have striven harder to reduce this overlap when creating the atlas layout. The likely obstacle then, however, would have been the perennial difficulty of accommodating the Italian peninsula deftly to maps oriented north. In the project's second phase of map production, digitization did prove to be of special value for ensuring speedily and efficiently that overlap coverage matched; but it could help only at the smaller scales, [43] and not therefore between 44 and 45, let alone between 43 and 44.

Timing

More than one observer has reflected that the project to create the *Bar-
rington Atlas* was unfortunate in its timing. [44] Had its launch been delayed by only a few years, the suggestion goes, the atlas could have been fully digital and therefore immediately more versatile. The sentiment is well-intentioned, but I am not fully persuaded by it. It is true that the atlas is an extraordinary, not to say unique, hybrid: the three maps at 1:150,000, and all but three of those at 1:500,000, were produced by the traditional film-based method, and the remainder were produced digitally [45]. This second, larger group – approaching 60 per cent of the atlas maps – is impressive testimony to Donnelley's skill in exploiting successive advances in technology from the early 1990s onwards, when the Digital Chart of the World was first released, and when I resolved that all production of the smaller-scale maps for the atlas should be digital from the outset. That novel production method, however, [46] did not alter the established means by which the expert compilers would assemble their data and mark it on herculenes superimposed on film-positive bases. Any notion that they might have made this mark-up electronically direct onto a monitor, I might add, is sheer futuristic fantasy. Even had it been practical to supply materials by this means, at that time few of these scholars worldwide had the capacity or the equipment to manipulate them in this medium.

In addition, from the project's short-term perspective, the hard fact was that digital production increased costs substantially rather than lowering them. The first edition of the Digital Chart of the World turned out to fall far short of its printed counterpart in quality of coverage. In part, this stemmed from conscious decisions, such as to omit all contours below 1,000 ft., for example; accordingly, Donnelley added in the 500 and 250 ft. contours. [47] But there were also countless instances where the scanning of the linework for physical landscape had been done with poor attention to detail (by accident or design, the rendering of Libya was especially defective, for instance), and the extra cost for Donnelley to bring it up to the standard of the printed ONC sheets was considerable.

Over time, it is true, digital production justified the initial high outlay, and it will continue to do so. At each proof stage (most maps were permitted two, and no more), correction and adjustment of film-based materials were unavoidably expensive by comparison, in particular the second time

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round when multiple elements might have to be re-shot in order to accommodate minimal changes. In a few instances therefore, on cost grounds, I forbore to make small changes in second proof that were not vital, although they would have been desirable [48].

In retrospect, it is the failure of APA's first atlas project to achieve anything that I would single out as the most fortuitous twist of fate. Had it proceeded from its inception in the early 1980s at approximately the same pace as its successor, the results would have been published in the early 1990s with the same outward appearance, but as an exclusively film-based production comprising materials that offered no potential for further exploitation. Whether the successor project should have waited before proceeding, I am far from sure. Perfect timing for any project is hard to achieve. In this case the need for the atlas envisaged was patent, and already long unfulfilled. No-one could predict how swiftly and how usefully digital technology would advance; in the late 1980s, it should be remembered, even fax and email were still emerging novelties to most scholars. Fortunately, all work for the *Map-by-Map Directory* could be computerized from the start, and so was able to proceed much faster and more efficiently (in the final stages especially) than would ever have been possible by use of the old conventional means.

A wait at the end of the 1980s – for how long in the first instance? – might only have led to further postponements as the technology of mapmaking turned out to experience dramatic, rapid change throughout the 1990s. My hunch is that, the longer the wait, the tougher it would have been to decide what to attempt. The new technology opened up an exciting, but also bewildering, array of possibilities, and that prospect could easily have encouraged prematurely ambitious plans. [49] At the risk of sounding over-cautious, I would claim that the plans for the atlas turned out to gain far more from the 1990s revolution in mapping technology than they lost. The need to rely exclusively on established conventional methods when the plans were made at the end of the 1980s discouraged any attempt to do more than lay the comprehensive foundation which was so badly lacking. This was labor enough in view of the immensity of the classical world and the complete lack of maps of many of its regions as they were in antiquity; here, the arduous pioneer work of gathering, assessing and synthesizing the mass of relevant data still had to be undertaken from scratch. The good fortune was that, as the 1990s advanced and digital technology developed, it could be harnessed to achieving the project's goals. As a result, the atlas is truly a transitional product. It achieved publication less than a year later than originally envisaged (in 2000, rather than 1999, minimal delay for a project of this size and complexity), [50] and it now forms the springboard for initiatives never even dreamed of at the outset. [51]

Future prospects

Hard though it is to believe today, everyone at the initial stage, in the late 1980s, regarded the atlas as an 'end', the definitive provision of a vital missing tool. Nobody foresaw then that, even before achieving publication, the atlas would appear rather to be only a beginning which opens the way to further mapping of many kinds. The University of North Carolina, Chapel Hill, merits gratitude for recognizing this potential by sponsoring the launch of an Ancient World Mapping Center to exploit it. [52] Bringing all the *Barrington Atlas* maps into a fully georeferenced format is one of the Center's early priorities, now well on its way to realization. Moreover, in place of the single map to cover all periods within the timespan of the

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“It is the technological revolution that transformed cartography during the 1990s which has given the achievement of the Barrington Atlas such unanticipated lasting value.”

“... it still seems to me a minor miracle that the exceptional collaborative effort to create the atlas succeeded.”

atlas, preparation of up to five successive ‘period’ versions now becomes a practical proposition in each case, with use of the ‘period of occupation’ data already assembled for each map’s Directory. Maps can be updated, too, as well as adapted and reissued in alternative formats; the range of possibilities is extraordinary. [53]

It is the technological revolution that transformed cartography during the 1990s which has given the achievement of the *Barrington Atlas* such unanticipated lasting value. Holdsworth’s wry comment that “perhaps the ultimate power statement in historical geography is revisionism that allows no subsequent revision due to prohibitive cost” [54] no longer holds good. The *Barrington Atlas* as published in 2000 will remain as a fixed foundation, but hereafter every component of it and its accompanying Directory stands ready to accommodate change as required. This is truly a more rewarding outcome than could ever have been sought for all the effort that went into the making of the atlas, especially when (in my estimation) the foundation laid was the right one regardless of technology. [55] Remembering how grim the outlook appeared at the start, not to mention the hazards of every kind encountered along the way, it still seems to me a minor miracle that the exceptional collaborative effort to create the atlas succeeded. All the same, it was a close run thing. I would be the last to dispute Dean’s caution in the Foreword to the HAC volume 1: “No good atlas exists that did not cost more than was expected and take longer to produce than was projected.”

Notes

1. R.J.A. Talbert (ed.), with *Map-by-Map Directory* (this latter both on CD-ROM and in two-volume printed format), Princeton and Oxford, 2000.
2. W.G. Dean (director), three vols., 1 (1987), 2 (1993), 3 (1990), Toronto.
3. J. Winearls (ed.), Toronto, 1995.
4. For overview and discussion, see R.J.A. Talbert, “Mapping the classical world: major atlases and map series 1872-1990,” *Journal of Roman Archaeology* 5 (1992) 5-38.
5. R.S. Bagnall (ed.), *Research Tools for the Classics: the Report of the American Philological Association’s Ad Hoc Committee on Basic Research Tools* (Chico, 1980), 27.
6. Publication was by Dietrich Reimer, Berlin, 1894-1914. There has been one reprint – to which I contributed an Introduction – by Edizioni Quasar (Rome, 1996). See further L. Zögner, *Antike Welten, Neue Regionen: Heinrich Kiepert 1818-1899* (Berlin, 1999).
7. On the production of this atlas, see further R.J.A. Talbert, “Carl Müller (1813-1894), S. Jacobs, and the making of classical maps in Paris for John Murray,” *Imago Mundi* 46 (1994) 128-50. Subsequently, by happy accident, I rediscovered the engraved copper plates of these very maps in the vault of the John Bartholomew Co., Edinburgh; they now form part of the Bartholomew Archive in the Map Library of the National Library of Scotland.

8. Since 1957 its sponsor has been the Union Académique Internationale (www.uai-iaa.org). For reports, see the annual *Compte Rendu* of that body (Projet VIa), in particular (among recent years) 1999 pp. 52-56.
9. Initially by Croom Helm. The current publisher is Routledge.
10. Winearls [above, n. 3], 164 (italics are mine). Annual reports on the progress of APA's Classical Atlas Project were published in the Association's *Newsletter*.
11. Winearls, 137.
12. This atlas, published by Reichert, Wiesbaden, was begun in 1972 and completed in 1994: www.reichert-verlag.de/ offers full information.
13. This title for the work (which I use hereon) was eventually settled upon in recognition of the support furnished by the largest individual contributor to its funding, Robert B. Strassler; his family home is at Great Barrington, Mass. A full list recognizing all contributors appears at the front of the volume. The necessity of ensuring that sufficient funds were always available to sustain map production on schedule without a break was a vital – and persistently nerve-wracking – dimension of the project not treated in this article. During the peak period of activity in the late 1990s, Donnelley's quarterly billings were in the region of \$250,000. The project's total costs were to exceed U.S. \$4.5 million, a massive sum by the standards of the humanities, but in fact low for all that was achieved.
14. Begun in 1966 under the sponsorship of the Österreichische Akademie der Wissenschaften and still actively in progress (www.oeaw.ac.at/tib/); note also the reports (most recently by J. Koder as Director) to successive meetings of the International Congress of Byzantine Studies.
15. In 2000, when the atlas went to press, its printer Eurografica S.P.A., Vicenza, Italy, amply fulfilled expectations in this very demanding respect.
16. Map 57, an overview of the Aegean, exploits this option to an exceptional extent in order to include places of importance. Many maps in the range from 64 down to 80 'bleed' extensively off their lower margins in order to permit less tight continuation of coverage from one map to the next.
17. Winearls, 152-53.
18. L.J. Cappon (ed.), Princeton, 1976.
19. Winearls, 166; note Holdsworth's further comment on 188.
20. Geosystems, 1994-98; MapQuest.com, Inc., thereafter. In order to avoid confusion, I refer to the team as "Donnelley" throughout the present discussion.
21. For the members of Donnelley's cartographic team, see *Barrington Atlas*, xv. Donnelley's summary record of map production and all

exchanges with myself and the project office from summer 1989 to spring 2000 comprises twenty-eight thick binders now held by the Ancient World Mapping Center at the University of North Carolina, Chapel Hill (see further below).

22. Compare Dean's novel demand for the *Economic Atlas of Ontario* (Toronto, 1969): "Yet another most critical event with this atlas was justly placing the cartographer's name in the same type size on the title page alongside that of the editor. This was done over the vehement objections of the publisher accustomed to thinking of a cartographer in the same category as the illustrator of a book" (Winearls, 145). While I trust that the published *Barrington Atlas* duly offers its cartographers the prominence and praise they richly deserve, it remains the case perforce that much of their design work and their skilled adjustment and improvement of the map bases will never be identified as such by most users of the atlas, and hence unfortunately never appreciated for their full worth.
23. *The International 1:1,000,000 Map Report for 1938* (Southampton), 6; see further *Journal of Roman Archaeology* 5 (1992) 19, cited above (n. 4).
24. See Map 74 and its accompanying text in the *Map-by-Map Directory*. In fact, all the great river deltas gave rise to comparable difficulty.
25. Most recent in 2001 (1:625,000 scale).
26. In some remote regions – parts of Libya, for example, on ONC H3 and H4 – physical landscape data was missing, and therefore had to be imported from other maps.
27. To be sure, in the event of a choice, it might have been preferable to adopt metric measurements for the atlas; but there was no such choice. By the same token, to convert all figures and redraw all contour linework to metric intervals would have been grossly wasteful. A scalebar in both miles and kilometres accompanies each map, and there are bars for the elevation tints likewise on the foldout Map Key page. Contour intervals are the only figures of measurement to appear on the maps; all spot-heights marked on the base series are removed.
28. A list of all map bases used appears in *Barrington Atlas*, xxix. As it turned out, no use was made of the JNC (1:2,000,000) series.
29. Later into the project, the availability of DCW's large seamless 'tiles' permitted some advantageous adjustments which earlier it had been judged impractical to implement. Notably, the bottom margin of Map 86 (its upper part all open water) could now be dropped to extend well below ONC F-3's bottom sheet-line at latitude 40 00, greatly improving the continuation to Maps 62 and especially 63, both at 1:500,000.
30. Hence the arrows pointing to Gat, Zella and certain other oases situated beyond the scope of the atlas.
31. Fortunately the base it required was the GNC sheet already ordered for Map 1.

32. Map 1 uniquely comprises a doublespread with a foldout continuation equivalent to a third page so that the entire Mediterranean can appear on a single map. A few very isolated islands (Ustica, Aethusa, Lopadusa, for example) are only shown here because at larger scales much open water is omitted. I now realize that one such island group with an ancient name – Strophades, south of Zacynthus at lat. 37 15N, long. 21 00E – was inadvertently overlooked altogether.
33. Such maps might have been hoped for in R. Stillwell et al. (eds.), *The Princeton Encyclopedia of Classical Sites* (Princeton, 1976), but it offers none. Even the third edition of the *Oxford Classical Dictionary* (edd. S. Hornblower and A. Spawforth, Oxford, 1996) makes no apology for its complete lack of maps (see p. ix), and in fact seldom refers to any.
34. Range and variety are well illustrated by, for example, the *Atlas historique des cadastres d'Europe* series edited by M. Clavel-Lévêque et al. (Luxembourg, vol. 1, 1995; vol. 2, 2002), and L. Haselberger et al., *Mapping Augustan Rome* (Journal of Roman Archaeology Supplementary Series, no. 50, Portsmouth, RI, 2002), the latter a most welcome city-plan.
35. It could otherwise remain limited to five inks (and did) – the standard four (cyan, magenta, yellow, black) and a custom brown. Each further ink used increases costs, and complicates printing (note the slight misregistration of Late Antique orange in Map 67, which only surfaced on press, and could not be corrected). *Tabula Imperii Byzantini* maps – printed at government expense – incorporate a complex color-coding scheme for periodization.
36. Headings for each entry are: grid square; name as marked on the map; period(s) of occupation; modern name/location; reference(s) to publication(s) where fuller information may be found.
37. Over seventy worldwide came to be engaged, grouped under ten further colleagues who served as regional supervisors ('vicars'); draft compilations were sent to almost 100 more experts for independent evaluation which proved invaluable. For names, see *Barrington Atlas*, xi and xiii-xiv respectively.
38. Susan Jenny began as project manager early in 1992 and continued in the post until summer 1999, when there was no longer the need for it. Two successive map editors each served for three years, Drs. Mary Downs (1993-96) and Joann McDaniel (1996-99). Altogether, for administration and editing the project benefited greatly from the kind of continuity in personnel that also served the HAC so well (Winearls, 157, 182).
39. For further details, see *Barrington Atlas*, xxvii.
40. HAC, with its far earlier start, was able to benefit much less in these ways, as Dean points out (Winearls, 157).
41. HAC, too, had to face the problem of contributors who were tempted to overload their maps (Winearls, 194 n. 3).

42. Two factors saved the overall production schedule from slipping behind, however: unexpectedly *early* delivery by some compilers, and (ironically) the sheer immensity of the project. Often the plan to move ahead next in one area had to be postponed, therefore, because a compilation or two were still missing; meantime, on the other hand, it had become possible to bring forward the work for another area.
43. In particular between Maps 1 and 3, for example; also 5 and 6.
44. Note, for example, S.E. Alcock, H.W. Dey and G. Parker, "Sitting down with the *Barrington Atlas*," *Journal of Roman Archaeology* 14 (2001) 454-61 at 461.
45. The three digital 1:500,000 maps (17, 47, 68) had all suffered severe delays of various kinds at the compilation stage, and were the last at this scale to go into production.
46. Its five phases are summarized in *Barrington Atlas*, xxvii-xxviii. Both to reduce the risk of error and to contain costs, all the scanning overlays for phase 3 were created by the map editor in the project office rather than by Donnelley. This placed an extra burden on her, as well as adding to a "veritable snowstorm of paper" (and hercules) in the cramped confines of the office, comparable to that generated by the HAC (to cite Dean's phrase in *Winearls*, 157).
47. No 250 ft. contour was added to all or part of certain maps where the landscape hardly called for it. The omission is noted in the margin in each such instance; see, for example, Maps 9 and 86.
48. Hence, for example, on Map 62 D3 the underline for *Türkmen Baba* is not wholly orange as it should be.
49. Note Holdsworth's cautions on the transition to computerized cartography (*Winearls*, 193). For HAC, this only began successfully in 1990, after three earlier attempts at computerization had all failed "because of excessive costs or inadequate technology or both" (Dean in *Winearls*, 149, 152). By then only volume two of the three in the set remained to be completed, and funds were perilously low. It was computerization that made completion possible, with fifty of this volume's fifty-eight plates produced thus, all of them indistinguishable in appearance (as in the case of the *Barrington Atlas*) from those produced conventionally.
50. The original estimate that the first volume of the HAC could be delivered in three years proved "simply wrong" (Cole Harris in *Winearls*, 164).
51. A brief note on funding is in order before leaving the issue of timing. To raise the necessary support for the atlas was challenge enough during the 1990s; thereafter (as is now all too clear) the economic downturn is likely to have made it impossible, and the entire effort might well have foundered at an advanced stage.
52. I advocated such a center in "Maps for the classical world: where do we go from here?," *American Journal of Philology* 118 (1997) 323-27.

53. The Center's activities and prospects are discussed in a chapter "Mapping the ancient world" contributed jointly by Tom Elliott, the current director, and myself to A.K. Knowles (ed.), *Past Time: Past Place; GIS for History* (Redlands, Ca, 2002), 145-62. For up-to-date information, visit www.unc.edu/awmc.
54. Winearls, 195 n. 14.
55. For comparable choice of goal by a project which began recently enough to use NIMA's VMAP0 (the 'successor' to DCW) as its base, note S. Parpola and M. Porter (eds.), *The Helsinki Atlas of the Near East in the Neo-Assyrian Period* (Casco Bay Assyriological Institute, Chebeague Is., Me, 2001).

Marianne Moore's "Sea Unicorns and Land Unicorns": The "Unreal realities" of Early Modern Maps and Animals

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This paper is about a poet and two cartographers. The poet is Marianne Moore, one of the most lauded and loved American poets of the twentieth century. In 1924 she published "Sea Unicorns and Land Unicorns," a poem examining four exotic beasts—narwhals, unicorns, sea lions, lions—and their celebrated, if unreal, relationships to one another. While describing sea unicorns early in the poem, Moore specifies "the cartographers of 1539." The date can only allude to the *Carta Marina* of the Swedish mapmaker and historian Olaus Magnus, whose famous 1539 "marine map" features a profusion of Scandinavian land and sea creatures. Moore's "cartographers of 1539" compels us, in turn, to consider other mapmakers who crowded their maps with animals. The plural phrase also balances and anticipates her comparison, near the end of the poem, of the unicorn and "an equine monster of an old celestial map." Though vague, the simile may suggest the winged figure of Pegasus on a celestial chart by Peter Apian. This popular German cartographer and astronomer originally designed his chart in 1536, then reproduced it—a year after the *Carta Marina*—in his exquisite *Astronomicum Caesareum* (1540). In the end, Moore's portrayal of animals in "Sea Unicorns and Land Unicorns" captures the spirit that animated mapping, art, and science during the sixteenth-century Age of Exploration.

Key words: Marianne Moore, Olaus Magnus, Peter Apian, pictorial maps, celestial maps, sixteenth-century cartography

If you do not expect the unexpected,
 you will not find it,
 for it is hard to find and difficult.

Heraclitus 18

Animals and maps have an abiding partnership. Prehistoric topographical maps reveal enclosures for game and the locations of hunting grounds.¹ Aboriginal maps use animals to signify bonds between clans and territories. Mandalas integrate animals into their hierarchic cosmologies. And celestial charts of differing cultures and periods display constellations shaped like animals.

European mapmakers used animal hides to create navigation charts and masterpieces like the Hereford world map (ca.1300). They depicted the Holy Roman Empire as an eagle (1574) and the Low Countries as a lion (*Leo Belgicus*, 1583). They embellished hundreds of medieval and early modern maps with animals (George, 1969: 25), a fashion that would culminate in the baroque maps of the seventeenth century.

After pictures of animals began disappearing from mapped space in the eighteenth century, thematic maps found more precise and abstract ways

to chart the distribution of animals. Yet zoomorphic maps made a comeback in the political cartoons of the nineteenth century: gerrymandered districts became a winged "salamander"; Spain, a bear; and Russia, an octopus. Children's games and geography texts began to include animals on maps. Today, children across the world portray animals on their picture maps. Maps with animals illustrate children's books and adult novels, appear in the visual arts, advertise eco-tours, and comment on the environment. Subjects of serious research and cultural fascination, early zoological maps are avidly sought after by libraries and museums, collectors and galleries. With their eye-catching charm, animals will always remain part of our "cartographic alphabet" (Wallis, in George, 1969: 19).

The portrayal of animals on maps links American poet Marianne Moore (1887-1972) with Olaus Magnus, Peter Apian, and the other cartographers surveyed in this paper. Among poets Moore was not alone in her attraction to early zoological maps: Canadian poet Earle Birney found inspiration for "Mappemounde" (1945) in the creatures displayed on early English maps and at the corners of Italian *portolani* (Haft 2002); and English poet Grevel Lindop featured the crocodile and centaur of the Hereford world map in "Mappa Mundi" (1987; Haft, 2003). But it was the 1539 *Carta Marina* of Olaus Magnus that galvanized Moore to write her only poem based on maps, "Sea Unicorns and Land Unicorns" (1924).

That Moore found inspiration in this particular sixteenth-century map is hardly surprising. Moore and Olaus Magnus were kindred spirits: acute observers of animals in nature and in art, they used unfamiliar and exotic animals to instruct and reveal the unexpected diversity of the world. The *Carta Marina* has long been recognized as "a major contribution to the natural history of northern Europe and the northeast Atlantic Ocean" (Wallis and Robinson, 1987: 160). But it is also a work of art. Combining Olaus Magnus's ambition for exactitude with his obsession with ornamentation, the *Carta Marina* epitomizes the two opposing developments in sixteenth-century cartography (Wallis, in George, 1969: 17). Inspired by his work, Moore crafted "Sea Unicorns and Land Unicorns" into a poem as expansive, exquisitely detailed, and teeming with creatures as the *Carta Marina*.

To my knowledge, no other poet attempted to distill Olaus Magnus's graphic poetry into verse until the year 2000, when the History of Cartography Project commissioned Lucia Perillo to write "The Carta Marina (1539)" in celebration its upcoming volume on Renaissance maps and charts.² But only Moore has linked *two* magnificently complex maps with a host of other visual and literary sources to create a masterpiece that universalizes the paradoxes of the sixteenth century. Along with (I suggest) Peter Apian's equally poetic map of the constellations from his *Astronomicum Caesareum* of 1540, the *Carta Marina* becomes a filter through which Moore explores the intersections of fact and fiction, and of science and tradition, in the sixteenth century.

This paper falls into four parts and an epilogue. Part I begins with Marianne Moore's reputation as a poet, then turns to "Sea Unicorns and Land Unicorns." Its definitive version is followed by discussion of the poem's distinctive style, content, and visual impact. Because references to cartographers and maps frame the poem, we consider why her phrase "the cartographers of 1539" must allude to Olaus Magnus. The startling dearth of scholarship on maps in "Sea Unicorns and Land Unicorns" leads, in turn, to the contributions this paper offers to the study of Moore's poem and our understanding of maps in poetry generally. Part II explores the ways that Olaus Magnus's work acts as a visual inspiration and analogue to Moore's poem. After surveying the exotic creatures in "Sea

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“Marianne Moore was among the most loved and lauded poets of the twentieth century.”

Unicorns and Land Unicorns,” it traces their non-cartographic sources and the poet’s lifelong fascination with animals. Next it describes the *Carta Marina*, emphasizing the circumstances behind Olaus Magnus’s creation of his map and subsequent “commentary,” the *Historia de gentibus septentrionalibus* (1555). It ends by showing how “Sea Unicorns and Land Unicorns” embodies the essence of Olaus Magnus’s consummately sixteenth-century work.

The next two parts argue that Moore’s pluralized “cartographers of 1539” (emphasis mine) compels us to consider other mapmakers active at that date—presumably those who, like Olaus Magnus, lavished creatures upon their maps. The implications of this plural form, never before acknowledged, lead us to Parts III and IV. Part III asks why Moore might have chosen Olaus Magnus over his predecessors and contemporaries, while Part IV asserts that Moore chose Olaus Magnus and one of his contemporaries—Peter Apian. Since Part III deals with makers of terrestrial maps and Part IV, with makers of celestial maps, Moore’s line “the cartographers of 1539” elegantly unites the two halves of her poem. At the same time, it subtly alludes to the paired celestial and terrestrial maps that the sixteenth century would popularize for the next two hundred years.

Part I

Introducing Marianne Moore

Marianne Moore was among the most loved and lauded poets of the twentieth century. The Pulitzer Prize, the National Book Award, and the Bollingen Prize for Poetry—all followed the publication of her *Collected Poems* in 1951. Within the avant-garde, recognition came even earlier. No sooner were her poems published in 1915 than their titles attracted Ezra Pound (Engel, 1964: 33), who began corresponding with her shortly after World War I (Costello, 1981: 122). In 1921 Moore’s first collection, *Poems*, was released in England. Before T.S. Eliot’s *The Waste Land* burst onto the scene in 1922, Moore may have been considered the premier modernist poet (Leavell, 1995: 44-45).

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The year 1924 proved a watershed. She completed “Sea Unicorns and Land Unicorns,” one of three long poems she’d been laboring over since 1922.³ Moore turned thirty-seven around the time that “Sea Unicorns and Land Unicorns” appeared beside contributions from Kenneth Burke, Marc Chagall, Thomas Mann, and Edmund Wilson in the November issue of *The Dial*, a New York periodical devoted to the arts (Moore, 1924a: 411-13); Schulze 2002: 321-22, 326). At the same time, the Dial Press published Moore’s second collection, *Observations*, featuring “Sea Unicorns and Land Unicorns” as its final poem (Moore, 1924b:91-93; notes: 107-109); Schulze 2002: 133-35; notes 149-51). *Observations*, in turn, brought her even closer to *The Dial* and its cultured audience, especially after the collection won The Dial Award. Moore was soon named acting editor of the prestigious journal, then became editor from 1926 until its demise in 1929.

Moore’s connections with *The Dial* established her reputation (Engel, 1964: 34-36). T.S. Eliot introduced her subsequent volume, *Selected Poems*, with the accolade: “Miss Moore’s poems form part of the small body of durable poetry written in our time; of that small body of writings, among what passes for poetry, in which an original sensibility and alert intelligence and deep feeling have been engaged in maintaining the life of the English language” (Eliot, in Moore, 1935: xiv). As for “Sea Unicorns and Land Unicorns,” Moore’s superb early poem appeared with slight revisions in her *Selected Poems* (Moore, 1935: 90-92; notes: 121-22) and in her

celebrated *Collected Poems* (Moore, 1951: 85-87; notes: 166-67). Five years before her death at the age of eighty-four, the version from which our text derives resurfaced in her definitive *Complete Poems* (Moore, 1967: 77-79; notes, 274-75). ("Sea Unicorns and Land Unicorns" is reprinted with the permission of Scribner, an imprint of Simon and Schuster Adult Publishing Group, from THE COLLECTED POEMS OF MARIANNE MOORE by Marianne Moore; copyright renewed © 1963 by Marianne Moore and T.S. Eliot.)⁴

"Sea Unicorns and Land Unicorns"

with their respective lions—
 "mighty monoceroses with immeasured tayles"—
 these are the very animals
 5 described by the cartographers of 1539,
 defiantly revolving
 in such a way that
 the long keel of white exhibited in tumbling,
 disperses giant weeds
 10 and those sea snakes whose forms, looped in the foam, "disquiet shippers."
 Knowing how a voyager obtained the horn of a sea unicorn
 to give to Queen Elizabeth,
 who thought it worth a hundred thousand pounds,
 they persevere in swimming where they like,
 15 finding the place where sea-lions live in herds,
 strewn on the beach like stones with lesser stones—
 and bears are white;
 discovering Antarctica, its penguin kings and icy spires,
 and Sir John Hawkins' Florida
 20 "abounding in land unicorns and lions;
 since where the one is,
 its arch-enemy cannot be missing."
 Thus personalities by nature much opposed,
 can be combined in such a way
 25 that when they do agree, their unanimity is great,
 "in politics, in trade, law, sport, religion,
 china-collecting, tennis, and church-going."
 You have remarked this fourfold combination of strange animals,
 upon embroideries
 30 enwrought with "polished garlands" of agreeing difference—
 thorns, "myrtle rods, and shafts of bay,"
 "cobwebs, and knotts, and mulberries"
 of lapis lazuli and pomegranate and malachite—
 Britannia's sea unicorn with its rebellious child
 35 now ostentatiously indigenous to the new English coast;
 and its land lion oddly tolerant of those pacific counterparts to it,
 the water lions of the west.
 This is a strange fraternity—these sea lions and land lions,
 land unicorns and sea unicorns:
 40 the lion civilly rampant,
 tame and concessive like the long-tailed bear of Ecuador—
 the lion standing up against this screen of woven air
 which is the forest:
 the unicorn also, on its hind legs in reciprocity.
 45 A puzzle to the hunters, is this haughtiest of beasts,
 to be distinguished from those born without a horn,
 in use like Saint Jerome's tame lion, as domestics;
 rebelling proudly at the dogs
 which are dismayed by the chain lightning
 50 playing at them from its horn—

the dogs persistent in pursuit of it as if it could be caught,
 "deriving agreeable terror" from its "moonbeam throat"
 on fire like its white coat and unconsumed as if of salamander's skin.
 So wary as to disappear for centuries and reappear,
 55 yet never to be caught,
 the unicorn has been preserved
 by an unmatched device
 wrought like the work of expert blacksmiths,
 this animal of that one horn
 60 throwing itself upon which head foremost from a cliff,
 it walks away unharmed;
 proficient in this feat which, like Herodotus,
 I have not seen except in pictures.
 Thus this strange animal with its miraculous elusiveness,
 65 has come to be unique,
 "impossible to take alive,"
 tamed only by a lady inoffensive like itself—
 as curiously wild and gentle;
 "as straight and slender as the crest,
 70 or antlet of the one-beam'd beast."
 Upon the printed page,
 also by word of mouth,
 we have a record of it all
 and how, unfearful of deceit,
 75 etched like an equine monster of an old celestial map,
 beside a cloud or dress of Virgin-Mary blue,
 improved "all over slightly with snakes of Venice gold,
 and silver, and some O's,"
 the unicorn "with pavon high," approaches eagerly;
 80 until engrossed by what appears of this strange enemy,
 upon the map, "upon her lap,"
 its "mild wild head doth lie."

As we read "Sea Unicorns and Land Unicorns" ("SULU"), we are struck first by its focus on exotic animals, then by its visual impact, literary content, and distinctive style. Except for the title, which also functions as her first line, Moore's poem is a single stanza of free verse. Eschewing most finite verbs beyond the deceptively factual "is"/"are," "SULU" abounds in participles, nouns, quoted phrases and catalogues—all of which lend a conversational style even as they compel the reader to "look 'at' her words" (Leavell, 1995: 94; see also 68, 76-77, 90-93). Like much of her work, "SULU" contains fragments borrowed predominately from prose writers like Henry James and Leigh Hunt (Moore, 1961: 260-61; see Moore, 1967: 274-75). Quotation marks are common, especially in "SULU" and the other verses she composed in 1923-24. Which is why Scofield Thayer, editor and owner of *The Dial*, asked for her sources when preparing *Observations* for publication. She agreed to "append, at the back of the book, notes such as these I am sending you" if "SULU" was also included (Stapleton, 1978: 36). Since then, Moore's poem always appears with notes in her collections.⁵

Throughout her career, Moore offered several reasons for calling attention to these fragments. She told Thayer, "As for quotations, sometimes I think a triviality gains a little weight by quotation marks; for the most part, however, my quotations have authority" (Moore, quoted in Stapleton, 1978: 36 and n.17). Forty years later, she confessed that "acknowledgments seem only honest," a way of sharing authors she enjoyed (Moore, 1967: 262; see Moore, 1961: 260). Or she protested (Moore, 1961: xv):

Pardon my saying more than once, When a thing has been said so well that it could not be said better, why paraphrase it? Hence my writing is, if not a cabinet of fossils, a kind of collection of flies in amber.... [A poem] is a little anthology of statements that took my fancy—phrasings that I liked.

"SULU" is also a collection of favorite images. "Almost every poem Moore wrote involved a picture or art object at some stage of composition" (Costello, 1981: 192; see Willis, 1987). Moore's passion for the visual arts began when she was young. She contemplated becoming a painter after her graduation from Bryn Mawr College in 1909, illustrated her notebooks with pen and ink sketches, took up watercolors, socialized with visual artists after she moved to Manhattan in 1918, befriended writers who painted (and painters who wrote), visited museums and galleries, and collected books on art throughout her life (Costello, 1981: 186-214; Leavell, 1995: esp. 6, 14, 56). Her poetry is often compared to collage because she mixed "subjects and categories through a literal scavenging of language from magazines, newspapers, atlases, overheard conversation" (Costello, 1981: 212). For Moore, collage—and, by implication, the assemblage techniques she herself employed—provided a "psychic map of the creative mind" (Moore, quoted in Leavell, 1995: 127; see 117-127).

Previewing the Maps in "Sea Unicorns and Land Unicorns"

Maps rank high among the visual inspirations for "SULU." Moore alludes to one when she describes the unicorn as "etched like an equine monster of an old celestial map" (line 75). Her reference to the *Carta Marina* or "marine map" of Olaus Magnus is more subtle. She names Olaus Magnus, not in the poem but in her note on "disquiet shippers" (line 10). Moore discovered that sea snakes "disquiet shippers" in Violet A. Wilson's 1922 work *Queen Elizabeth's Maids of Honour*, a book she mined for anecdotes during her three-year gestation of "SULU."⁶ Wilson was quoting from yet another source, which she (and subsequently Moore) identified as *The History of the Goths and Swedes* by Olaus Magnus (Wilson, 1922: 157). The title refers to the *Historia de gentibus septentrionalibus*, a popular ethnography completed by the Swedish archbishop Olaus Magnus in 1555. Wilson's quote came from the first English translation of his work, the abridged *Compendious History of the Goths, Swedes, and Vandals, and Other Northern Nations*, printed in 1658. At the back of *Observations*, Moore excerpts the passage Wilson took from this translation (Moore, 1924b: 107):

[The sea serpent] hath commonly hair hanging from his neck a cubit long, and sharp scales and is black, and he hath flameling [*sic*] shining eyes. This snake disquiets shippers, and he puts up his head like a pillar, and catcheth away men.⁷

Neither Wilson nor her 1658 source, however, gave Moore the detail of the snake's "forms looped in the foam" (line 10). *A Compendious History* concentrated on the creature's gigantic size (Olaus Magnus, [1555] 1658: 235 at 21:27), while Wilson emphasized its "terrible appearance and unattractive habits." Moore dug deeper. That she found the *Carta Marina* is attested by her lines "mighty monoceroses/ these are the very animals/ described by the cartographers of 1539" (lines 3-5). The date, otherwise puzzling in its specificity, is the year Olaus Magnus published his marine map. Not only

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“Not only was the Carta Marina his most enduring legacy, but its mapped lands and seas are teeming with creatures like the coiled sea serpent.”

was the *Carta Marina* his most enduring legacy, but its mapped lands and seas are teeming with creatures like the coiled sea serpent.⁸

Scores of books and articles examine Moore’s life and poetry (see, for instance, Abbott, 1977 and 1978). But only one author seems to have identified Olaus Magnus as the cartographer alluded to in the opening lines of “SULU.” Moore’s reference to Olaus Magnus’s *History* led Elizabeth Phillips to argue that “SULU” describes two maps: one earthly, the other heavenly (Phillips, 1982: 128-33). By emphasizing “the cartographers of 1539” and naming the Elizabethan explorers John Hawkins (line 19) and Thomas Cavendish (note on lines 11-13), Moore suggests that the first half of “SULU” alludes to sixteenth-century mapmaking and exploration. For Phillips, these achievements—and the strange animals reportedly associated with them—revealed the palpable transitions in western Europe from a medieval to an early modern perspective (cf. Lynam, 1949: 4). Balancing the terrestrial map is “an old celestial map,” part of a simile describing the unicorn in the second half of the poem. Moore’s focus on the unicorn in the last forty lines and the creature’s willingness to be “tamed only by a lady inoffensive like itself” (line 67) indicated to Phillips that Moore’s second map represents a thematic shift from the secular realm to the religious (Phillips, 1982: 131):

The unicorn, common to many cultures, is not an exclusively Christian symbol, but one rich in associations transfigured by the art of Christianity. Moore recovers the religious imagination of the medieval world and reinterprets the legends in a fable for a post-Christian era.

Phillips regarded Moore’s “celestial map” as a metaphor for the “spiritual forces” within her life and art: that the poet’s unicorn ultimately rests its head “upon the map, ‘upon her lap’” supposedly demonstrated Moore’s belief that spirit supersedes matter.

There is no doubt that Moore was a devout Christian⁹ or that her poetry is quietly didactic, a celebration of the morals and virtues she held dear. That said, it is not my intent to wrestle with the question of how Moore’s faith influenced either her poetry or modernism in general, a movement that emphasizes the artifice behind even the most “realistic” art (see Leavell, 1995: 3, 43-44, 91, 136, 144, 157).

“My paper examines the work of Olaus Magnus in depth to reveal how the map may have influenced ‘SULU.’”

Instead, my paper expands in different ways upon Phillips’s very brief analysis. First, it continues where she left off. Phillips mentions the *Historia* only in passing and limits her description of the *Carta Marina* to fourteen words: “the first detailed map of Scandinavia and the north with any pretensions to accuracy” (Phillips, 1982: 129). My paper examines the work of Olaus Magnus in depth to reveal how the map may have influenced “SULU.” Second, it argues that Moore’s plural “cartographers” alludes to other makers of terrestrial maps who were active in 1539, especially those featuring the kinds of creatures in Moore’s poem. Third, it suggests that “the cartographers of 1539” also encompasses the creator of her “celestial map,” a chart every bit as sublime and *real* as the *Carta Marina*. Finally, it ponders the relationship between “SULU” and any celestial map.

“SULU” is not *about* a particular map (or maps), of course, any more than it is *about* the other important works of art to which Moore alludes. But her verbal images remain vivid today because she observed nature and art so attentively throughout her long career. To appreciate her work requires that we attempt to view such inspirations through her eyes. Just as poems about maps are unfamiliar to most cartographers today, the maps woven into the fabric of “SULU” are less familiar than other works

of art to most readers of twentieth-century poetry. When combined with the fact that Latin was the written language of the sixteenth-century humanists, these points account for the dearth of scholarship on the subject. This paper, then, offers some of the opportunities afforded Moore, who benefited not only from the museums and art galleries of New York City, but also from the incomparable treasures of The New York Public Library. During the years she was composing "SULU," Moore worked as part-time librarian at the Hudson Park branch in Manhattan's West Village (Engel, 1964: 13), and her reading diaries are full of quotes from the books and periodicals available to her at The New York Public Library.¹⁰ Seeing the images that inspired "SULU" helps us understand the ways in which Moore used animals to portray the "unreal realities" of the sixteenth century.¹¹

Part II

Moore's magnificent beasts

From title to final line, "SULU" brims with animals. Moore pairs land unicorns with sea unicorns and lions with sea lions, then makes their four-fold combination even more fluid by her use of synonyms. The "land unicorn" can be merely a "unicorn" or, more poetically, "the one-beam'd beast." Sea unicorns are also "mighty monoceroses." "Lions" lengthen to "land lions." And "sea lions" may be hyphenated or called "water lions." To this "strange fraternity," Moore adds sea serpents (line 10), white bears (17), penguin kings (18), long-tailed Ecuadorian bears (41), horses (46), dogs (48-51), salamanders (53), and snakes (77). Such animals are real, brought together in Moore's verse-zoo from different parts of the world.¹²

The unicorn, of course, is fabulous. Yet for over 4000 years it "permeated human thought and art perhaps more than any other animal, real or imagined" (Bruemmer, 1993: 10; cf. Shepard, 1930: 94)—a paradox that Moore happily exploits in "SULU." Consider its effect on the humble narwhal. Long hailed the "sea unicorn" (Bruemmer, 1993: 13), the narwhal was known as *monoceros*, "one-horned," the Greek cognate of "unicorn" and the name given originally to the unicorn alone (Pliny, *Natural History* 8.31.76). Like its mythical counterpart, the small whale was thought to possess a horn that could detect and counteract poison (Bruemmer, 1993: 26; see Wilson, 1922: 154, and Freeman, 1976: 14, 27-29 and pl.2). Though the unicorn's elegant spiral horn is, in fact, the left tusk of the arctic whale, the narwhal's icy habitat meant that most medieval and early modern readers dreaded the mysterious sea unicorn (Bruemmer, 1993: 55-56).

Moore took her animals from a kaleidoscope of literary and visual sources. Her "equine monster" springs from classical mythology. She credits Bulfinch's *Mythology* for the story of the unicorn throwing itself headfirst from a cliff and surviving (note on line 57). "This feat which, like Herodotus, I have not seen except in pictures" (62-63) alludes to the ancient Greek historian's fondness for describing fabulous creatures—but only after ascribing such stories to his sources (Moore, note on line 65: Herodotus, *History* 2.73).¹³ The salamander is one of the many animals in "SULU" that graced the pages of medieval bestiaries. Those illuminated bestsellers, whose authority waned only in the sixteenth and seventeenth century, touted the Christian "morality" of all manner of beasts, from the common to the imaginary. Moore's phrase "unconsumed as if of salamander's skin" recalls a belief perpetuated by the Roman naturalist Pliny the Elder—that the amphibian could remain unharmed while extinguishing and even living in fire.¹⁴

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"The unicorn, of course, is fabulous. Yet for over 4000 years it 'permeated human thought and art perhaps more than any other animal, real or imagined'—a paradox that Moore happily exploits in 'SULU.'"

“Animals in late fifteenth- and sixteenth-century masterpieces are particularly evident in ‘SULU.’ The Carta Marina itself features a sea unicorn.”

Animals in late fifteenth- and sixteenth-century masterpieces are particularly evident in “SULU.” The *Carta Marina* itself features a sea unicorn; while Moore, in her note to line 3, attributes “mighty monoceroses with immeasured tayles” to a poet she greatly admired—Edmund Spenser, author of *The Faerie Queene* (Spenser, [1596] 1987: II.xii.23.9; Leavell, 1995: 203). “Saint Jerome’s tame lion” (line 47), it has been suggested, alludes to an unfinished painting by Leonardo da Vinci (ca. 1482), the subject of Moore’s later poem “Leonardo da Vinci’s” (Moore, 1959: 30-31; see Engel, 1964: 76; Costello, 1981: 200; and Marani, 1999: 95-100). Moore enjoyed his drawings (Leavell, 1995: 138), which include sketches of a unicorn with a lady (see Stites *et al.*, 1970: 69 and figs. 62a and 62b). There’s nothing “tame,” however, about the roaring lion in Leonardo’s painting. Moore may have envisioned, instead, any one of the studies made from 1492 to 1514 by Albrecht Dürer (Eisler, 1991: 143, figs. 6.7-11, 6.14-15, and pl.21), the German Renaissance master who was one of Moore’s favorite artists (Costello, 1981: 193-97). Among Dürer’s nearly 2000 works are various depictions of unicorns (Eisler, 1991: pl.26 and figs.11.39-43) and exquisite renderings of the animals and sea creatures he observed during his travels. Moore’s poetry notebook of 1922-30, in fact, reveals that she turned from “SULU” to begin writing her Dürer poem “The Steeple-Jack” (see Moore, 1967: 5, lines 1-3; Rosenbach, 7:04:04, 1251/7, p.110): “Dürer would have seen a reason for living/ in a town like this, with eight stranded whales/ to look at...” (1932).

Tapestries are the backdrop for Moore’s lines about the lion “standing against this screen of woven air” opposite the unicorn with “its hind legs in reciprocity/ a puzzle to hunters” (lines 40-44). Here Moore refers to the Cluny Museum’s *Lady with the Unicorn* series in Paris and, more obliquely, to the famous Unicorn Tapestries in New York City—both sets of which were woven around 1500 (Sullivan, 1987: 154-56; see Verlet and Salet, 1961: 38-39; and Freeman, 1976: 13, 62-65, pls.75-80). In 1922, six of the Unicorn Tapestries arrived in New York City from Paris and were displayed at the Anderson Galleries before being sold, the following February, to John D. Rockefeller, Jr. (Freeman, 1976: 225 and nn.10-13). Moore’s poetry notebook of 1922-23 describes three in enough detail to indicate that she’d visited the Anderson Galleries or seen reproductions of the tapestries in print (Rosenbach, 7:04:04, 1251/7, pp.88-89).

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Moore’s preoccupation with beasts in “SULU” reflects a lifelong fascination. Long before she was published, she and her family used animal nicknames for one another. Her mother became “Fawn,” “Mouse,” “Bunny,” and “Mole”; her brother, (John) Warner Moore, “Toad,” “Turtle,” and “Badger”; and Marianne, “Fangs,” “Gator,” and “Rat” (Costello, in Moore, 1997: 4-5; Leavell, 1995: 43 and 83). These and other pet names recur in the thousands of letters she wrote to them (Costello, in Moore, 1997: ix-x). While Moore explores heterosexual union in “Marriage,” one of the two poems she composed with “SULU,” the “strange fraternity” of animals in our poem grapples with more complex sets of relationships—like those the decidedly unmarried Moore sustained with her mother, brother, and later Constance Eustis, whom Warner took to wife when he became a navy chaplain in 1918.

Moore’s correspondence around the time of the poem reveals her enthusiasm for the lions and sea lions she watched at Barnum Bailey Circus in Madison Square Garden, and for the animals she encountered at zoos and country fairs (Moore, 1997: 154-55, 162, 167, 169, 205). Moore may have observed sea lions in the wild during her visits to Warner between 1920 and 1923, while his ship was based in Bremerton, fifteen miles west of Seattle (Stapleton, 1978: 47; Moore, 1997: 119-20). Not only did

Warner present his sister with a narwhal's tusk (Stapleton, 1978: 46), but their visits inspired her third companion piece, "An Octopus." Although Moore never composed a poem about maps again,¹⁵ throughout her life she took copious notes on unusual animals, sketched them in her notebooks (see Rosenbach, 7:01:03, Reading Notebook 1250/3, 1921-22, p.79, for her lizard), and featured them in some forty poems written between 1909 and 1967 (Holley, 1987: 128; more are now found in Schulman, 2003).

Asked why she found animals so fascinating, Moore quipped (Moore, 1961: xvi):

They are subjects for art and exemplars of it, are they not? minding their own business. [They] do not pry or prey—or prolong the conversation; do not make us self-conscious; look their best when caring the least...

Carefully observed in their own right, Moore's animals are lessons in the wonder, variety, and persistence of both life and art. She admired the grace and beauty of animals, their lack of artifice and self-consciousness, their amoral purity of action. To them she often ascribed the qualities to which she herself aspired: "courage, independence, responsibility, genuineness, and a certain ardor in the conduct of one's life" (Engel, 1964: 17). In her verse, animals become "friends and magical protectors" whom she could protect in turn by "'capturing' them, saving them from the danger of extinction through ignorance, classifying and preserving them" (Hadas, 1977: 103 and 107). Exotic beasts, whether real or imaginary, were particularly appealing because her readers were unlikely to be sentimental about them (Engel, 1964: 20). As one scholar put it, "By adopting animals as subjects instead of persons the moral critic could go disguised as animal lover" (Leavell, 1995: 155).

Not that she didn't feel a genuine kinship: she once confessed that whenever she met animals she "wonder[ed] if they [were] happy" (Weatherhead, 1967: 67). But kinship involves ambivalence. In a 1921 letter, the poet acknowledged that "religious conviction, art, and animal impulse are the strongest facts in life, I think, and any one in the ascendant can obliterate the others" (Moore, 1997: 180; cf. 120). In "SULU" Moore's lady—despite her resemblance to the unicorn (lines 67-70)—remains its "strange enemy" (line 80).

The Carta Marina of Olaus Magnus

Returning to the first half of "SULU," however, we find that Moore's opening lines showcase the sea unicorn. It is here that she reveals her debt to Olaf Magnusson, the Swedish cartographer and historian known by his Latin name, Olaus Magnus (1490-1557).

The *Carta Marina* of Olaus Magnus is the poem's first visual inspiration and analogue (Figure 1). "SULU" resembles this map in its size, expansiveness, and celebration of sea and land creatures. When published in 1539, the *Carta Marina* was the most ornate map of Scandinavia ever seen (Urness, 1999-2001, "The Importance of the Map: Geography"). No fewer than nine woodcuts were needed to create it. Measuring 1.25 meters by 1.7 meters when assembled (4 x 5 1/2 feet: Lynam, 1949: 3), the *Carta Marina* was one of the largest maps of any type and boasted a scale larger than any comparably-sized map to date (ca. 1:1,400,000: Lynam, 1949: 3-4). Gazing at it, our eyes focus on Norway, Sweden, and Finland (center and center right), then wander northwest to Greenland and Iceland (top

"When published in 1539, the Carta Marina was the most ornate map of Scandinavia ever seen. No fewer than nine woodcuts were needed to create it."



Figure 1: Olaus Magnus's Scandinavia 1539. Facsimile (1996) of Olaus Magnus, *Carta Marina*, Venice, 1539. Colored facsimile, 67.3 x 86.4 cm (26 1/2 x 34 inches): the original map, created from nine woodcuts, is 4 x 5 1/2 feet. A tapestry of shapes, the *Carta Marina* is packed with the animals and peoples native to northwestern Europe. Courtesy of Wychwood Editions. (see page 77 for larger color version)

left), southward to Great Britain (bottom left), and eastward from there to Germany, the Baltic states, and Russia (bottom to right edges).¹⁶ The land is filled with buildings, towns, forests, and mountains; water appears as streams, lakes, waves, and ice-filled seas. A tapestry of shapes, the *Carta Marina* is packed with the animals and peoples native to northwestern Europe. On land, they hunt, fight, or engage in numerous activities. At sea, monsters threaten ships as sailors hurl cargo overboard, or innocently dine on a whale's back.

The words "Carta Marina" introduce the title that Olaus Magnus has displayed along the top border of his 1539 map:

"Olaus Magnus was clearly proud of his map. He had made it, he would later explain, to enlarge upon the work of Claudius Ptolemy, the revered second-century cartographer from Alexandria, Egypt."

Carta Marina et descriptio septemtrionalium terrarum ac mirabilium rerum in eis contentarum, diligentissime elaborata Anno Domini 1539 Veneciis liberalitate Reverendissimi Domini Ieronimi Quirini: Patriarche Venetiae.

A "marine map" and description/drawing of the northern lands and of the wondrous things contained in them. Very diligently elaborated in Venice in the year of our Lord 1539 through the generosity of the Patriarch of the Republic of Venice, the Most Revered Lord Hieronymo Quirino.

Its publication in Venice is noteworthy. Olaus had been working on his map since 1527, while traveling for his king and the Church outside of Sweden. In 1530, he and his brother Johannes, then archbishop of Uppsala and primate of Sweden, learned that their property had been confiscated. The pretext was religious. Like Moore, Olaus Magnus was a devout Christian. But he was also a Catholic priest caught up in the Reformation. Later he would confess that he had created the *Carta Marina* while "in exile from his native land because of his Catholic faith" (Olaus Magnus, [1555] 1972: *Historia*: preface). After living in Danzig (Gdansk) for several years, Olaus and his brother took refuge in Venice from 1538 to 1540. There they were welcomed by the patriarch of the Republic of Venice, whom Olaus so gratefully acknowledges in his map's title (*ibid.*, 16-17). Later they moved to Rome, where Johannes died in 1544 and Olaus, in 1557 (Olaus Magnus, [1555]: 1996-98, vol.1:xxxii; cf. Lynam, 1949: 3; Karrow, 1993: 362-66). The *Carta Marina* and Olaus's subsequent work on Scandinavia are poignant tributes to Sweden—the home to which he never returned.

"Olaus Magnus seized the opportunity to update Ptolemy's representation of northern Europe, an area virtually unknown to the Greeks and Romans."

Olaus Magnus was clearly proud of his map. He had made it, he would later explain, to enlarge upon the work of Claudius Ptolemy, the revered second-century cartographer from Alexandria, Egypt (Olaus Magnus, 1555: *Historia*: preface). The only cartographic treatise surviving from classical antiquity, Ptolemy's *Geography* had been translated into Latin as recently as 1406, after having been "lost" to western Europe until around 1300. By the late fifteenth century, the *Geography* began appearing in print, lavishly illustrated with maps that revealed the spatial layout of the 8000 place-names that Ptolemy had catalogued regionally by latitude and longitude (see Ptolemy, [1540] 1991: Books 2.1 to 7.4). Olaus Magnus seized the opportunity to update Ptolemy's representation of northern Europe, an area virtually unknown to the Greeks and Romans.

He was successful in his attempt. Olaus Magnus created the most accurate map to date of Scandinavia and the northern lands, a vast improvement on the one revised in 1482 by Dominus Nicolaus for the first German edition of Ptolemy's *Geography*, the Ulm Atlas (*ibid.*, 168-69; Lynam, 1949: 1). Like other maps illustrating the *Geography*, the *Carta Marina* is

oriented north, boasts a double frame to indicate lengths of longest days and degrees of latitude or longitude, and employs a parallelogram projection found in editions of Ptolemy's *Geographia* (Olaus Magnus, [1555] 1972: 21). Practical as well as scientific, the *Carta Marina* also resembles navigation charts known as *portolani*. Its regional focus, its accurate depiction of coastlines and waterways, its four compass-roses and network of rhumb lines—all typify the *portolani* used by sailors since the thirteenth century. Olaus Magnus included yet another useful device. At the bottom of the map, to the right of Britain, he placed a pair of dividers straddling scales marked with German (*Theutonica*) and Italian miles; he also included a method for converting German into Swedish (*Gothica*) miles (Lynam, 1949: 6). Near the upper-right corner of his map, Olaus Magnus drew a "Magnetic Island" (*Insula Magnetû*) below his *Polus Arcticus*, thus distinguishing magnetic north from geographical north (*ibid.*, 10). At times, his intentions exceeded his abilities. Most glaring is his placement of the Arctic Pole beyond 90° north latitude (see upper-right corner), a fanciful reconciliation of folktale, hearsay, and science (Olaus Magnus, [1555] 1972: 23-24; see Lynam, 1949: 4-6).

In the end, his delightful pictures made the *Carta Marina* too large for a Ptolemaic atlas. Yet Olaus found even its enormous size confining (Lynam, 1949: 10; Knauer, 1981). To minimize description on the map, therefore, Olaus Magnus inserted a large Roman letter in the center of every woodcut. From left to right, the letters "A" to "C" indicate the three sheets at the top of the map; "D" to "F," the three in the middle; and "G" to "I," the three at the bottom. Within each sheet, he used smaller capital letters to identify individual pictures. The curious reader can find more about an image by consulting the box in the map's lower-left corner, where Olaus Magnus has summarized in fifty-eight lines the contents of all nine sheets. Here, for instance, we learn that picture "D" on Sheet "B" (i.e., BD) is none other than the *serpens* or sea snake that so intrigued Moore.

This commentary, tastefully relegated to a corner of the map, reminds us of the notes Moore appended to "SULU." But Olaus Magnus still wasn't satisfied. The same year the *Carta Marina* appeared, he published a sixteen-page booklet offering further elaboration on the images (1539). To reach a wider audience, he released his booklet in Italian (*Opera breve*) and German (*Ain kurze Auslegung und Verklerung der neuuen Mappen*: see Richter, 1967). Then in 1555, just two years before he died, Olaus Magnus published the work that Moore cited in her note on line 10—namely, his encyclopedic *Historia de Gentibus septentrionalibus* or "History of the Northern Peoples." Its twenty-two books, 778 chapters, and nearly 900 pages contain a wealth of information about the Nordic races: their warfare and beliefs, mines and buildings, customs and activities, agriculture and physical surroundings. The *Historia* saw over twenty editions by 1670 and remained the most trusted source on Scandinavia for two centuries (Olaus Magnus, [1555] 1996-98: vol.1: lxx; Karrow, 1993: 366). Equally important, it was Olaus's definitive commentary on the *Carta Marina*.¹⁷

Olaus Magnus prefaced his treatise with the hope that it would describe "for all future generations, clearly, plainly, and so to speak, in natural colours, what I only sketched incidentally in that geographical work" (i.e., the *Carta Marina*: Olaus Magnus, [1555] 1996-98: vol.1:11; see also vol.1:xxxvi). Every seventh chapter covers some aspect of the map or the booklets that accompanied it (Olaus Magnus, [1555] 1972: 25). A quarter of its nearly 500 images derive from the *Carta Marina* (*ibid.*, 31-32; cf. Lynam, 1949: 38; Karrow, 1993: 363). Like his map, the *Historia* explores how animals shape the lives of people, defining them as hunters, farmers, fishermen, and whalers (Olaus Magnus, [1555] 1972: 25).

"In the end, his delightful pictures made the Carta Marina too large for a Ptolemaic atlas."

"The encyclopedic Historia de Gentibus septentrionalibus or 'History of the Northern Peoples' . . . was Olaus's definitive commentary on the Carta Marina."



Figure 2: Detail from the *Carta Marina* showing the sea serpent (at Bv, between the most northerly compass-rose and the whirlpool) and the sea unicorn south of Iceland (left, by the symbol for 73° north latitude). Courtesy of Wychwood Editions. (see page 78 for larger color version)

Olaus Magnus and Marianne Moore, purveyors of exotic creatures

Two of the sea creatures Moore names in the opening of "SULU" are portrayed on the *Carta Marina*: the sea unicorn (line 1), or *monoceros* (line 3), and the sea snake (line 10) (Figure 2). The latter makes its alarming appearance off western Norway near the Lofoten Island, between the most northerly compass-rose and the Maelström labeled "horrendous Charybdis" (*Horrenda Caribdis*: Bf). Described in the legend as three-hundred feet long (300 *pedum*), it coils its massive body around an unfortunate ship and bares its fangs before devouring the Swedish sailors onboard (see Olaus Magnus, [1555] 1996-98: vol.3:1140, n.1 on *Historia* 21: preface; and vol.3:1152, note on *Historia* 21: 43). As for the *monoceros*, only its head and horn break the surface of the waters south of Iceland (*Islandia*). Olaus Magnus doesn't label the beast, though we can find it swimming in the lower left of Sheet A.¹⁸ Just below on the map, the *Physeter* whale looks far more "defiant" ("SULU," line 6) as it spouts torrents at a nearby ship (Do: see also Olaus Magnus, *Historia* 21:6; and [1555] 1996-98: vol.3:1142 n.1). In *Historia* 21:14, however, Olaus Magnus pictures the *monoceros* as a snarling fish with an enormous horn on its forehead (Figure 3). Entitled *De Xiphia, Monocerote, & Serra* ("Concerning the Sword-fish, Unicorn-fish, and Saw-fish"), this chapter describes how the monster uses its formidable horn to puncture ships and drown sailors. "But in this case," Olaus Magnus adds,

God's pity has provided for the sailors. While the monster may be fierce, its extreme slowness—once foreseen—allows those who fear its approach to flee.

Although the brittleness of the narwhal horn makes it an impractical weapon, the detail about the beast's lack of speed reveals that Olaus Magnus knows something about the arctic whale, if only by hearsay (Rosling, 1999: 28; Olaus Magnus, [1555] 1996-98, vol.3:1144, n.8-8 on *Historia* 21:14).

"In *Historia* 21:14, however, Olaus Magnus pictures the *monoceros* as a snarling fish with an enormous horn on its forehead."

Olaus Magnus's familiarity with Scandinavia prevented him from portraying unicorns or sea-lions on the *Carta Marina*, even though the horses with pennants on their heads look a bit like unicorns as they draw sleds across the ice from Finland to Sweden (FA). Instead, he covers his map with lynx (EH), pelicans (FI), wolverines (BG), reindeer (BI, EG), and elk (EI). Among the animals in "SULU," snakes (FC), horses (CI, EF, FN, HA), and white bears also adorn the *Carta Marina*. Identified as *Ursi Albi*, two "white bears" hunt for fish on ice packs in the *Mare Glaciale* ("Icy Sea") off eastern Iceland; another emerges from his island den (AD). As for lions, in the preface to Book 20 of the *Historia*, Olaus Magnus explicitly contrasts Libyan lions with Swedish reindeer. That doesn't mean that Moore's lions are absent on the *Carta Marina*, however. They pose on regal coats of arms beside the monarchs of Norway (*Norvegia*, EC), Denmark (*Dania*, HA), and ancient Sweden (*Gothia*, HG). Near the top-right of the map, a leonine beast accompanies the Swedish giant and strong-man, *Starcaterus*, whom Olaus Magnus calls "a second Hercules" (*Historia* 5:1). In the lower right corner, under four rows of shields, a tethered lion rests his right front paw on the Magnus family crest. Below the lion is a mouse and the words: "See the frightful lion there. When ensnared, it was set free by a mouse. So are the great often helped by the smallest act" (cf. [1555] 1996-98, vol.1:xlvi). Hopeful of a reconciliation that would never come, Olaus Magnus saw himself as the mouse: he even placed his own name on the other side of the coat of arms opposite



Figure 3: The sea unicorn (monoceros) and other marine monsters in Olaus Magnus's *Historia*, Book 21, chapter 14: "Concerning the Sword-fish, Unicorn-fish, and Saw-fish." (After Olaus Magnus, *Historia de Gentibus Septentrionalibus*, Romae 1555. Copenhagen: Rosenkilde and Bagger, 1972, p.743.)

the mouse. The lion, of course, is Gustav Vasa, whom Olaus Magnus prominently depicts at the center of the map above his eulogy: "Gustav, most powerful King of the Swedes and Goths" (EB).

The duplication of beasts in "SULU" is made explicit in the *Historia*: both works assume that the sea contains "copies" of land animals. Consider Olaus Magnus's preface to *Historia* 21—one of six books in the *Historia* devoted to natural history, and one of three keyed to the *Carta Marina*. Here is how the 1658 English abridgment translates his description of the phenomenon (Olaus Magnus, [1555] 1658: 222):

In the Ocean that is so broad, and by an easie and fruitful increase, receives the Seeds of Generation, there are found many monstrous things in Sublime Nature, that is always producing something; which being perplexed and rolled up and down one upon another by the ebbing and flowing of the Waters, they seem to generate Forms from themselves and from other principles; that whatsoever is bred in any part of nature, we are perswaded is in the Sea, and many things are to be found there, that are to be found no where else. And not onely may we understand by sight that there are Images of Animals in the Sea but a Pitcher, Swords, Saws, and Horses heads apparent in small Shell-fish. Moreover, you shall find Sponges, Nettles, Stars, Fairies, Kites, Monkeys, Cows, Woolves,...Mice, Sparrows, Black-Birds, Crows, Frogs, Hogs, Oxen, Rams, Horses, Asses, Dogs, Locusts, Calves, Trees, Wheels, Beetles, Lions, Eagles, Dragons, Swallows, and such like...

"The duplication of beasts in 'SULU' is made explicit in the *Historia*: both works assume that the sea contains 'copies' of land animals."

Olaus Magnus was not alone in this belief. That every terrestrial animal had a marine counterpart was a commonplace not only in his day but in classical antiquity as well.

Olaus Magnus's conceit ultimately derives from Pliny the Elder, whose thirty-seven volume *Natural History* dates back to 77 CE. Remarkably influential during the Middle Ages, Pliny's tome spawned other ency-

“Olaus Magnus may have been the first to include on a map so many marine counterparts of land-based animals.”

clopedias of human knowledge, which appropriated its anecdotes often without attribution. After the *Natural History* was printed in 1459, this process of “borrowing” from the Roman naturalist continued throughout the early modern period. More than half of *Historia 21* comes from sources like Pliny and Aristotle, or from the thirteenth-century encyclopedist Vincent of Beauvais, who himself “plundered Pliny” (Fisher, in Olaus Magnus, [1555] 1996-98, vol.1:li; see also Olaus Magnus, [1555] 1972: 31). At times Olaus Magnus might rely on the thirteenth-century scientist Albertus Magnus rather than on Pliny or Aristotle for material about northern Europe (*ibid.*, 1:liv). But in his preface to *Historia 21*, Olaus Magnus declares his debt to Pliny by recommending “the last chapter of Pliny, Book XXXII” to the reader eager to know more about sea creatures (21: preface; *ibid.*, 3: 1082).

Olaus Magnus repackaged Pliny’s notion of terrestrial and aquatic duplicates. The first half of the excerpt from his preface to *Historia 21* comes almost verbatim from *Natural History* 9.1.2-3; while Olaus Magnus’s catalogue is reminiscent of *Natural History* 32.53.144-145 (see Olaus Magnus, [1555] 1996-98, vol.3:1140, n.2-2 at *Historia 21*: preface). The *Carta Marina* also shows its debt to the Roman naturalist. At its center under “Scandia,” an inscription prominently advertises Scandinavia as “a second world,” ten times the size of Britain and comprising thirteen kingdoms. The expression “a second world” is from Pliny, who attested that the ancient Scandinavians viewed their homeland as *alterem orbem* (*Natural History* 4.13.96). More important, Olaus Magnus may have been the first to include on a map so many marine counterparts of land-based animals.

Part III

Sources for the Animals Engraved on the Carta Marina

Moore’s plural “cartographers” compels us to consider other mapmakers active in 1539, especially those who embellished their maps with the types of creatures cavorting in “SULU.” As we shall see, others did crowd lands with beasts and pictured monsters in the seas. What ultimately concerns us here is why Moore chose to model her poem on the *Carta Marina* rather than on the terrestrial maps of others who lived before or during Olaus Magnus’s time.

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We’ll begin by offering sources for the animals engraved on the *Carta Marina* and in the *Historia*. Zoological maps were among Olaus Magnus’s inspirations. To understand how he stood apart from his predecessors and contemporaries, it is necessary to survey how cartographers mapped the four animals that dominate “Sea Unicorns and Land Unicorns”: the unicorns, lions, narwhals, and sea lions. Wilma George’s pioneering *Animals and Maps* offers insight into the depiction of terrestrial beasts on maps through the end of the eighteenth century (George, 1969). Since no previous study has examined sea creatures on early maps, however, a brief digression is needed to outline what is known, and what may be surmised.

Olaus Magnus observed in nature many of animals later pictured on the *Carta Marina* and in the *Historia*. A native of southeast Sweden, he was well-traveled by the time he published his map. Of the places portrayed, he had visited Oslo when he was fifteen (ca. 1505); studied in Germany for seven years (1510-17); traveled for two years on Church business to the far north of Scandinavia (1518-19); and spent the 1520s on business frequenting the Hanseatic cities on the Baltic Coasts (e.g., Danzig, Hamburg, Lubeck, Bremen) (Karrow, 1993: 362; see Lynam, 1949: 2; Olaus Magnus

[1555] 1996-98, vol.1:xxvi-xxvii, xxxvii; and *Historia* 2:6,29,26, 13:32). What he didn't observe himself, he found in books or picked up from folk stories and sailors' "immeasured tayles" (Moore, line 3). Konrad Gesner, the "German Pliny" whose *Historia Animalium* (1551-58) laid the foundation of modern zoology, adopted many of the images in the *Carta Marina* and *Historia* because they seemed so true to life.¹⁹ If some of Olaus Magnus's sea creatures nevertheless appear bizarre, it is because he attempted, as Gesner did after him, "to draw animals that [he] had never seen from descriptions that [he] misunderstood" (Matthews, 1968: 22; see Lynam, 1949: 26). No wonder Olaus Magnus inserted this disclaimer in the dedication that opens his *Historia*: "Be sure that everything I have reported, whether of natural phenomena or the customs among those races, can be strongly substantiated on the evidence of incontrovertible authorities, who have put in writing even greater marvels, almost transcending belief" (Olaus Magnus, [1555] 1996-98, vol.1: 1-2).

Visual texts provided many of the creatures he couldn't observe first-hand. Although little is known about their iconography, some of his images may have come from bestiaries (Lynam, 1949: 25; Olaus Magnus, [1555] 1972: 33). Others, from the *Dyalogus creaturarum moralizatus* ("Animals' Dialogues Moralized") of the 1480s. A popular collection of animal conversations and tales from classical works, the Bible, and other traditional sources, the *Dyalogus* was the first book printed in Sweden (1483: Olaus Magnus, [1555] 1996-98, vol.1:xliii, *Carta Marina* BE, and *Historia* 21:28 and 21:34). Other images derive from the *Hortus sanitatis* ("A Garden of Health"), which was first published in Mainz in 1491. That was a medieval encyclopedia on herbs, animals, minerals, and remedies (Olaus Magnus, [1555] 1996-98, vol.1:xliii, and *Historia* 21:38; see Hudson, 1954). And at least one picture, the monstrous "sea-pig," illustrated a 1537 pamphlet condemning the heretical Protestants (Olaus Magnus [1555] 1972: 41-42; [1555] 1996-98, vol.1:xliii, *Carta Marina* DK, and *Historia* 21:27). Whatever his sources, however, Olaus Magnus probably sketched the original drawings himself. An anonymous Italian artist subsequently embellished and engraved them on the *Carta Marina*, and an inferior engraver copied them into the *Historia* (Lynam, 1949: 19; Olaus Magnus [1555] 1972: 24 and 32; [1555] 1996-98, vol.1:xliii).

The Carta Marina, pictorial maps, and "the cartographers of 1539"

Other pictorial maps also inspired Olaus Magnus to adorn the *Carta Marina* with images (Lynam, 1949: 4; Granlund, 1951: 41). Since at least 560 AD—when the Byzantine Madaba map featured a lion chasing a gazelle across a plain in southwest Jordan—cartographers had portrayed animals on mapped lands (George, 1969: 28). Although regional in scope, the *Carta Marina* resembles three thirteenth-century "zoogeographical" *mappae-mundi* known as the Ebstorf, Hereford, and Vercelli "world maps"—each showing the distribution of animals throughout the Old World (*ibid.*, 186, 113-17). Lions roam the palearctic region on the Ebstorf map (*ibid.*, 30); the ethiopian region on the Hereford map (see Westrem, 2001: 364-67); and both regions on the Vercelli map (George, 1969: 35, 109). Some maps depicted animals in their corners. For example, both a portolan chart in the anonymous 1390 Venetian atlas and the Leardo *mappamundi* of 1452 portray the four evangelists: each apostle appears as one of the many-winged, multi-eyed creatures in the Book of Revelation 4:7. On these maps, the flying lion represents Mark; the eagle, John; the angel, Matthew; and the winged ox, Luke (Mollat and Roncière, 1984: fig.10; Harley and Woodward, 1987: fig.18.40). The king of the beasts reappears throughout

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“Sea creatures present a different story. Because medieval world maps focused on land, few sea dwellers were portrayed.”

the Old World on the Borgia map, a pictorial “distribution” chart from the mid-fifteenth century (George, 1969: 49 and 186; cf. Lynam, 1949: 4); on the Miller Atlas of 1519 (George, 1969: 128-29, fig.6.1; see 126-27, 144); and, shortly after the *Carta Marina*, on the Ulpius Globe of the early 1540s (*ibid.*, 140-41: fig.6.6).

As for the unicorn, the Hereford *mappamundi* both pictures and describes the creature in Africa. Above the unicorn’s image on the Hereford map is a legend derived almost verbatim from *Etymologies* 12.2, the influential encyclopedia by the seventh-century saint and polymath Isidore of Seville. The passage tells a familiar story: that the unicorn, upon seeing a virgin’s naked breasts, abandons his ferocity and rests his head upon her flesh (Westrem, 182-83, and fold-out map). In the sixteenth century, according to Wilma George, unicorns reappear in the palearctic on the Maggiolo map of 1504 and on an anonymous Portuguese map made about the time of the *Carta Marina* (ca. 1540; George, 1969: 117-119).

Sea creatures present a different story. Because medieval world maps focused on land, few sea dwellers were portrayed—a mermaid above the words “Mediterranean Sea” on the Hereford Map, and occasional fish in the narrow band of ocean at the edges of the Ebstorf or Beatus *mappamundi* are among the only examples (Harley and Woodward, 1987: fig.18.19 and pl.13). Then came the fusion of *portolani* and world maps in the late fourteenth century, the translation of Ptolemy’s *Geography* in the fifteenth, and the explosion of maritime exploration, trade, and colonization that characterizes the early modern period. Suddenly, oceans became as important as land. Ships joined compass roses, rhumb lines, and flags as popular adornments. Portraits of exotic creatures, once confined to the map’s landmasses, began migrating into increasingly vast and empty oceans. The mermaid and her kin could be found preening in the Indian Ocean on Abraham Cresques’s Catalan Atlas of around 1375 (Harley and Woodward, 1987: fig.18.77), on the mid-fifteenth-century Catalan world map (Whitfield, 1994: 27), and on the Genoese World Map of 1457—the last of the great “distribution” charts before the discovery of the “New World” (*ibid.*, 40-41).

But when a mermaid and merman wander into the Atlantic on Martin Behaim’s famous world globe of 1492, they are not alone. Around them are real, if imaginatively realized, “fishes, seals, sea-lions, sea-cows, sea-horses, [and] sea-serpents” (Ernest Ravenstein, quoted in Stevenson, [1921] 1971: 49; Wolff, 1992: pl.11b). Originally a native of Nuremberg, Behaim credited Portuguese explorers for many of the novelties portrayed on his *Erdapfel*. A few years later, in 1500, the magnificent bird’s-eye view of Venice by Jacopo de’ Barbari depicts Neptune harnessing a sea monster (Eisler, 1991: 280-82 and fig.11.6); while the printed version of Martin Waldseemüller’s 1516 world map shows Manuel I of Portugal bestriding a dolphin in the waters below Africa (Wolff, 1992: fig.14).

“Renowned artists may have drawn some of these creatures. The school of Albrecht Dürer is believed to have ornamented Waldseemüller’s 1516 map.”

Renowned artists may have drawn some of these creatures. The school of Albrecht Dürer is believed to have ornamented Waldseemüller’s 1516 map (*ibid.*, 119). Not only did Hans Holbein the Younger create the Old Testament vignettes (1538) that Olaus Magnus would use in the *Carta Marina*, but he also decorated maps between 1528 and 1532 (Olaus Magnus, [1555] 1972: 32, and [1555] 1996-98, vol.1:xliv and n.2). Holbein probably designed the decorative vignettes around a world map attributed to Sebastian Münster. Münster’s *Typus Cosmographicus Universalis* first appeared in his 1532 commentary on the travel reports collected by Simon Grynaeus and Johann Huttich in their *Novus Orbis Regionum* (Figure 4). On Münster’s map, a large fish inhabits the north Atlantic; a



Figure 4: Typus Cosmographicus Universalis, attributed to Sebastian Münster (world map) and Hans Holbein the Younger (decorative vignettes). From Simon Grynaeus and Johann Huttich, *Novus Orbis Regionum*, Basel: J. Hervagius, 1532. Double-folio woodcut on paper: 35.5 x 55.5 cm (14 x 22 inches). On this map, a large fish inhabits the north Atlantic; a mermaid churns the waves off southeast Asia; and two enormous creatures undulate dolphin-like across the south Atlantic. (After H. Wolff, ed., *America: Early Maps of the New World*. Munich: Prestel, 1992, 70.)

mermaid churns the waves off southeast Asia; and two enormous creatures undulate dolphin-like across the south Atlantic.

The decade that produced the *Carta Marina* is particularly rich in its portrayal of sea monsters. In addition to Münster's map, the Nancy globe displays them in its blue enameled waters (ca. 1530; Stevenson, [1921] 1971: 101-2 and figs. 50 and 50b); Georg Hartmann engraved sea monsters on his gores (1535; Shirley, 2001: pl.64); and Gemma Frisius shows them swimming among ships on his terrestrial globe (ca. 1536; Dekker and van der Krogt, 1993: pl.6). Shortly after the *Carta Marina*, the Ulpius Globe featured sea creatures swimming in the Atlantic and Pacific (ca. 1541; Stevenson, [1921] 1971: fig.58), while Gerard Mercator's famous globe sports both sea-cow and physeter (1541; Shirley, 2001: pl.68).

The Uniqueness of the Carta Marina

That Olaus Magnus was not the only mapmaker embellishing his work with animals is confirmed by yet another source. In his *Tratado da Sphera* (1537), published two years before the *Carta Marina*, Portuguese mathematician Pedro Nuñez criticized his contemporaries for the many bears, elephants, and camels on their maps (Wallis and Robinson, 1987: 160).

“Because the Carta Marina is so lavish in portraying sea life—note that Nuñez refers only to land animals—, Olaus Magnus’s map may have indirectly inspired the noticeable proliferation of sea monsters prowling among ships on maps from the mid-sixteenth century on.”

“Three centuries passed. A year before Moore’s birth, one copy of the Carta Marina miraculously reappeared in Munich (1886: Urness, 2001: 32). The other known copy came to light in Switzerland a decade before she died (1962).”

As maps and globes multiplied after the invention of printing, so did the number of them decorated in this way. Yet Moore chose to focus on the *Carta Marina* because it remains unique. The strange charm and detail of Olaus Magnus’s creatures invite comparison to Dürer (Lynam, 1949: 18-19), and the *Carta Marina* may be the first surviving map—or at least the most famous one—to picture the sea-unicorn that Moore featured so prominently in “SULU.” Furthermore, the creatures on Olaus Magnus’s map fill more space than their aquatic or terrestrial counterparts do on works by his contemporaries. And because the *Carta Marina* is so lavish in portraying sea life—note that Nuñez refers only to land animals—, Olaus Magnus’s map may have indirectly inspired the noticeable proliferation of sea monsters prowling among ships on maps from the mid-sixteenth century on.²⁰

We know that the *Carta Marina* influenced subsequent mapmakers; two of the most notable being Gerard Mercator (1512-94) and Abraham Ortelius (1527-98), the “inventor” of the atlas as we know it (Lynam, 1949: 35-40; Karrow, 1993: 364-66). Antonio Lafreri published a new, if smaller edition of the *Carta Marina* in 1572 (Lynam, 1949: 30 and back fold-out map). However, it was the great sixteenth-century geographer Sebastian Münster who paid his contemporary the greatest compliment. For Münster engraved Olaus Magnus’s sea and land animals on a double-folio woodcut in the 1550 edition of his *Cosmographia*. While Olaus Magnus’s 1539 map became increasingly rare, Münster’s *Cosmographia*—dedicated, incidentally, to Gustav Vasa—was the most successful scientific work of the sixteenth century and appeared in thirty-five editions by 1628 (see Strauss, 1965) (Figure 5). This fashion for displaying animals and sea monsters culminated in the baroque maps of the seventeenth century. Then, gradually, such charming excesses were exiled to the map’s borders and cartouches, only to vanish during the eighteenth century (see Whitfield, 1994).

The *Carta Marina* itself came to resemble Moore’s unicorn in “disappear[ing] for centuries and reappear[ing]” (line 54). Sixteenth-century cartographers referred to Olaus Magnus’s map when making their own maps of Scandinavia and Europe. But by the end of that century, not a single copy of the original map seems to have been known. Few may have been printed in 1539, a map of Scandinavia on nine woodblocks having been an expensive specialty item in a predominantly Italian market; and, once issued, the size of the *Carta Marina* would have made it difficult to preserve (Urness, 1999-2001: “The Importance of the Map, Copies” and “..., Keys”; Urness, 2001: 28; Olaus Magnus, [1555] 1972: 21). Three centuries passed. A year before Moore’s birth, one copy miraculously reappeared in Munich (1886: Urness, 2001: 32). The other known copy came to light in Switzerland a decade before she died (1962).

Finally, Moore’s lines “these are the very animals/ described by the cartographers of 1539” allude not only to Olaus Magnus as the maker of the *Carta Marina* but acknowledge his contemporaries, who also “described” animals in words and images on their maps. Moore’s “cartographers of 1539” may serve a third function by linking the poem’s beginning to its closing. Eight lines from the end, she pictures the unicorn as “etched like an equine monster of an old celestial map” (line 75).



Figure 5: Sebastian Münster, *De regnis Septentrionalibus*: *Monstra marina et terrestria, quae passim in partibus aquilonis inveniuntur*, a chart of "the animals and sea monsters found throughout the northern regions." From Book 4 of his *Cosmographiae Universalis*, Basle, 1550, pp.852-53. Double-folio woodcut on paper: image, 25.4 x 33 cm (10 x 13 inches); folio page, 30.5 x 38 cm (12 x 15 inches). Münster has engraved Olaus Magnus's sea and land animals on his own woodcut. (After W.P. Cumming, R.A. Skelton, and D.B. Quinn, *The Discovery of North America*. New York: American Heritage Press, 1972, p.44.)

Part IV

Pegasus, the "equine monster of an old celestial map"

No matter how fast light travels, when we gaze at the stars we are looking back in time. Even the constellations our parents taught us to identify are outlines of mythological beings thousands of years old. The zodiacal constellation Leo ("Lion"), for instance, had its origins among the peoples of the Euphrates valley several millennia ago. The ancient Greeks probably adopted Leo and invented others like it until their constellations numbered forty-eight, each associated with traditional myths, however tenuously and variously. From the late-sixteenth century to the mid-eighteenth century, that number nearly doubled as navigators explored new regions and observed unfamiliar stars in the southern hemisphere (Whitfield, 1995: 8, 86-87). In 1930, only a few years after Moore composed "SULU," the International Astronomical Union announced its definitive list of eighty-eight constellations—12 in the zodiac, 28 in the northern skies, and 48 in the southern (see Menzel and Pasachoff, 1983: 132-33, and figs.3-4).

Of the forty-eight constellations the Greeks bequeathed us, four can be considered "equine monsters." Sagittarius and Centaurus, both half-

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“Moore’s ‘equine monster’ must be Pegasus—the winged horse birthed by the violence of Perseus and tamed by the skill of Bellerophon.”

“Claudius Ptolemy regarded Pegasus in a very different way. Author of the *Geography* that inspired Olaus Magnus to create his *Carta Marina*, Ptolemy was also antiquity’s leading astronomer.”

horse and half-human, are certainly “monstrous.” But this type of composite creature has no counterpart in “SULU,” which celebrates relationships among animals or between animals and people. As for Equuleus, the “little horse” otherwise known as *Equus Minor* or *Equiculus*, there is nothing unusual about him except that his head alone is visible on star charts (Ptolemy, 1984: 358 n.164; G.J. Toomer, in *OCD*, 1996: 382). Which means that Moore’s “equine monster” must be Pegasus—the winged horse birthed by the violence of Perseus and tamed by the skill of Bellerophon. Known in most ancient texts as “The Horse” (*Hippos* or *Equus*), Pegasus is the immortal counterpart of the domesticated horses to which Moore alludes in lines 46-47: “those born without a horn,/ in use..., as domestics.” Pegasus is undoubtedly “monstrous.” Son of sea-god Neptune (Poseidon) and Medusa, he sprang from the severed neck of his mother, the snaky-haired gorgon whose gaze could turn men to stone. Star charts feature the front half of his body, including his very unequine wings.

The constellation Pegasus appears on the earliest extant globe from antiquity. The globe itself is part of a Roman marble statue known as the Farnese Atlas, which portrays the god Atlas shouldering the weight of the celestial sphere. Carved in the late second century and based on a Hellenistic original, the statue was lost during the Middle Ages only to reappear—like Moore’s miraculously elusive unicorn—early in the sixteenth century.²¹ The Farnese Atlas illustrated the best-selling *Phaenomena*, written by Aratus of Soli in the third century BCE (Aratus Solensis, 1997). Celebrating the constellations as well as their connections on globes and in myth, Aratus’s work became more popular than any poem except the *Iliad* and the *Odyssey*. Aratus based his *Phaenomena*, in turn, on the texts of Eudoxus of Cnidus, an astronomer of the fourth-century BCE (Aujac, in Harley and Woodward, 1987: 140-43). Eudoxus made a landmark celestial globe, whose contents he explained in his equally lost *Phaenomena* and *The Mirror*. More important for us, he may have been the first to divide all of the sky seen by the Greeks “into named constellations, which (with some minor changes and additions at later periods) became canonical” (G.J. Toomer, in *OCD*, 1996: 381). So fragmentary is his work, however, that it is not until Aratus’s *Phaenomena* that the “horse” constellation can be identified confidently with Pegasus (Aratus, 1997: 261 and lines 216-24; cf. Ptolemy, 1984: 358 n.165).

Claudius Ptolemy regarded Pegasus in a very different way. Author of the *Geography* that inspired Olaus Magnus to create his *Carta Marina*, Ptolemy was also antiquity’s leading astronomer. His magisterial *Mathematical Systematic Treatise* rendered obsolete the works of his predecessors, whose contributions Ptolemy meticulously collected, criticized, and updated (Toomer, in Ptolemy, 1984: 1). Ptolemy opened his thirteen-book tome with the earth’s relationship to the heavenly sphere (Books 1-2); covered such topics as the length of the year (Book 3), the motions of the sun and moon (Books 3-6), the astrolabe (Book 5), and the fixed stars (Books 7-8); then concluded with the order of the heavenly spheres (Book 9) and an examination of the planets (Books 9-13). In a table spanning half of Books 7-8, he catalogued 1022 stars visible from the Mediterranean and described their position within, or just outside of, the forty-eight known constellations. He assigned each star several numbers, indicating its zodiacal longitude and latitude and its magnitude (relative brightness). Ptolemy’s Pegasus has twenty stars, the four brightest stars being slightly less than second magnitude. One of these, now known as α Peg, he located at $26\ 2/3^0$ longitude (within the sign

of Aquarius); 19 2/3° north latitude; and, more poetically, “between the shoulders and the shoulder-part of the [Horse’s] wing” (*ibid.*, 358, Book 7.5, H78; cf. 14-17, 339-40; and Book 7.4, H36-37).

The Ptolemaic system endured for 1400 years. In the ninth century, his treatise was translated into Arabic and retitled *Almagest*, “The Greatest” (Dilke, in Harley and Woodward, 1987: 177-82). In the twelfth century, the *Almagest* appeared in Latin. No ancient copies have come down to us, however, and medieval European manuscripts of the *Almagest* rarely show figures accompanying the text. Even when illustrations are present, they resemble the isolated constellation figures often found in illuminated manuscripts of Aratus’s *Phaenomena*: spatially, they offer no sense of Pegasus’s relationship to the other constellations, no clue as to what constellations lie “beside” it (Warner, 1979: xi-xiii and 269; Stott, 1995: 40-41; Whitfield, 1995: 35, 42, but see 24-25). Which means that none of these is likely to be Moore’s “old celestial map.”

Furthermore, Ptolemy followed his predecessors in recommending that the constellations be depicted on a globe. Given the number of stars in his catalogue and the distortion inherent on flat maps, such advice was eminently practical. With the exception of the Farnese Atlas, however, any celestial globe made before the fifteenth century has disappeared (Stevenson, [1921] 1971: 38-42). Moreover, although a globe is a form of map, Moore presumably chose the word “map” at lines 75 and 81 because she meant a flat map, one like the *Carta Marina*. But even if the ancient Greeks or Romans had mapped the heavens on a flat surface, these works too have vanished (Aujac, in Harley and Woodward, 1987: 165-66). In the end, neither ancient globes nor medieval charts can provide a model for Moore’s unicorn “etched like an equine monster of an old celestial map, beside a cloud or dress...” (lines 75-76).

The early modern period saw the first printing of Ptolemy’s *Almagest* (1515) and the birth of the celestial map *per se* (Warner, 1979: ix-x; Whitfield, 1995: 2, 100). During the sixteenth century, artists and cartographers in western Europe produced celestial charts that successfully packaged Ptolemy’s science in Renaissance artistry. In 1515, for instance, Albrecht Dürer made history by producing the first printed celestial maps. His woodcut of the southern sky, entitled *Imagines coeli Meridionales*, portrays the fifteen constellations Ptolemy located there. Dürer’s northern sky, *Imagines coeli Septentrionales cum duodecim imaginibus zodiaci*, contains the other thirty-three, radiating outward from Draco and Ursa Minor (“Little Bear”/Dipper) to the zodiacal signs wheeling around the periphery (Figure 6). The circle that encloses the figures is divided into twelve pie-shaped wedges, each widening into a scale of 30 degrees. Although a mathematician and an artist, Dürer did not act alone—as the banner in the lower left of his southern hemisphere attests. The coordinate grid was designed by Johann Stabius (*I. Stabius ordinavit*), the Imperial court historian and mathematician who also partnered with Dürer that year to create a unique map on which the earth is portrayed as a geometrical sphere (see Whitfield, 1994: 52-53; Stevenson, [1921] 1971: 88). The Nuremberg mathematician Conrad Heinfogel, who was associated with the 1503 sources of Dürer’s celestial maps (Eisler, 1991: 252-54, figs.10.4-10.5), positioned the stars within the grid and assigned them the numbers from Ptolemy’s tables (*Conradus Heinfogel stellas posuit*). As for Dürer himself, he not only engraved the maps but designed the figures of the constellations, then surrounded them with portraits of his venerable predecessors (*Albertus Dürer imaginibus circumscipsit*). Dürer’s superb draftsmanship inspired others to combine artistry with science (Warner, 1979: 71-74; Snyder,

“In the end, neither ancient globes nor medieval charts can provide a model for Moore’s unicorn ‘etched like an equine monster of an old celestial map, beside a cloud or dress...’ (lines 75-76).”

“In 1515, for instance, Albrecht Dürer made history by producing the first printed celestial maps.”



Figure 6: Albrecht Dürer, Johann Stabius, and Conrad Heinfogel, *Imagines coeli Septentrionales cum duodecim imaginibus zodiaci* ("Northern celestial figures with the twelve figures of the zodiac"), Nuremberg, 1515. Woodcut on paper, 45.5 x 43.1 cm (18 x 17 inches). Pegasus is at 2 o'clock, surrounded by thirty-two other constellations. In the corners are Aratus of Cilicia (Aratus Cilix: top left); Marcus Manilius, the first-century Roman astrologer and poet of the *Astronomica* (M. Mamilius Romanus, bottom left); Ptolemy (Ptolemeus Aegyptius, top right); and Al-Sufi, the tenth-century Arab astronomer and author of the influential *Book of the Fixed Stars* (Azophi Arabus, bottom right). Courtesy of the Map Library of The British Library: BL "Maps 20.(75.)."

1984: 52-55): he certainly helped propagate the naked, classically based constellation figures that dominated early modern celestial maps. Nevertheless, Moore cannot be referring to his unpainted woodcuts, nor to those of anyone else. For the "equine monster" on her "old celestial map" is located "beside a cloud or dress of Virgin-Mary blue."

Peter Apian's "old celestial map"

Enter Peter Bienewitz, the popular cartographer and astronomer better known as Petrus Apianus, or Peter Apian (1495 or 1501-1552; Wattenberg, 1967: 40). During the years that Olaus Magnus was creating his map, Apian abandoned terrestrial cartography to focus on the heavens. In 1536, Apian produced his last map, *Imagines Syderum Coelestium* or "Images of the Celestial Constellations" (Karrow, 1993: 61-62; see Brown,

[1932] 1968: 14). Designed for his students at the University of Ingolstadt in Bavaria, *Imagines Syderum Coelestium* emulated Dürer's constellation figures, his centering of the figures on the northern ecliptic pole, and his view of the heavens seen from outside the celestial sphere. But Apian not only named many of the stars but also placed all forty-eight constellations on a single map, centered like Dürer's, yet extending almost as far as 60° south latitude (Warner, 1979: 10). Although the objects on the periphery are much longer than they should be, Apian ingeniously compressed a great deal of useful information onto a single map (Whitfield, 1995: 73).

Four years later, in 1540, Apian reproduced his celestial map in his *Astronomicum Caesareum*. The "Imperial Astronomy" made Apian rich and famous. (It didn't hurt that he was patronized by the Holy Roman Emperor Charles V or his brother Ferdinand I, the Hapsburg monarchs to whom the *Astronomicum Caesareum* was dedicated: see Wattenberg, 1967: 62-65.) Today, Apian's *Astronomicum Caesareum* is still considered "a pinnacle of the bookmaker's art" (Stott, 1995: 38), "a great work of art in and of itself, and ... a source of inspiration to readers who may never have seriously studied the sky" (Snyder, 1984: 56).

Apian's sumptuous volume appeared just one year after the *Carta Marina*. That lines 75-76 of "SULU" allude to the celestial map in the *Astronomicum Caesareum* is made even more probable by the colors, artistry, contents, and didacticism of Apian's work (Figure 7). In 1536, his *Imagines Syderum Coelestium* had been engraved on a woodblock, then distributed as a monochrome broad sheet without further modification. But Apian intended his *Astronomicum Caesareum* for a more exclusive market. After printing its plates on his own press, Apian had most of the illustrations colored by hand. Although individual copies of the map differ slightly in coloring, a general pattern emerges (Gingerich, 1971: 168). Apian's Pegasus, for instance, is always surrounded by blue. Not only does the winged horse emerge from a blue cloud—which conceals his tail, hind quarters and back legs—but he nuzzles Equus Minor, whose neck is surrounded by a cloud of the same color. In the copies of the *Astronomicum Caesareum* owned by the New York Public Library and the Pierpont Morgan Library in New York, the blue on the celestial map is a pale blue-grey; but it is a deep, vibrant blue in the copy housed at The National Maritime Museum in London (see Stott, 1995: 39).

Both shades qualify as "Virgin-Mary blue." Traditionally, Mary wears robes of blue, white, or red in medieval and renaissance art. While white represents her purity, and red, her physical suffering, a blue dress or mantle symbolizes her unwavering faith as well as her association with heaven (cf. "true-blue"; Snyder, 1985: 127-128 and fig.122; Speake, 1994: 152; Hall, 2001: 324). Medieval patrons and artists prized the stable blue pigment made from lapis lazuli, second in cost only to gold in religious art: to paint the Virgin in the deep, rich blue of lapis pigment was considered an exemplary form of veneration. The natural pigment remained in use until the early nineteenth century: Dürer himself even complained about its cost (Gettens and Stout, 1966: 166-67). But renaissance paintings—even those produced by a single artist like Leonardo or Dürer—reveal as many shades of blue as those applied to Apian's hand-colored celestial maps (e.g., Marani, 1999: 19, 35, 48-61, 125-49, and 275-301, for Leonardo; and Dürer, 1968: pls. VIII-IX, XXIII, XXXI, XXXVII, XLV, XLVIII; Eisler, 1991: pl.26).

To an art-lover, Apian's celestial map is a revelation. In the *Astronomicum Caesareum*, the map is one of 21 paper wheels or volvelles meticulously layered on 60 double-sided pages (Wattenberg, 1967: 52). A hand-

"Apian's sumptuous volume appeared just one year after the *Carta Marina*."



Figure 7: Peter Apian, the celestial map in his *Astronomicum Caesareum*, Ingolstadt, 1540. Hand-colored woodcuts: volvelle, 30.5 cm (12") in diameter; plate, 47 x 31.8 cm (18 1/2 x 12 1/2 inches). Pegasus appears among the other forty-seven constellations at 12 o'clock, below the sea monster Cetus and the oval scale used to determine stellar precession. Opposite Pegasus at 6 o'clock are the long-tailed bear (Arctus Major, i.e., the Big Dipper) and the lion (Leo), both familiar from Moore's poem. Missing from this copy of the celestial map are the silk thread and the seed pearl once attached at the end of the thread. The New York Public Library purchased Apian's celestial atlas in 1919, five years before Moore published "Sea Unicorns and Land Unicorns." Courtesy of the Rare Books Division of The New York Public Library--Astor, Lenox and Tilden Foundations: NYPL *KB+++ 1540. (see page79 for larger color version)

“Like the other volvelles in the Astronomicum Caesareum, Apian’s celestial map brilliantly epitomizes his century’s obsession with scientific diagrams and illustrations.”

colored woodcut in the shape of a disc, the map is usually attached by a silk string to another disc that extends one centimeter beyond the celestial map. On the narrow border of this larger disc is a ring divided into 360 degrees: twelve colored panels contain six sections apiece, each subdivided into smaller units of five degrees. Both concentric discs revolve on an octagonal background resembling a clock or observational device, Apian also having been renowned as a maker of instruments (Wattenberg, 1967: 40; Karrow, 1993: 52-62; see Clutton and Daniels, 1979: 29-30). Above, a painted arm emerges from a cloud to hold the device by its ringed handle. Like the other volvelles in the *Astronomicum Caesareum*, Apian’s celestial map brilliantly epitomizes his century’s obsession with scientific diagrams and illustrations (Whitfield, 1995: 63).

Latin text surrounds the celestial map. Part 1, chapter 4 of the *Astronomicum Caesareum* describes the 48 constellations, their relation to one another, their alternative names, and the number and magnitude of their stars. Opposite the map is a description of the volvelle and an example of how to set the discs for determining the position of the stars and constellations at any given time. An oval scale below Cetus accounts for stellar precession—the stars’ increasing longitude or westward shift over time—from 7000 years before Christ to 7000 years after (Wattenberg, 1967: 55; and see Warner, 1979: x and 10; Ptolemy, 1984: Book 7.2). Like Moore’s poetry, the *Astronomicum Caesareum* combines science, artistry, and instruction. As the first century of printing led to the wide dissemination of texts, an exponential increase in literacy, and the decline in the type of knowledge passed from instructor to pupil (Whitfield, 1995: 107-108), Apian recognized that books held the key to educating people outside the monasteries and universities. He devised his marvelous volvelles, as he explains in his preface (*Apianus Lectori*), so that readers less proficient in mathematics than he can perform the calculations necessary to practice astrology and study astronomy.

Peter Apian and “SULU”

“Nevertheless, Apian’s work—like Moore’s poem—reflects the transitional character of the sixteenth century. The Astronomicum Caesareum illuminated the Ptolemaic system on the eve of its demise.”

Nevertheless, Apian’s work—like Moore’s poem—reflects the transitional character of the sixteenth century. The *Astronomicum Caesareum* illuminated the Ptolemaic system on the eve of its demise: in 1543, Nicholas Copernicus would publish his *De revolutionibus orbium coelestium*, a work he’d completed a decade earlier and whose contents were known to Apian, at least in part (Wattenberg, 1967: 62-67). Although Apian never addresses Copernicus’s heliocentric system in print, the formerly prolific astronomer becomes silent after the publication of his *Astronomicum Caesareum*, as if acknowledging its obsolescence. Danish astronomer Tycho Brahe subsequently exposed as myth Ptolemy’s theory of crystalline spheres revolving around the earth. Yet in 1599 Brahe presented a copy of Apian’s expensive work to someone important, perhaps the scholar who had published his observations (*ibid.*, 61). Johannes Kepler in his *Astronomia Nova* (1609) predicted the “perpetual fame” of Apian’s *Astronomicum Caesareum*. But Kepler, who ultimately overthrew the Ptolemaic system, also lamented

the misdirected efforts of Apianus, who in his *Opus Caesareum*, as a faithful servant of Ptolemy, has wasted so many fine hours and so many highly ingenious arguments on constructing a most complicated maze of spirals, loops, lines and whirls which represent nothing more than what exists in the imagination of man, and is wholly divorced from nature’s true image (*ibid.*, 62).

Whatever the fate of Apian's cosmology, however, his celestial map allowed Moore to elegantly unite the two halves of her poem. Her line "the cartographers of 1539" accounts not only for the terrestrial maps of Olaus Magnus and his peers but even for the celestial map of another contemporary. By balancing her poem in this way, Moore also alludes to the paired maps and globes popularized during the sixteenth century. Consider the pair of terrestrial and celestial globes that Hans Holbein the Younger had painted on his double portrait *The French Ambassadors* (1533; Chamberlain, 1913: 2, pl.9 and 2.74; Dekker and van der Krogt, 1993: 24 and figs.8-10). Although Holbein's were based on the globes of Johann Schöner (ca. 1515-17), it was the globes of Gemma Frisius (1536-37) and of his student Mercator that opened the market for pairs of matching globes—a market that would thrive through the eighteenth century (Dekker and van der Krogt, 1993: 31, pls.7-8; cf. Stevenson, [1921] 1971: fig.28; Wallis and Robinson, 1987: 29). As exploration revealed more about the enormous landmass separating western Europe from eastern Asia, the double-hemisphere map also became increasingly popular and remained so through the eighteenth century (Whitfield, 1994: 60, 100, 114-15). The earliest one known—a double-hemisphere map made by Jean Rotz in 1542—shows the earth opened out like a locket (Whitfield, 1994: 60-62; cf. Wolff, 1992: 77; Shirley, 2001: pls. 97 and 99); typical examples show the right-hand circle enclosing the Old World, the left-hand circle embracing the New World (see Whitfield, 1994: 75-115). Eventually complementary celestial maps occupied the cleavage between the two hemispheres: one above, the other below (see Portinaro and Knirsch, 1987: pls. LXVIII, XCIII, c; Whitfield, 1994: 106-107). By alluding to a terrestrial map in the first half of her poem and a celestial map in the second half, Moore has incorporated within "SULU" the sixteenth-century expectation of balance and paired counterparts.

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EPILOGUE

A Beautiful Misfit

Fifty years after Olaus Magnus and Peter Apian died, a fifth "equine monster"—*Monoceros* or "Unicorn"—began appearing on the celestial charts in the southern sky. Many still regard Kepler's astronomer nephew Jakob Bartsch as its inventor (see Menzel and Pasachoff, 1983: 143; Whitfield, 1995: 8). But credit probably goes to the Flemish cartographer Peter Plancius (Warner, 1979: 201-206; Dekker and van der Krogt, 1993: 48, fig.22). Plancius seems to have been the first to create entirely new constellations, thus expanding the forty-eight that had been modified only slightly by Islamic and European astronomers after Ptolemy. A promoter of Dutch navigation and trade, Plancius began adding to the list in the late sixteenth century. When he became cartographer for the Dutch East India Company sometime after 1602, the observations from those daring commercial voyages gave Plancius even more information and stimulus (Tooley, 1979: 509). Around 1612, he made a globe with Pieter van der Keere that featured no fewer than ten additional constellations, including *Monoceros*. Although revolutionary, his globe immediately became rare. Another made by Isaac Habrecht II in 1621 introduced Bartsch to Plancius's creations, though Bartsch mistakenly regarded them as Habrecht's own (Warner, 1979: 14 and 105; see Bartsch's *Planisphaerii Stellati*, 1624).

A monk turned Calvinist theologian, Plancius chose the name "*Monoceros*" because the unicorn is conspicuous not only in Greco-Roman

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Figure 8: Andreas Cellarius, *Haemisphaerium Stellatum Boreale cum Subiecto Haemisphaerio Terrestri* (“Northern hemisphere of stars with a terrestrial hemisphere below”), from his *Atlas Coelestis seu Harmonia Macrocosmica*, Amsterdam, 1660. Hand colored engraving on paper, 44 x 52 cm (17 x 20 1/2 inches). Monoceros appears at 6 o’clock, accompanied by *Canis Major* (below) and *Canis Minor* (above) and to the right of blue-caped Orion. This 1660 edition of Cellarius’s atlas has belonged to the British Library since before 1757. Courtesy of the Map Library of The British Library: Maps C.6.c.2. (see page 80 for larger color version)

sources but in Judeo-Christian tradition as well. Monoceros is mentioned several times in the Greek Bible, where it is an apparent mistranslation of the Hebrew word *re’em* or “auroch,” the now extinct wild ox; the Latin Vulgate continued the error by translating “monoceros” several times as “unicorn” (e.g., Numbers 23:22, Deuteronomy 33:17, Psalms 22:21, 29:6, 92:10, Isaiah 34:7, Job 39:9-12; see Shepard 1930: 41-45). Its location near the mythical hunter Orion, and between *Canis Major* and *Canis Minor*, accords with the unicorn’s pursuit by the hunters and dogs portrayed on the Unicorn Tapestries, and in “SULU.”

Among the celestial maps depicting Monoceros, the closest match to Moore’s “Virgin-Mary blue” is a spectacular hand-colored plate from the *Atlas Coelestis seu Harmonia Macrocosmica* (“Celestial Atlas or Universal Harmony”), first published in 1660. Dubbed “the most beautiful celestial atlas ever made” (Snyder, 1984: 115; cf. Whitfield, 1995: 101), the *Atlas Coelestis* was the work of Andreas Cellarius, a German mathematician and cosmographer employed as rector of a Latin school in Holland (van Gent, 2000). The *Atlas Coelestis* contains twenty-nine engraved plates, including four pairs of constellation maps. One pair pictures only the constellations known in antiquity (Cellarius, 1660: 186-187 and 204-205). Another replaces the Greco-Roman constellations with figures from the Old and New Testaments (*ibid.*, 160-61 and 168-69), a trend Plancius inspired with his new “Biblical” constellations (Warner, 1979: xi; and see Snyder, 1984: 99; Stott, 1995: 76-77). On the map entitled *Coeli Stellati Christiani Haemisphaerium Posterius*, for instance, Cellarius replaces Pegasus with Gabriel (*ibid.*, 168-69; see Stott, 1995: 19). Two other pairs feature the constellations known by the mid-seventeenth century (Cellarius, 1660: 200-201 and 212-13, 192-93 and 208-209). On these two pairs, Cellarius makes us armchair astronauts, able to view the constellations from space as they float over different parts of the earth. The map of the northern sky entitled *Haemisphaerium Stellatum Boreale cum Subiecto Haemisphaerio Terrestri*, an immense celestial globe is steadied by Atlas and Hercules, and surrounded by putti and astonished men (*ibid.*, 200-201; Snyder, 1984: 114-16). Near the bottom of the “globe,” Monoceros faces toward eastern Africa and the constellation Orion, who turns away from us. Dressed like a Roman centurion, Orion sports a blue cape, which hangs from his right shoulder and almost brushes the unicorn’s muzzle (Figure 8). Then there is the map of the southern sky labeled *Haemisphaerium Sceno Graphicum Australe Coeli Stellati et Terrae* (“Southern hemisphere pictured with the background of starry heaven and earth”). With the terrestrial south pole (*Terrae Australis Incognita*) just below center, Cellarius juxtaposes Monoceros at rest beside a blue-caped Orion (right center) and Pegasus galloping across the ceiling of the celestial globe (top left: *ibid.*, 208-209; see Whitfield, 1995: 102).

Because the second half of “SULU” focuses upon the unicorn, it is tempting to regard Cellarius’s Monoceros as yet another inspiration for Moore’s “equine monster of an old celestial chart.” Unlike Apian’s celestial map, however, there appears to be little consistency in the coloration of the plates in the various editions, making it less likely that Moore would have seen the appropriately colored map.²² And Cellarius’s date in the mid-seventeenth puts him a century or more after most of the sources and events described in “SULU.” Following Moore’s early reference to “the cartographers of 1539,” the first half of the poem deals with English exploration during the reign of Elizabeth I (1533-1603); and, in particular, with the voyage of John Hawkins to Florida in 1564-65 and the circumnavigation of Thomas Cavendish in 1586-88. Yet neither Olaus Magnus nor the Elizabethans knew anything about the constellation that

Plancius would name Monoceros. If anything, Moore's allusions to the unicorn beginning at line 44 look back to the late fifteenth-century tapestries and the artistry of da Vinci or Dürer rather than forward to seventeenth-century innovations. For all its beauty, Cellarius's Monoceros is a beautiful misfit, inconsistent with the overall fixation of "SULU" upon the sixteenth-century.

Looking Back in Time and Space

Today, many refuse to regard *as maps* even such austere constellation charts as those illustrating Menzel and Pasachoff's *A Field Guide to the Stars and Planets*. There is simply too much of the "unreal" about them. That our constellations are named for (or imagined as) mythological creatures is only part of the problem. Maps, after all, are human artifacts; their purpose, appearance, and use often differing markedly among cultures and periods. More subjective is the act of linking the visible stars together within an imaginary construct known as a constellation: the Chinese, for instance, group the stars into smaller and more numerous figures than we do (Stott, 1995: 106). Yet our ubiquitous political maps—with their arbitrary and often disputed boundaries—reveal even more glaringly the differences in peoples' desires and perspectives. Ultimately, skeptics point to the lack of technological sophistication or fault the assumptions underlying constellation figures. Until Brahe exploded the myth in the late sixteenth century, scientists imagined the stars the way Ptolemy had—as "fixed" within a crystalline sphere revolving around the earth at a huge distance (Ptolemy, 1984: 1.6 and 7.1-4). Which is why antique celestial maps and globes could portray the constellations as observed from the earth (front, or man's view) or as if viewed from beyond the celestial sphere (rear, or "god's" view) (*ibid.*, 15 and 7.4; see Snyder, 1984: 61; Whitfield, 1995: 100-101).

Our astronomers are now pioneers venturing into an entirely new universe. The twentieth century brought us the Hubble Space Telescope; increasingly sophisticated land-based telescopes capable of picking up not only visible light but also x-rays, radio waves, and other types of electromagnetic radiation; and CCDs (charge-coupled devices) that can project these photonic images onto television monitors. Such technologies reveal a universe measuring more than ten billion light-years in diameter and filled with billions of galaxies, billions upon billions of stars, and far more empty space than matter. As we struggle to comprehend a minuscule earth surrounded by such vastness, we look back with nostalgia to a time when the naked eye allowed our ancestors to imaginatively transform the perceptible stars of the Milky Way into the constellations they believed lay somewhere beyond our solar system. Ironically, that "time" ended within the decade that Moore published "SULU." During the 1920s the Milky Way ceased to be the universe: the American astronomer Edwin Hubble discovered that other galaxies exist (1924) and that they are flying away from us and each another at speeds proportional to their distance (1929; Hall, 1992: 250 and 331). Now that our astronomers can measure distance—the third celestial coordinate that eluded Ptolemy and his successors (Hall, 1992: 354)—, the "Big Bang" has become our myth about the origin and nature of an expanding universe.

Ptolemy had recommended mapping the stars on a dark surface to represent the night sky, then using a similar color to outline the constellation shapes (Ptolemy, 1984: 8.3). Throughout the early modern period, however, most European mapmakers failed to heed his plea for realistic-looking maps of the stars. Despite the telescope's discovery of stars invisible

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to the naked eye, artistic portrayals of constellation figures like Pegasus and Monoceros continued to overshadow the stars on celestial maps until around 1800 (Dekker and van der Krogt, 1993: 14-15). Now, however, while modern astronomers make increasingly sophisticated maps of the stars and galaxies (see Geller, 1997), most of us seek reassurance in old celestial maps and in pointing out the constellations whose shapes have been handed down through generations. Such figures remain memorable precisely because they are so simple, and so fabulous.

Like "SULU," the celestial map combines fact and imagination, nature and art, "living" creatures and inanimate objects, land animals and aquatic beasts. On the page, the constellations float side-by-side, just as they seem to do in space—guides for helping us navigate across the deserts and seas of our own terrestrial geography. Like Moore's unicorn, the mythical figures in the heavens have become "more real than anything modern man can supply in their absence" (Snyder, 1984: 26).

NOTES

1. Harley and Woodward (1987: 1:68ff); see *The History of Cartography*, vol.2.1-2 (1992-94), for mandalas, and vol.2.3 (1998), for aboriginal maps. What follows is further reading on the maps mentioned in my first three paragraphs: Turnbull (1993) for aboriginal and prehistoric maps; Stott (1995) and Whitfield (1995) for celestial maps; Mollat and Roncière (1984) for portolan navigational charts; Westrem (2001) for the Hereford *mappamundi*; Whitfield (1994: 76-77) for the eagle map; Wallis and Robinson (1987: 68-69) for *Leo Belgicus*; George (1969) for animals on maps from 1500 BCE to 1804; Wallis and Robinson (1987: 160-62) for thematic maps; Hill (1978) and Monmonier (1995: 198-99) for zoomorphic maps, including political cartoons; Hill (1978: figs.6-8) and Whitfield (1994: 128-29) for children's games; Patton (1999) for children's geography texts; the Barbara Petchenik Children's Map Competition, sponsored by the International Cartographic Association (<http://collections.ic.gc.ca/children>), for animals on children's picture maps; Hunt (1987) for children's fiction illustrated with animals on maps; Emery Walker's map of Thomas Hardy's semi-fictional "Wessex" (in Hardy, 1912) for a famous map-with-animals illustrating a novel; Holmes (1991: 105) for one of many modern advertisements; and Storr (1994: 36) for a fine animal map in art.
2. Lucia Perillo's "The Carta Marina (1539)" can be found on-line at <http://www.geography.wisc.edu/histcart/broadsht/brdsh9.html>.
3. The other two are "Marriage" and "An Octopus." Moore's poetry notebook of 1922-30, preserved in the Marianne Moore Collection at the Rosenbach Museum and Library in Philadelphia, reveals that lines 77-78 of "Sea Unicorns and Land Unicorns" were originally in her draft of "Marriage" (Rosenbach 7:04:04, 1251/17, pp.1-96, esp. 21). See also Moore's letter of 9 September 1924 to Bryher (Winifred Ellerman): "I have been rather lacklustre about speaking of work that I have been doing off and on for two years, but Mother has goaded me into completing it, so I am again at work on it—two poems, "Sea Unicorns and Land Unicorns," and "An Octopus" which is descriptive of Mt. Rainier in Washington" (Moore, 1997: 208; see Stapleton, 1978: 37 n.20 and 46). The Rosenbach houses a carbon copy of "Sea Unicorns and Land Unicorns" dated 13 November 1924 (Rosenbach, 1:04:14).
4. None of these versions is identical in punctuation, in its usage of single or double quotes, or in its line divisions (see, for instance, Moore 2003, 164-66, final line). Between 1924 and *The Complete Poems*, Moore changed a few phrases slightly (see, for instance, Schulze 2002, 327), although not enough to affect my arguments. For convenience, I have

added line numbers to the poem. Note that Simon & Schuster owns the rights to early poems, like "SULU," published in *The Complete Poems by Marianne Moore*.

5. Because later collections tend to compress the notes, those in *Observations* are the most transparent and complete. The notes in *Complete Poems* include line numbers—a convenience marred by the misnumbering of lines 65, 80, and 82 (instead of 63, 79, and 81).
6. Moore's notes and journal (Rosenbach, 7:04:04, Poetry Notebook 1251/7; 1923, pp.90-91, 96) indicate that the following phrases come from Wilson (1922, 131-33, 154-55): the horn worth "a hundred thousand pounds" (lines 11-13); the unicorn in "Sir John Hawkins' Florida" (lines 19-22); and words that originally described Queen Elizabeth's embroidered gowns ("cobwebs, and knotts, and mulberries," line 32) and petticoats ("snakes of Venice gold, / and silver, and some O's," lines 77-78). Because Wilson also describes the unicorn's capture by the lady, her book provided Moore with both "halves" of "SULU" (see below).
7. Wilson (or an intermediary) misquoted the 1658 source, turning the serpent's "flaming shining eyes" into "flameling shining eyes" (Olaus Magnus, 1658: 235). Wilson's actual words also reveal that Moore chose not to quote her exactly, for Wilson and her source agree that the sea serpent "'disquiets the shippers'" (emphasis mine).
8. At the time Moore was composing "SULU," a popular source for the map was Nordenskiöld (1889).
9. Granddaughter of a Presbyterian minister, sister of another, Moore lived for nearly sixty years with her mother until Mary Warner Moore's death in 1947. They resettled on several occasions to keep house for, or simply to be near, their beloved clergymen (1894, 1916, 1929). Throughout her life, Moore neither worked nor socialized on Sundays (Leavell, 1995: 29-30). Her funeral was held at the Brooklyn Presbyterian church where she had worshipped for thirty-seven years (Phillips, 1982: 19).
10. Moore's descriptions of the library are found in her letters (e.g., Moore, 1997: 151 and 157). In 1934, Moore also met her protégé and life-long friend Elizabeth Bishop outside the Reading Room of the research division of The New York Public Library on 42nd Street and Fifth Avenue (Costello, in Moore, 1997: xi). Later that same year Bishop penned her seminal map-poem, "The Map" (see Haft, 2001).
11. The phrase is from Lynam (1949: 40), who, unfortunately, restricted belief in "unreal realities" only to scholars living before 1450.
12. Moore expanded the geographical range of her poem during its composition: its title evolved from "Tropics and Unicorns" in 1922, to "In the Tropics," then to "Sea Unicorns and Land Unicorns" (Rosenbach, 7:04:04: Poetry Notebook 1251/7, 1922-30, pp. 1, 8, 87, respectively).
13. In her poetry notebook of 1923, Moore highlighted the words "I have not seen it myself except in a picture (Herodotus: phoenix)" (Rosenbach, 7:04:04, Poetry Notebook 1251/7, 1922-30, p.92). Moore took the quote and three others on the same page from Bulfinch's *Mythology*, though she does not cite the text in her notebook.
14. In her note on line 66 of "SULU," Moore explicitly attributes to Pliny the detail about the unicorn being "impossible to take alive" (see Pliny, *Natural History* 8.31.76). On the salamander in bestiaries, see White 1954/1960, 182-84 and 236; the animals in "SULU" include the lion (*ibid.*, pp.7-11); the unicorn enticed by the virgin (pp.20-21); the beautifully horned, horse-like *monoceros* that can't be captured (pp.43-

- 44); the hunting dog (pp.61-67); the horse (pp.84-88); the salamander (pp.182-84); and sea creatures that resemble land animals (p.195).
15. In verse, Moore's only other reference to maps occurs in her light-hearted rant against clichés entitled "I've Been Thinking" (1963; Moore, 1967: 237-39): "Though flat,/ myself, I'd say that/ "Atlas"/ (pressed glass)/ looks best/ embossed." She clearly enjoyed maps, however. In a 1921 letter, Moore wrote about seeing Marguerite Zorach's "wool map of New York in minute stitches" at a Wanamaker's show (Moore, 1997: 176; see Leavell, 1995: 120-21, 148). The shape of the glacier on a map of Mount Rainier inspired her to name her companion piece "An Octopus" (Stapleton, 1978: 42 and 240 n.33). In the November 1926 "Comment" section of *The Dial*, she named three early mapmakers whose works had impressed her at a New York Public Library exhibition: Diego Ribera, Girolomo da Verrazzano, and William Burgis (Moore, 1986: 175). From 1943 to 1961, Moore corresponded with American artist Joseph Cornell, who made his own type of collage: boxes fashioned from all types of materials, including maps (Moore, 1997: xii and 562).
 16. Although in his later work Olaus would call his map *Carta Gothica* (e.g., *Historia* 2:7), the charted islands and peninsulas were never unified politically under the Swedes or their self-styled Gothic ancestors (Granlund, 1951: 37; Olaus Magnus, [1555] 1972: 20; Olaus Magnus, [1555] 1996-98: vol.1:xl). For an excellent website that displays the separate "sheets" of the *Carta Marina*, see Urness (1999-2001).
 17. The detail of the *Carta Marina* made the map impossible to reproduce in his *Historia*. Instead, Olaus recycled a smaller, inferior map of Scandinavia that he had made for Johannes's *History of the Gothic and Swedish Kings* (1554). Olaus retitled the map *Regnorum Aquilonarum Descriptio*, "Description/Drawing of the Northern Realms," then inserted it into the *Historia* after his preface (see Olaus Magnus, [1555] 1972).
 18. The image from the *Carta Marina* reappears at *Historia* 21:31, where it illustrates a chapter that doesn't even mention the sea unicorn.
 19. *quae [animalium figurae] tamen verae aut ad vivum pictae minime videntur*: Gesner, *Bibliotheca universalis*, fol. 526 (quoted in Nordenskiöld, [1889] 1993: 61).
 20. One fine example is a map made around 1561 by Giacomina Gastaldi (Shirley, 2001: pl.92), the renowned Italian cartographer whom Olaus Magnus may have met in Venice in 1537-38 (Lynam, 1949: 15). According to Wallis and Robinson (1987: 160), "by the middle of the sixteenth century the convention of depicting animals on maps and charts was well-established and confirmed in instructional works."
 21. Warner (1979: xii-xiii, 31). Illustrated in Dekker and van der Krogt (1993, fig.2); Stott (1995: 6); and Whitfield (1995: 23). The Farnese family who acquired the globe used the unicorn resting on the virgin's lap as their *impresa* (Hall, 2001: 316).
 22. The British Library, for instance, owns three copies and a later 1708 edition. According to Peter Barber, Head of Map Collections, the three copies from the 1660s are very different in their coloration. Our Figure 8 comes from the 1660 edition. Of the two 1661 reprints, one is uncolored, like the copy in the New York Public Library. The other features a bluish wash covering all the figures (Peter Barber, e-mail to the author, 27 September 2003). Contrast these to the very differently colored plates from the 1661 copy housed in the J. Willard Marriott Library at the University of Utah (<http://www.lib.utah.edu/digital/cellarius.html>).

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reviews

Changing Faces, Changing Places: Mapping Southern Californians.

By James P. Allen and Eugene Turner

Northridge, CA: Center for Geographical Studies, California State University Northridge, 2002. 60 pp., 29 maps and graphs, 14 tables, 15 photographs, bibliography.

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This atlas is another in the excellent series of ethnic atlases produced by Allen and Turner that includes the award winning *Ethnic Quilt* and *We the People*. First, a caveat. Although the subtitle of this atlas is "Mapping Southern Californians," the atlas does not cover all of southern California. It focuses on the five-county metropolitan area designated by the federal government as Los Angeles-Riverside-Orange County Consolidated Metropolitan Statistical Area. Thus, a reader hoping to learn about San Diego, Santa Barbara, or interior southern California will be disappointed, but, that said, the choice was deliberate because this is the part of the state where nearly half of its 34 million people reside. As the authors point out, San Diego is a metropolitan area in its own right separated from Los Angeles by the expanse of Camp Pendleton Marine Corps Base and is worthy of its own study.

Like the two predecessor volumes by Allen and Turner, *Changing Faces, Changing Places* is a collection of maps with explanatory text, and *Changing Faces* is somewhat of a companion volume to

The Ethnic Quilt published in 1997. However, this work looks at the changes in the ethnic make-up of the Los Angeles CMSA by showing patterns from the 2000 census and changes from the 1990s.

Changing Faces is an oversize (11"x15") spiral-bound, landscape format work of 60 pages. It consists of eight chapters with 31 maps and graphs, 14 tables, and 15 photos. The text for each chapter explains the patterns shown on the maps. The eight chapters can be thought of as making up three parts: introductory material, the ethnic change maps, and the conclusions.

The first three chapters include, first, the "Introduction" that spells out the authors' goals, terminology, the map preparation and design, limitations of some maps and data, and defines the subject area. The second chapter is a description and discussion of Census 2000 data. Changes in census procedures, especially the new mixed race options, and changes in census tract boundaries that affect the maps are explained. Census undercounting and errors are also discussed. The third of the introductory chapters "Getting Oriented" is illustrated with two primary maps—a population map on a shaded relief base that uses dots of different colors for different values to show population density patterns and a map of patterns of home ownership. Graphs show ethnic population change by county and a table gives data for ethnic population change since 1960.

The second group of maps examines patterns of specific ethnic groups—whites and blacks in chapter 4; Latinos and American Indians in chapter 5; and Asians and Pacific Islanders in chapter 6. The patterns of change are striking for all groups. Especially interesting is the migration of ethnic groups from older enclaves to newer suburban, frequently

more upscale, enclaves. The maps show clearly "White flight" to distance suburbs, blacks leaving the "South Central" area of Los Angeles for the suburbs, and the large increase of Latinos in all parts of the CMSA. These are shown dramatically by red and blue dots for increase or decrease of 100 people.

Southern California has the largest U.S. Latino population, outnumbering Latinos in New York, Chicago, Miami, and Houston combined. The Latino population of over 6.5 million in 2000 represents a 38 per cent change from 1990. In addition to maps of Latino population change and concentration, the authors include maps of Mexican and Central American concentrations.

The Los Angeles CMSA also has the largest Asian population of any metropolitan area in the United States, and Asians have outnumbered blacks since the 1980s. The CMSA includes well known ethnic enclaves, such as Korea Town, Little Tokyo, Chinatown, Little India, and Little Saigon, and lesser known enclaves of Samoans, Thai, and Cambodians. Not all groups have a map and for the general Asian map, Pacific Islanders, Thai, Cambodians, and Indians are included with all other Asians. The reason for this is the relatively low percentages of these groups within the areas. The focus maps are for Filipino, Japanese, Chinese, Korean, and Vietnamese.

The concluding chapters show general patterns and provide some conclusions. Chapter 7 has a map of "Predominant Ethnic Group" that shows concentrations at a glance; a map of "Ethnic Diversity" shows what a distinctly diverse area the Los Angeles CMSA is, and the final map is of people who identify with two or more races. An accompanying table shows that nearly 800,000 people in Los Angeles identify

with more than one race. Chapter 8, "Conclusions," discusses residential separation and enclaves and attempts to give some explanations.

The maps in this work are clear and attractive. The large, landscape format is well suited to the area and allows the maps to be shown at a reasonable scale. The colors used on choropleth maps are pleasing and easy to distinguish from one another, and the base map is useful without being obtrusive. There are 15 small, color illustrations within the text that show typical scenes from different ethnic areas. While the work would not suffer from their absence, they do add color and a feel for the diversity of Southern California.

The text is clearly written and describes the patterns seen on the maps with explanations. All terms are defined, which is useful to a reader who might not be familiar with the distinctions between Hispanic and Latino, for example. Problems with creating the maps because of weaknesses in data or overlaps of ethnic identity are explained. There are extensive endnotes for each chapter and three pages of references at the end.

Overall, this is an excellent work and would serve as a model for similar atlases of other CMSAs. It will be of interest to anyone involved in population mapping, demography, or planning.

Representations of Space and Time

By Donna J. Peuquet
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(no list of figures)

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Donna Peuquet's *Representations of Space and Time* is an overview and synthesis of our understanding of space and time: what they are, how they are represented in minds, and how we might most fruitfully represent them in computers. Covering all of that in a single, highly readable volume is a challenging undertaking for author.

The task undertaken in this book, to offer a compact yet satisfyingly full treatment of what we understand of space and time from work in philosophy, psychology, cognitive science, computer science, and geography, and to tie that into the GIScience enterprise, is ambitious. There is a lot of ground to cover (indeed, the publisher refers to the book as "sweeping" and a "tour de force"), but the route is direct enough, and both the journey and the destination are worth the effort.

Taken as a survey and a summary, the book serves as a guide to the large and disparate literature, from several disciplines, that addresses thought about, and representation of, space and time. With that overview achieved, Peuquet invites us to look ahead with a more firmly situated view of the GIS enterprise. Her ambitious route in tying together our understandings of cognitive representations in minds and of computer representations in GIS brings us to a vantage point from which to develop a roadmap for future GIS research.

The Contents

The introductory chapter situates the book in the effort to create a conceptually coherent framework for the representation of space and time, as an exploration of both cognitive and formal representations of geographic space and time. The rest of the book is structured in two parts.

The first part of the book deals with knowledge representation in human minds. It integrates material from the beginnings of western philosophy through recent psychological research to define space and time, to distinguish them from their representations, and to examine how people acquire, store, and use spatial and temporal knowledge. The treatment is broad and dense.

The second chapter, "Representation versus Reality," offers definitions of "Space" and "Time," provides a broad survey of how they have been conceptualized from early mythology through modern science, and draws out common threads from that cloth. The swath is impressive, weaving together the contributions of Hesiod, Democritus, Epicurus, Plato, Aristotle, Copernicus, Galileo, Descartes, Newton, Leibniz, Einstein and Minkowski on the nature of time and space with those of Kant, Locke, Werner, Piaget, J.J. Gibson, Marr, Talmy, Herskovits, and others on space and time as context for human understanding. Common threads are extracted: that views of both space and time share two dualities (discrete vs. continuous; and absolute vs. relative conceptualizations). "A fundamental thesis of this book is that absolute and relative views of space and time are complementary and interdependent. The same holds true for continuous and discrete views of space and time."

Differences in the measurement and conceptualizations are also

noted (absolute time is progressive, while absolute space is not, but relative space and time are both amenable of similar patterns).

This survey is expanded in the remaining chapters of the section. Chapter 3 deals with the overall process of learning about one's environment and acquiring knowledge of it. Here, contributions of Hegel and Cassirer are woven into the piece alongside Werner and Piaget, and an accumulative process, joining direct experience and more abstract experience, mediated through symbols, emerges. The geographic in this is exemplified by Siegel and White, and by Golledge. Given the universal types and sources of knowledge, the book moves on to its storage.

Chapter 4 deals with some elements of the conceptual structures for storing world knowledge and what the ontology of spatial things tells us about them. It notes the embodiment of spatial knowledge, touching on biologically-motivated parallel distributive process models of cognition, and passing into the characteristics and constraints developed in the mental map literature to pull out the structures that they indicate. The roles of categories, schemata, frames and other such structures used in thinking about things geographic are examined. Philosophical and psychological threads from Rosch, Tversky, Lakoff, Lynch, and others come together to underwrite a core idea of the book—that mental representations of spatial and temporal knowledge are multi representational and dynamic. Further, they develop through and support the integration of inputs of various kinds.

The next two chapters examine how we learn and integrate world knowledge from direct experience. Chapter 5 expands upon the mechanisms for acquiring world

knowledge through direct experience. It draws on the work of J.J. Gibson and Marr, among others, to describe the interaction of cognition and perception, and to indicate how the internal structures influence the apperception of the external. Chapter 6 extends this to explore thought on how sensory data can be taken from simple observation to become understanding. Here, imagery and metaphor are invoked as familiar examples of the explorative and generative mechanisms, thought processes, by which connections are made between observations and mental structures to build the richly inter-related structures that constitute intelligence and understanding.

Chapter 7 considers the role and processes of acquiring geographic knowledge through indirect experience, i.e., through graphical and spoken and written linguistic representations. Peuquet argues that graphics of various types tap into the ability of the human visual system to derive pattern and coherence instantly and further, to feed the conceptual structures. The facts that linguistic representations and graphics, including pictures, diagrams, maps, and other types are products of human agency, are generally abstractions from someone's (culturally and physically embedded) perceived reality, and may be inaccurate, is noted but the problems this implies are tacitly left to the sense-making processes of the mind to arbitrate.

Peuquet argues that maps convey meaning through both their algebra-like and their visual image structure.

Reviewing work by Levy, Herskovits, Talmy, Lakoff, Jackendoff and Landau, and others, Peuquet delves into how language represents the content of mental structures that note spatial relationships and what it reveals about those structures. Further,

the value of processes and mechanisms that facilitate the leveraging of society in creating individuals' spatial knowledge stores is clear. It is clear too that a great deal of the mental content that many of our minds hold derive from indirect experience of space and time. It is clear that graphics and language intertwine to provide a richer yarn to be worked into the weave of spatial-temporal knowledge and that the examination of these external manifestations gives insight into the internal representations.

The eighth chapter goes further in describing how spatial knowledge is encoded in minds. The debates of the past several decades on how spatial information is encoded in minds, i.e., imagery vs. propositional vs. dual-encoding vs. homomorphism debates, exemplified in the works of Kosslyn, Pylyshyn, Pavio, and Johnson-Laird are worked-over and a higher-order perspective assumed: the exact form of the internal representation is probably impossible to determine but, whatever it is, it supports at least several functional modes of use, each with distinct advantages and disadvantages. Evidence from several studies is mustered to support the notion of separation of "what," "where," and "when" knowledge is one of the key properties of encoding. Doubtless, Figure 8.4 is worth more than a thousand words; likely a thousand lectures will find it a useful summary of the first half of the book. It may well rise to the level of use made of Robinson and Petchnik's simplified version of Kolacny's or of Muehrcke's diagrams of the cartographic communication model.

By page 205, the first half of the book has taken a direct and detailed trip through more than two millennia of thought about space and time, and provided a convincing account of how we

experience and think about them. It is a compelling and well aimed coverage. Those who are unfamiliar with this literature will find this a dense stand-alone treatment and an inviting guide to further reading. Those who are familiar with this literature will find the organization of this explication beneficial. It would be the backbone of a pretty demanding graduate level reading course on philosophical and psychological underpinnings of spatial cognition and hence of fundamentals in geographic information science.

The second part of the book deals with the formal computer-based representations employed in using computers as tools for storing and processing spatial knowledge. This may be more familiar terrain for most GIS practitioners, but the focus is different from the usual prescriptive (here's how we do GIS) one. Peuquet's objective is to apply what we know about human spatio-temporal cognition to move toward a more human centered approach to handling spatial and temporal information than is currently practiced.

Chapter 9 raises a number of questions about how best to use computer technology to display information and to solve problems involving the manipulation of spatial and temporal information. Examples of several paths that have been explored are offered: Dana Tomlin's map algebra, spatial and temporal extensions to SQL, application of human-computer interaction principles and of developments in artificial intelligence particularly computer vision, expert systems, and natural language processing knowledge discovery/data mining/pattern noticing.

The new tools suggest many new opportunities, but the differences between these and earlier tools suggest that we need to think through how computers can

more effectively be used. One possibility is to note the similarities between the cycle of knowledge acquisition in cognitive and scientific contexts.

In chapter 10, the perspective that computers are best thought of as a medium comes to the fore. The medium brings together (distributed) databases and display screens with interactivity. "The greatest potential power of the computer as a representational medium derives from its dynamic, conceptually multidimensional nature, and its ability to produce multisensory output" (p. 221). Via the computer, maps take on more of the exploratory role in addition to the presentational role. Most of this is old hat to cartographers who habitually sketch-out distributions and patterns as a way of understanding their data. It is now a common-place that maps serve two functions: areal storehouse and source of distributive pattern—that has not changed.

Chapter 11, "Storing Geographic Data," provides an historic overview of current approaches to representing digital geographic data in computers. It sets a discussion of datamodeling within the context of levels of representations within a database management system (physical storage, conceptual schema, and subschemas). The formal cleanness of current database design is contrasted with the relative *ad hocery* of the various vector and tessellation data models employed in GIScience. Way-points of the past thirty years, such as SYMAP, GBF/DIME, POLYVERT, and Morton indexing serve as landmarks in an emergent landscape. It has worked, and can be described in a surprisingly cohesive framework, but it still lacks a comprehensive theoretical foundation.

Chapter 12, "A New Perspective on Geographic Database Representation," attempts to say what that foundation might be and is the core of the book's contribution.

Stating with the lessons learned in the raster versus vector debate (they both can do the job and they each have advantages in different specific applications), noting the diversion to hybrid models and that most commercial systems now do both and also integrate relational database technology, and tying in calls for both new analytic techniques (e.g., inductive exploration as in Openshaw's Geographical Analysis Machine) and the desire by some to represent human concepts of reality rather than cartographic representations of it, the first section of the chapter sets up a metaview from which one can ask: what should the theoretical foundation be?

Gamely taking a stab at an answer, Peuquet identifies characteristics that the theoretical foundation framework should have in support of representation (allow effective representations for various specific uses, be extensible, formalize our intuitive notions, and support new insights into spatial cognition), and suggests that frames and object-oriented techniques (which ease systems development by making their components more like our normal conceptualizations) provide a potential direction. They could be used to support the dual ontological models (continuous and discrete) of space and time, as well as the taxonomic and partonomic relations among objects, with a single underlying data store which incorporates locational/where, temporal/when, and thematic/what data. This notion, dubbed the pyramid model, has been used to develop a working prototype, the Apoala system (Mennis, Peuquet, and Qian (2000)).

The bigger picture that emerges is that geographic databases can partake in, and benefit from, the hierarchical organization, abstraction, and associative retrieval which characterize the multi-representational model evident

in human spatial and temporal cognition.

Chapter 13, "Interacting with Databases," delves into advances in interfaces to indicate how linguistic and visual interfaces will provide richer and easier access to information in geographic databases. It ranges over query languages, computer graphics, visualization, and virtual environments and emerging technologies for interacting with computers, and makes the point that "the true power and utility of database and information systems...lie in the ability to perform analysis," here characterized as exploration, explanation, prediction, and planning. Peuquet seems hopeful that the semantic problems that arise in these higher-level operations can be addressed by the coupling of richer data models with rich interaction.

Chapter fourteen, "Issues for Implementing Advanced Geographic Databases," revisits some of the sticky wickets in spatial and temporal information systems that must be navigated simultaneously. These include dealing with vagueness, uncertainty, and imprecision in data, as well as working out the higher-level issues in getting computers to be fuller partners with their human users. Handling time satisfactorily requires that something beyond the bitemporal model be integrated with the handling of space. Handling the inexactness inherent in spatial-temporal databases is also required. Formalizing the ontologies needed to support advanced data models and interfaces poses another fundamental challenge, and one in which there is lack of agreement on the best approach. Promising advances in computational implementations suggest that sophisticated programming can raise the level of "artificial creativity" in tasks performed by computers, but leave little doubt that humans are still better at some things. There also remains the

issue of bringing database technology to the point of embracing the need to handle the desired richer representations while maintaining reasonable performance.

Finally, in a short epilogue, Peuquet re-gathers the insights of the past to assess the prospects for the next ten years of geographic information science research. The needs to consolidate and extend recent work on formal ontologies and the capabilities of experimental systems are noted and the challenge issued.

Assessment

The principal contribution of this book is in pulling a wide range of material together to produce a coherent view of thinking on space and time and how insights into the mental and computer representations of them can be brought to bear on further development of spatial-temporal database technology. It is geared to those interested in wrapping their minds around GIS research frontiers and working on its future development—not those wanting to use current GIS technology, though they too would benefit from it.

This is a great book; it succeeds even where it can only point toward possible answers to the questions it raises. The book occupies open ground within the thicket of GIS books. It stands alone between the pragmatic explications of current GIS practice exemplified by deMers *Fundamental of Geographic Information Systems*, the more computationally motivated volumes such as Worboy's *GIS: A Computer Science Perspective* or Laurini and Thompson's *Fundamentals of Spatial Information Systems*, and such conceptually motivated volumes as Chrisman's *Exploring Geographic Information Systems*. The degree of integration of human-centered disciplines, principally philosophy and psychology, set it apart. It is neither a textbook nor a how-to

text, but rather a what-to text in the sense of pointing out what are the next steps that GIS must take to move toward its promise.

This is an intriguing invitation to conceptualize the next generation of GIS. It reminded me of the questions that interested me in GIS and served as an intellectual spring tonic. I will make it required reading for my graduate students.

Critique

This book is a sufficiently important contribution that I am wary of offering any criticism of it at all. But that would be boring, so I'll share a couple of questions that remain for me.

While the suggestion that computer representations of space and time will be more advantageous if they are more like human mental representations is plausible, it is ultimately taken as an article of faith. This is quizzical given the notion that the strength of the human-computer partnership lies in the former's creative flexibility and the latter's indefatigable unerring attention to computational detail. This is compounded by the implication "that the deterministic and closed-world comfort of a *mathematical* basis for representation is insufficient." It leads one to wonder whether the partnership might be weakened by putting more of the human's fallibility into the machine. Peuquet believes that it won't. I hope that she is right. I'm not so sure. Time will tell.

The problems raised in the penultimate chapter clearly identify research directions that will occupy a number of disciplines for several decades. They already have, and while progress seems to be made, fundamental problems remain unsolved in general. The epilogue seems a thin answer to this concern. The value and intellectual pluck shown in casting these problems in this framework

is nearly as remarkable as Pequet's resolute determination that we can make progress by working on them. Turning over the material in this book reveals both progress and potentials. Putting all of this together in one cohesive picture is remarkable.

Minor Complaints

The title is ambitious and perhaps misleading: the work is at once more focused and broader. The title may suggest to some that it will catalog all of the ways that space and time have been represented as in art, maps, etc. It contains very little of that. Rather the book surveys philosophical, psychological, and computer science thought on mental and database representations of things that are situated and related in both space and time. Many kinds of representations of them are barely considered: artistic renderings or the various approaches that cartographers have taken to trying to show both space and time.

The large number of back and forth references within the text become a distraction, but, in fairness, may be the only way to meet the case. The various threads of thought that are woven into this piece each are developed in their turn, but the relations among them might have been lost without explicitly noting the connections. Still, the number of forward and backward references within the text suggests that a hypertext version may have been more natural.

Cataloging what we know about mental representation of space and time leaves one with the dismaying realization of how little we really know about how all of this works.

Conclusion

This is an important, even a great, book. It covers a lot in a thin volume. It will be valuable for

organizing graduate seminars on geographic information science and on spatial cognition for years to come. The book organizes several threads into a coherent cloth. It reflects Pequet's faith that these things can work.

This book is deep-thought provoking. It surveys and synthesizes a pile of far-flung literature, summarizing and raising questions with it as it goes. Psychology, philosophy, computer science, and even cartography are brought together. In the process, it leads a reader through the field of GIS in a way that provides understanding far deeper and insightful than any of the GIS texts that are out there. It shows the conceptual roots of representing geographic phenomena in computers. It brings one to the edge of the research frontiers. And points the way ahead.

map library bulletin board

From Christopher Mixon, new Map Library Bulletin Board Editor.

Recently I went on a ski trip to Northern Wisconsin and on my way I spent four nights with friends in Milwaukee. I had made plans to meet a fellow map cataloger from the American Geographical Society Map Collection and my former cartography employer for lunch. Of course we chose Indian cuisine, who wouldn't? After lunch I visited the AGS Collection for a quick tour. Though I had used the AGS collection as a UW-Milwaukee geography student, I had never had the tour. While at the AGS, I was able to speak with some colleagues I knew and was introduced to several others I did not know. As I

spoke to the folks at the AGS collection, I noticed that almost three hours had slipped by. I was struck by the fact that librarians (map librarians at least) have a lot to talk about.

As your new Editor of the Map Library Bulletin Board for 2004 through 2006, I invite you, who are involved in library map collections, to tell your story. Tell us about a conference or workshop you have recently attended. Submit your research papers. Many articles in past issues have described map collections in great detail, from their histories to circulation policies to notable collections within. We all want to know how other institutions deal with issues such as cataloging, storage, maintenance, etc.

One issue that came to mind for this column was the name. A bulletin board might be fine if you are selling puppies but not so for posting your scholarly research. Perhaps a new name for this column is in order. Just a thought – let me know what you think.

Please submit your work to me, preferably as an email attachment, to mixonch@auburn.edu, or in the **body of an email**. **Submissions via snail-mail are gladly accepted and should be sent to me at RBD Library, 231 Mell St., Auburn University, AL 36849-5605.**

Christopher H. Mixon

Color Figures

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Barrington Atlas of the Greek and Roman World: the Cartographic Fundamentals in Retrospect

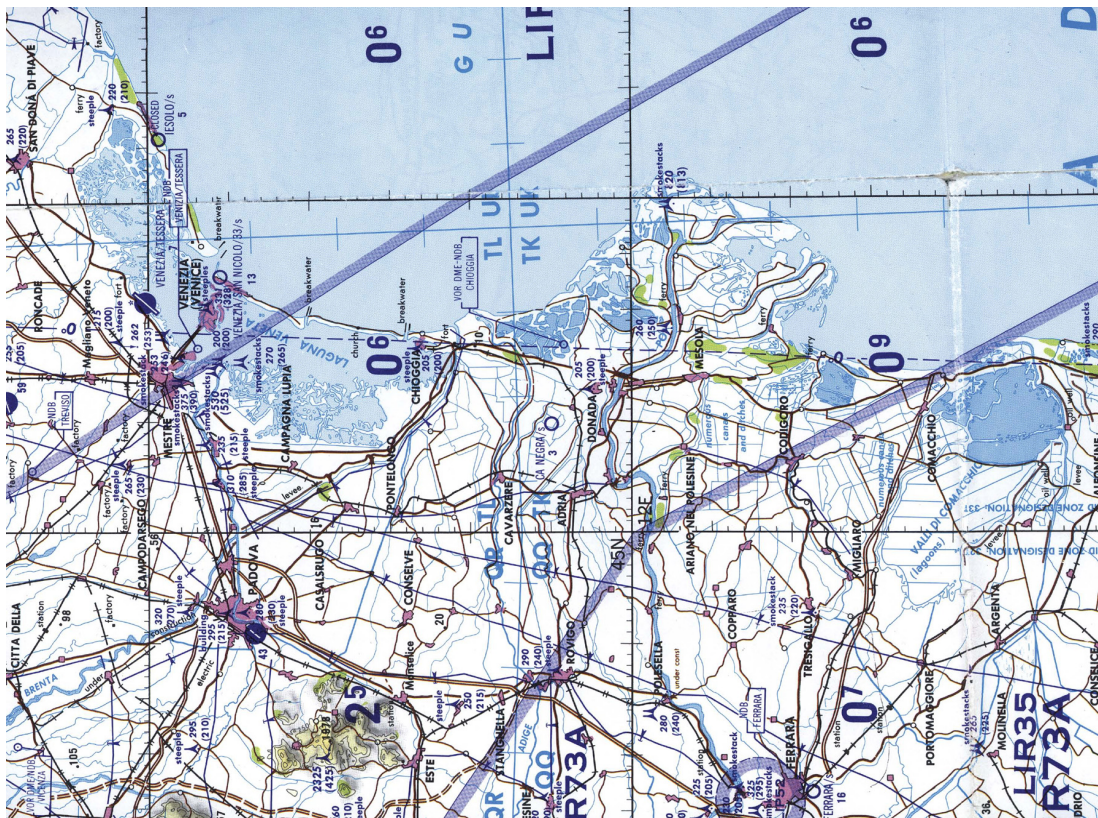
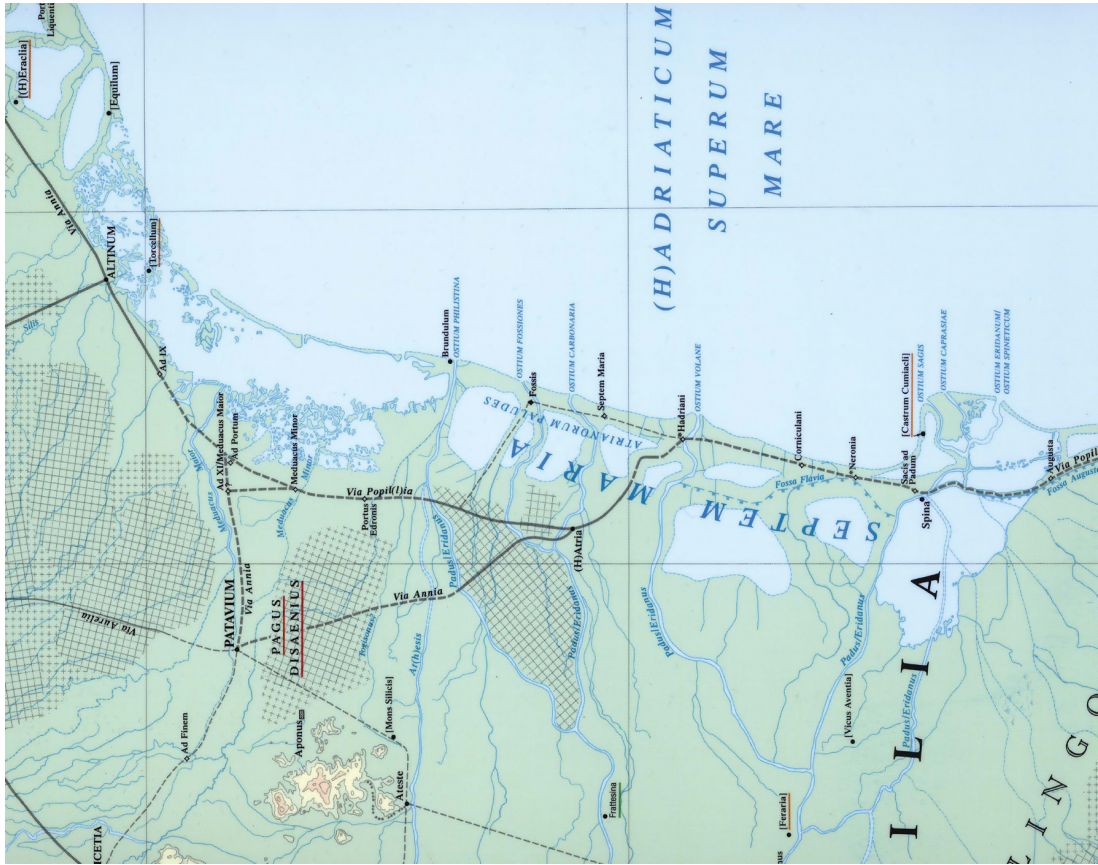


Figure 1. Part of Map 40 (right) showing the Po delta in antiquity and the corresponding part of TPC F-2B (left) on which the map is based. As Map 40 clearly illustrates, the Barrington Atlas uses two line weights to distinguish major roads from minor (the recommendation of a road specialist that as many as seven different weights be distinguished was hardly practical.). Solid linework of any kind (be it for a road, wall, aqueduct, etc.) signifies that the course of the feature is known for certain in this location; where linework is dashed, by contrast, it can only be traced approximately. The checkerboard patterns denote 'centuriated' areas – land surveyed, divided and assigned by the Roman authorities.

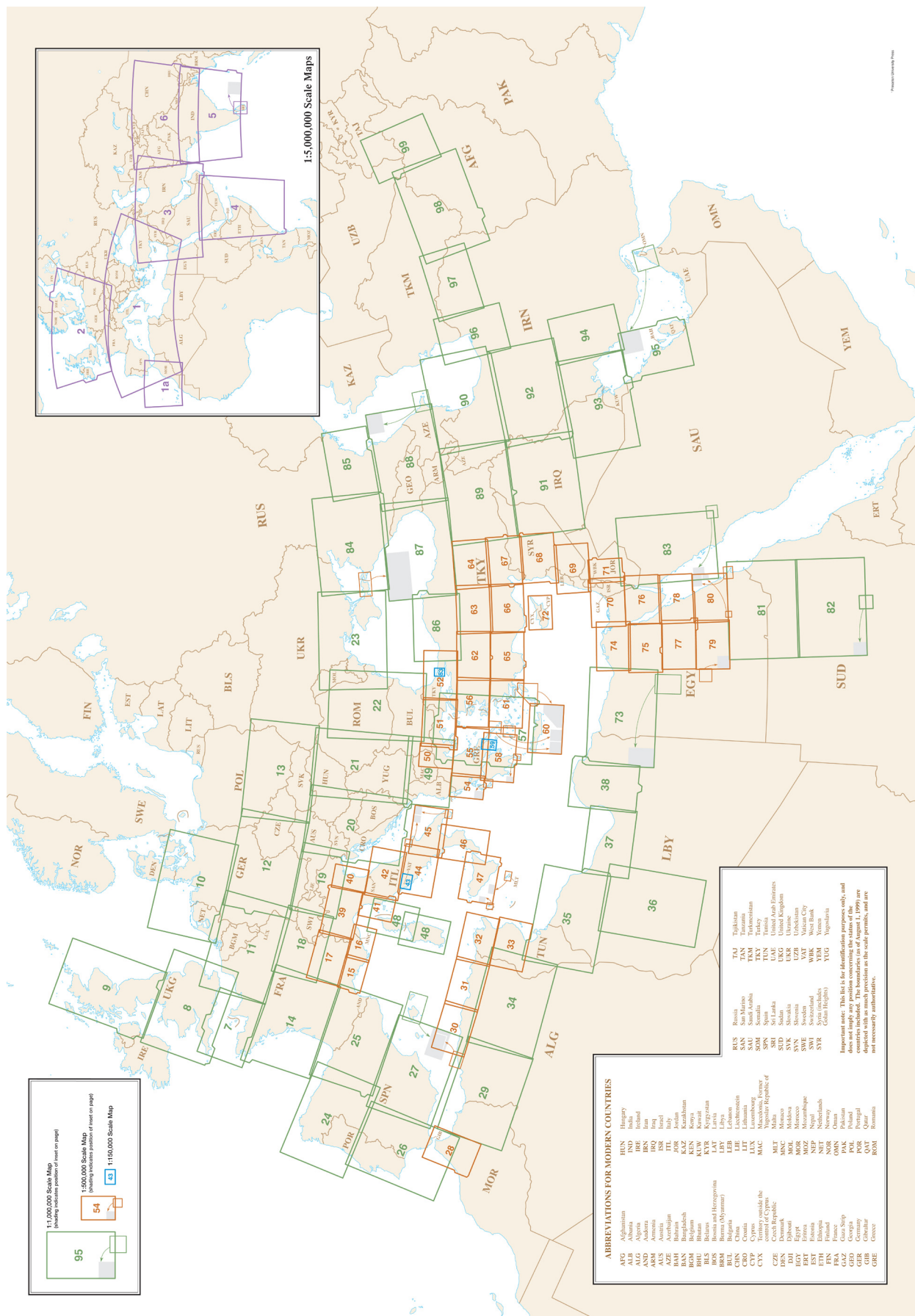


Figure 4. The locator outline map in the published atlas, 2000. While the framework of the initial layout is maintained throughout, after 1990 many part-maps and insets become better integrated (such as 26 a and b, and the insets between 30 and 31, in Fig. 2), and excessive overlaps eliminated (in eastern Asia Minor, for example). More overviews at 1:5,000,000 are added, and eventually coverage at 1:1,000,000 is extended so that the map planned from the outset to show Greek settlement in Bactria (85 in Fig. 2, 94 in Fig. 3) no longer remains an isolated one at this scale.

ABBREVIATIONS FOR MODERN COUNTRIES

AFG	Afghanistan
ALG	Algeria
AND	Andorra
ARG	Argentina
AUS	Australia
AZE	Azerbaijan
BAN	Bangladesh
BEL	Belgium
BGR	Bulgaria
BHS	Bahamas
BOL	Bolivia
BRA	Brazil
BUL	Bulgaria
CHN	China
CHE	Switzerland
CYP	Cyprus
CZE	Czech Republic
DNK	Denmark
DJI	Djibouti
EGY	Egypt
ESP	Spain
ETH	Ethiopia
FRA	France
GBR	Great Britain
GER	Germany
GRC	Greece
IND	India
IRN	Iran
IRL	Ireland
ISR	Israel
ITA	Italy
JPN	Japan
KAZ	Kazakhstan
KEN	Kenya
KOR	South Korea
KWT	Kuwait
LAT	Latvia
LBN	Lebanon
LIT	Lithuania
LUX	Luxembourg
LVA	Latvia
MAG	Magyar Republic
MEX	Mexico
MLT	Malta
MOR	Morocco
MYS	Malaysia
MOL	Moldova
MUS	Mauritius
NET	Netherlands
NIP	Nepal
NET	Netherlands
OMN	Oman
PAK	Pakistan
POR	Portugal
PRT	Portugal
ROM	Romania
RUS	Russia
SAU	Saudi Arabia
SDN	Sudan
SPN	Spain
SRB	Serbia
SVK	Slovakia
SVN	Slovenia
SWE	Sweden
SWI	Switzerland
SYR	Syria
TAN	Tanzania
TUN	Tunisia
TUR	Turkey
UKR	Ukraine
USA	United States
UZB	Uzbekistan
VAT	Vatican
WBR	West Bank
YEM	Yemen
YUG	Yugoslavia

ABBREVIATIONS FOR MODERN COUNTRIES

RUS	Russia
SAN	San Marino
SAU	Saudi Arabia
SDN	Sudan
SPN	Spain
SRB	Serbia
SVK	Slovakia
SVN	Slovenia
SWE	Sweden
SWI	Switzerland
SYR	Syria
TAN	Tanzania
TUN	Tunisia
TUR	Turkey
UKR	Ukraine
USA	United States
UZB	Uzbekistan
VAT	Vatican
WBR	West Bank
YEM	Yemen
YUG	Yugoslavia

Abbreviations for: This list is for identification only, and does not imply any political stance. The boundaries as of August 1, 1999 are shown. The boundaries on the scale permits, and are not necessarily authoritative.



Figure 6. Part of Map 5 India, first in an early draft (left) incorporating only the physical elevation offered by the GNC 12 base sheet, and then as published in 2000 (right) incorporating custom-designed digital elevation modeling by Dommelley (with use of GTOPO30, as described in Barrington Atlas, xxviii) which was adopted for all twelve maps at the 1:5,000,000 scale.

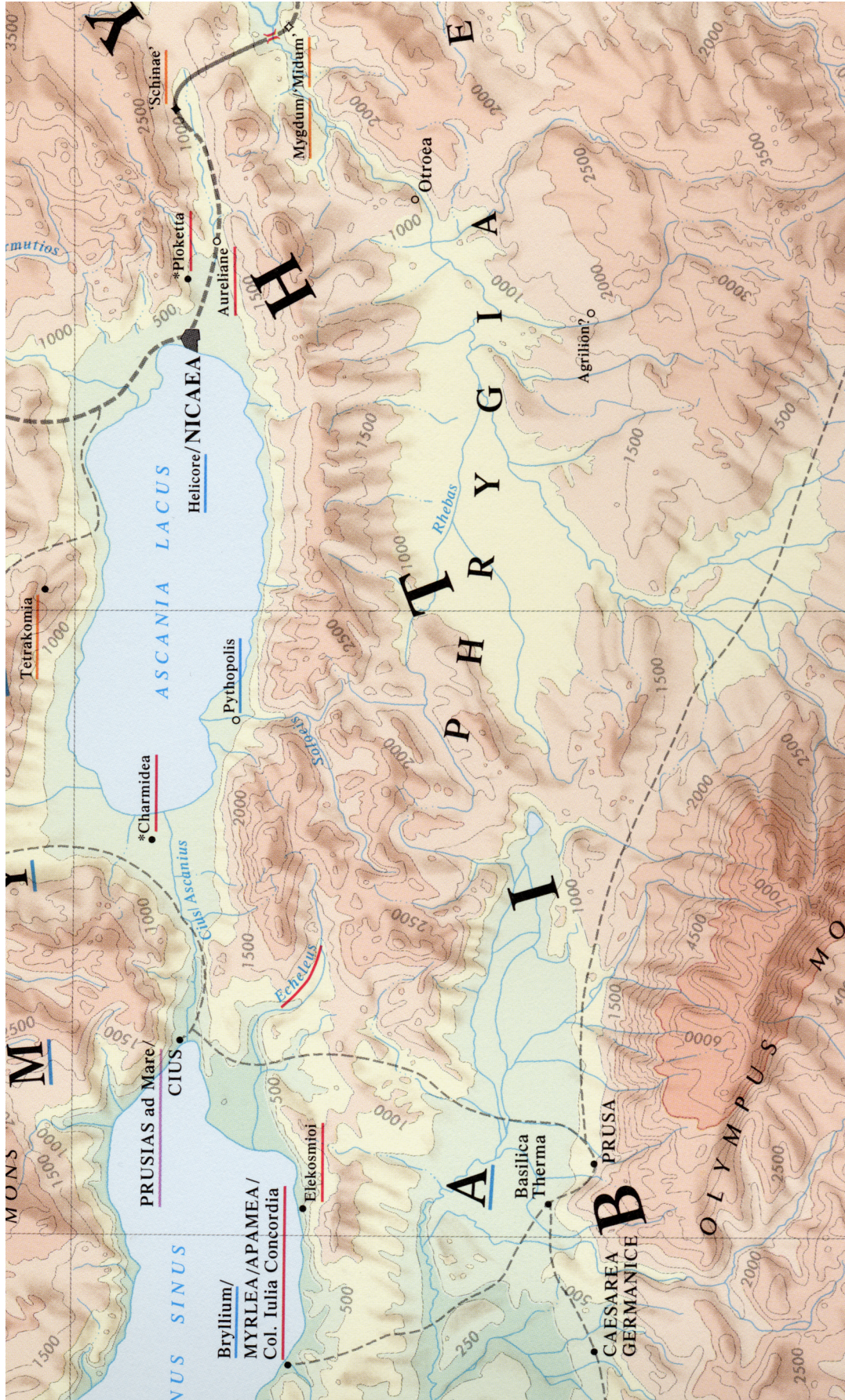


Figure 7. Part of the specimen map at 1:500,000 as printed in 1990 (a revised version of which appears in the published atlas as 52 Byzantium). The colors developed to differentiate single-period features stand out distinctly. Note that physical elevations are enhanced by incorporation of the TPC series shaded relief element. However, its incorporation in the next map at this scale to go into production (54 Epirus-Acarnania) proved far less satisfactory, because in this more mountainous region it overwhelmed the elevation tints and single-period colors. Consequently, after much fruitless experimentation, the decision was taken to drop the use of the shaded relief element throughout.

Marianne Moore's "Sea Unicorns and Land Unicorns": The "Unreal realities" of Early Modern Maps and Animals



Figure 1: Olaus Magnus's Scandinavia 1539. Facsimile (1996) of Olaus Magnus, Carta Marina, Venice, 1539. Colored facsimile, 67.3 x 86.4 cm (26 1/2 x 34 inches); the original map, created from nine woodcuts, is 4 x 5 1/2 feet. A tapestry of shapes, the Carta Marina is packed with the animals and peoples native to northwestern Europe. Courtesy of Wychwood Editions.



Figure 2: Detail from the Carta Marina showing the sea serpent (at *BD*, between the most northerly compass-rose and the whirlpool) and the sea unicorn south of Iceland (left, by the symbol for 73° north latitude). Courtesy of Wychwood Editions.



Figure 7: Peter Apian, the celestial map in his *Astronomicum Caesareum*, Ingolstadt, 1540. Hand-colored woodcuts: volvelle, 30.5 cm (12") in diameter; plate, 47 x 31.8 cm (18 1/2 x 12 1/2 inches). Pegasus appears among the other forty-seven constellations at 12 o'clock, below the sea monster Cetus and the oval scale used to determine stellar precession. Opposite Pegasus at 6 o'clock are the long-tailed bear (Arctus Major, i.e., the Big Dipper) and the lion (Leo), both familiar from Moore's poem. Missing from this copy of the celestial map are the silk thread and the seed pearl once attached at the end of the thread. The New York Public Library purchased Apian's celestial atlas in 1919, five years before Moore published "Sea Unicorns and Land Unicorns." Courtesy of the Rare Books Division of The New York Public Library--Astor, Lenox and Tilden Foundations: NYPL *KB+++ 1540.



Figure 8: Andreas Cellarius, *Haemisphaerium Stellatum Boreale cum Subiecto Haemisphaerio Terrestri* ("Northern hemisphere of stars with a terrestrial hemisphere below"), from his *Atlas Coelestis seu Harmonia Macrocosmica*, Amsterdam, 1660. Hand colored engraving on paper, 44 x 52 cm (17 x 20 1/2 inches). Monoceros appears at 6 o'clock, accompanied by *Canis Major* (below) and *Canis Minor* (above) and to the right of blue-caped Orion. This 1660 edition of Cellarius's atlas has belonged to the British Library since before 1757. Courtesy of the Map Library of The British Library: Maps C.6.c.2.