4-2000

Charting Neptune's Realm: From Classical Mythology to Satellite Imagery (Exhibit Guide)

Osher Map Library and Smith Center for Cartographic Education

CHARTING NEPTUNE'S REALM:

FROM CLASSICAL MYTHOLOGY TO SATELLITE IMAGERY

APRIL 4, 2000 TO JANUARY 11, 2001

OSHER MAP LIBRARY AND SMITH CENTER FOR CARTOGRAPHIC EDUCATION
usm.maine.edu/maps/exhibit8

University of Southern Maine

Introduction

For most people, the words "map" and "chart" are freely interchangeable. However, a distinction may be made between the two. The concern of landsmen is with the geographic characteristics within their realm—its rivers, mountains, forests, and swamps, along with cultural features of roads and towns—in order to grasp the nature and extent of the land and know how to move around within it. Maps provide that information. Oceans are considered merely as blank spaces separating the land-masses. The mariners' interest is the reverse; their primary domain is the ocean, and land is portrayed only to define the outer bounds of that region. Interest in land is confined to that thin strip containing harbors of refuge at the end of a voyage. Only those features of land visible from the sea, such as headlands and prominent features which enable one to identify correctly a landfall, are of importance. A chart, then, is a "mapping" of the ocean.

Everyone is familiar with maps and the information they contain, but few are aware of the nautical chart with its special characteristics and iconography. In the absence of land, one piece of water looks like any other, leading one to ask, "what is there that can be delineated on the vast, trackless ocean?" And, "how did this notation arise and develop?" The charts in this exhibit answer these questions.

Donald S. Johnson

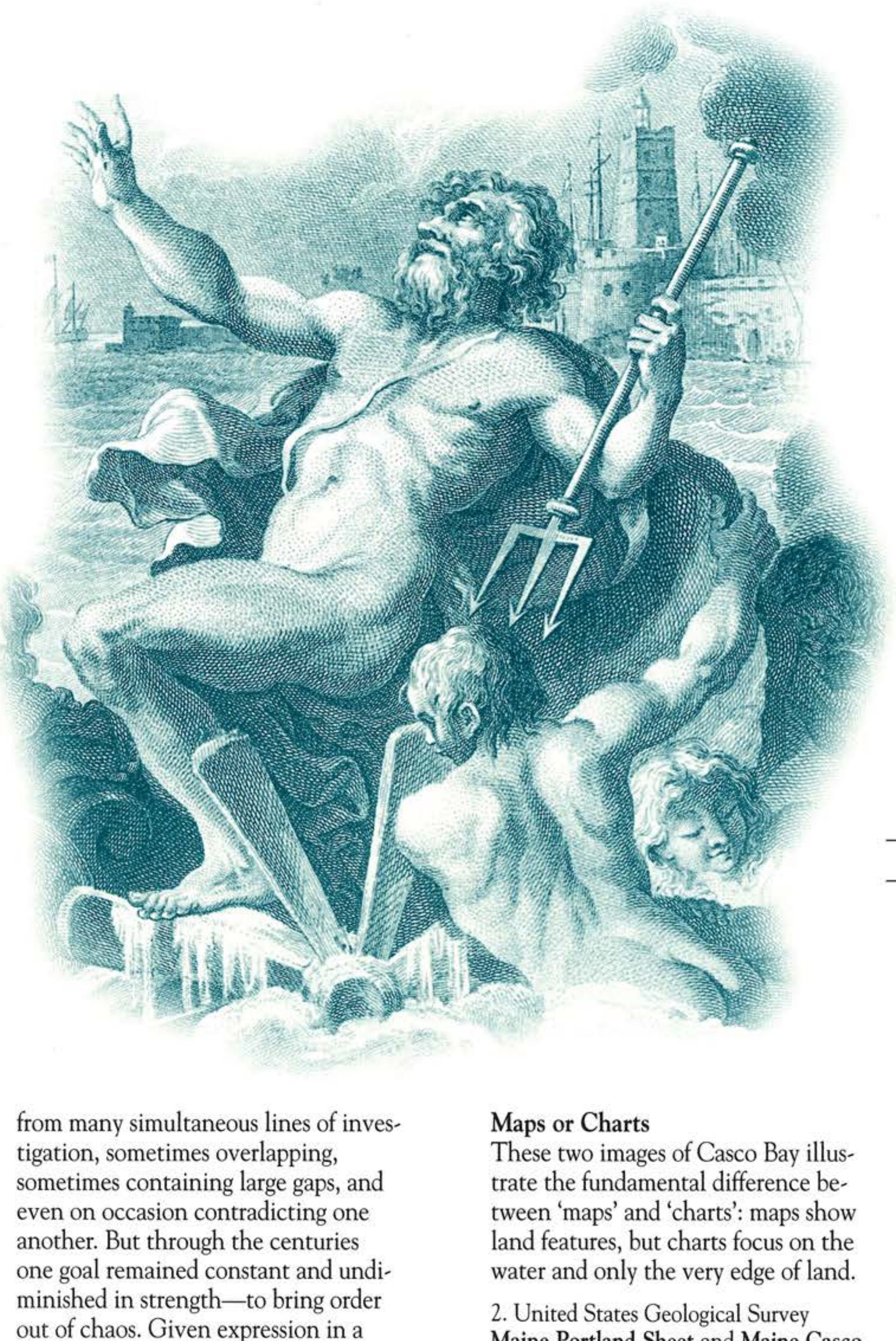
Acknowledgements

With *Charting Neptune's Realm*, the staff of the Osher Map Library has once again been privileged to work with a guest curator whose historical interests, combined with his sailing experience, provide a unique insight into the cartographic collections. We wish to epxress our deep gratitude to Donald S. Johnson, author of *Phantom Islands of the Atlantic* (1993), and *Charting the Sea of Darkness: The Four Voyages of Henry Hudson* (1994), for his sustained commitment and dedication to this exhibition over the past three years. Thanks also go to Beth Humphrey, head of the Art Department at Windham Middle School, and her students for the loan of their hand-built clay sculptures. Valuable assistance was given by Dr. Harold L. Osher, Professor Matthew Edney, and George Carhart. We also wish to thank the staff and student assistants of the Osher Map Library, in particular Tami Christopher, Tim Nason, Daryl Sasser, and Nell Blodget for their help, and Nancy Kandoian of the New York Public Library Map Division for her research assistance. This exhibition has also benefited from the professional assistance of the staffs of Media and Community Relations and the Publications and Marketing Departments of the University of Southern Maine. The technical assistance of Stuart Hunter and Jay York is also gratefully acknowledged. Lastly, we wish to acknowledge the Osher Library Associates and the W.P. Stewart Asset Management, Inc., whose generous gifts supported the publication of the exhibition checklist and poster.

Yolanda Theunissen
Curator, Osher Map Library and
Smith Center for Cartographic Education

Classical Mythology

1.François Boucher
French, 1703-1770
[frontispiece]
Copper engraving, 46.4cm x 30.5cm
From: *Le Neptune Oriental* (Paris: Jean Baptiste Nicolas Denis D'Après de Mannevillette Demonville, and Brest: Malassis, 1775)



Quos ego—Sed motos praestat componere fluctus . . . "But first—it is better to calm the turbulent seas." Sparing no time for words, Neptune, god of the deep, helper to those who voyage in ships across his domain, brought order to the motion of the waves. Then he spoke to Aeolus, king of the winds, who had unleashed the fury of the brawling winds and howling storms to overwhelm and sink the ships of Aeneas.

In the remote past—our legacy from Greco-Roman culture—gods and goddesses descended from their celestial realm to earth. There, they unloosed their heavenly powers and passions to control events. Scholars of antiquity balanced the mythic significance of these deities with their explanations of the phenomena of wind and wave. Their speculations, however, were based on philosophy and logic, rather than on physical and experimental proofs. Nonetheless, this tradition of theoretical geography continued well into the fourteenth century.

As mariners ventured beyond familiar coasts into the illimitable seas and oceans, they made discoveries and brought back observations of the earth's fluid envelope. Their newfound information could not be explained by the theories of the ancients, and required re-thinking into a body of knowledge we call science.

The collective experience of seafarers, when connected with advances made in the sciences of chemistry and physics, produced new interpretations of the world. This knowledge of the physical geography of the sea grew from many simultaneous lines of investigation, sometimes overlapping, sometimes containing large gaps, and even on occasion contradicting one another. But through the centuries one goal remained constant and undiminished in strength—to bring order out of chaos. Given expression in a cartographic form, these graphic images reveal more succinctly than the written word, and are grasped more quickly by the mind, man's search for and knowledge about the watery sector of our globe the ancients called Neptune's Realm.

Maps or Charts

These two images of Casco Bay illustrate the fundamental difference between 'maps' and 'charts': maps show land features, but charts focus on the water and only the very edge of land.

2. United States Geological Survey
Maine Portland Sheet and **Maine Casco Bay Sheet**
Lithograph, 44.5cm x 64.8cm
Washington, DC: United States Geological Survey, 1889/1893/1909/1910

3. United States Coast and Geodetic Survey
Casco Bay Maine
Electrotype, 62.7cm x 98.6cm
Washington, DC: United States Coast and Geodetic Survey, 1870/1896/1905

Where the Winds Blow

King Aeolus, lord of wind and cloud, ruler of contending winds and moaning gales, controlled their fury lest they flay the sea into a great uproar. So great was his power that Agamemnon, leader of the Greek expedition to destroy Troy, sacrificed his daughter Iphigeneia to secure a favorable wind for his voyage across the sea.

Winds, and the place from which they blew, were the earliest means of dividing the horizon into named parts in order to express direction. The ancients used various forms of wind systems: Homer described four winds, consisting of the four cardinal points we now call north, south, east, and west; Pliny and Poseidonius recognized eight winds; whereas Aristotle enumerated twelve winds.

Mediterranean mariners named winds after the lands from which they originated, such as Greco (from Greece) to designate the northeast, or Africus for southwest. Other directions were named after the gods who reigned in that region. Astronomical positions, as well, were used to indicate wind direction. Septentrio designated north, since that wind blew in from the direction of the seven stars in the constellation of Ursa Major—the north pointing big dipper. Sunset and sunrise at the summer and winter solstices filled in the intermediate points between the four cardinal directions, corresponding roughly to northeast, southeast, southwest, and northwest. Some wind names had no set bearing, but were identified and personified according to the weather they brought with them.

As if this nomenclature weren't complicated enough, different names often indicated the same direction, or the same name for different directions. In Roman usage, Boreas reigned in the north; whereas to the Greeks, Boreas' realm was in the northeast. Septentrio Tramontana, Hyperboreas, or Aquilo were all interchangeable for north.

4. Gregor Reisch
German, ca. 1470-1525
[untitled map of the ecumene]
Wood-cut, 27.9cm x 40.5cm
From: *Margarita Philosophica* (Strassburg Johan Grüniger, 1504)

5. Sebastian Münster
German, 1489-1552
Typvs Vniversalis
Wood-cut, hand-colored, 25.5cm x 34.4cm
From: *Geographia vniversalis, vetvs et nova, complectens Clavdii Ptolemaei Alexandrini enarratio. Nis libros VIII.* (Basle: Hinrich Petri, 1540/42)

6. Jan Jansson
Dutch, 1588-1664
Tabular Anemographica Seu Pyxis Nautica
Copper engraving, hand-colored, 43.3cm x 54.2cm
From: *Ianssonii Novus Atlas, sive Theatrum Orbis Terrarum*, vol. 5 (Amsterdam: Jansson Heirs, 1650/ca. 1680)

7. Edward Wright
English, 1558-1615
Plat of All The World
Copper engraving, 52.7cm x 77.8cm
From: *Certaine Errors in Navigation* (London: Joseph Moxon, 1655/1657)

8. John Thornton
English, 1641-1708
Samuel Thornton
English, d. 1715
New and Correct Map of the World
Copper engraving, hand-colored, 52cm x 87cm
From: [*English Pilot*] (London: Mount & Page, ca. 1700/after 1708)

9. Hermann Moll
English, d. 1732
A View of the General Trade-Winds, Monsoons or Shifting-Winds
Copper engraving, 18.1cm x 50.7cm
London, 1736

The Enigma of Currents

In the sixteenth and well into the seventeenth century, the course of ocean currents was virtually unknown. But as European ships left the familiar shores of continental Europe and their trade routes in the Mediterranean to venture out into the Atlantic Ocean, they encountered great rivers within the sea—the ocean currents. With an ever increasing number of expeditions to discover new lands and a sea route to the East Indies, mariners slowly accumulated new knowledge of these currents.

Gradually, general patterns began to emerge. The Portuguese, in sailing toward the East Indies, kept away from the westward setting Agulhas current off *Cabo bone sperance* (Cape of Good Hope) by sailing a hundred or a hundred and fifty leagues south of the Cape. On the return trip they made use of this same current to speed their passage by sailing close to the Cape. When they entered the northern Atlantic, mariners avoided the contrary setting Canary Current, and the Northeast Tradewinds, by making a wide sweep to the northwest until halfway to America, before setting a final course homeward.

The Spanish also gained knowledge of this invisible mover of ships—the great clockwise gyre of water in the North Atlantic. On their way to the West Indies, Spanish ships sailed south past the Canary Islands, then turned west to take advantage of the westward flowing North Equatorial Current. Returning, they sailed north with the Florida Current (between the Bahamas and Florida) to higher latitudes, then headed homeward. Christopher Columbus followed this route on his voyages, but he attributed the favorable eastward set of the Gulf Stream to the effect of tides, rather than recognizing it as part of the continuous circle of current in the North Atlantic.

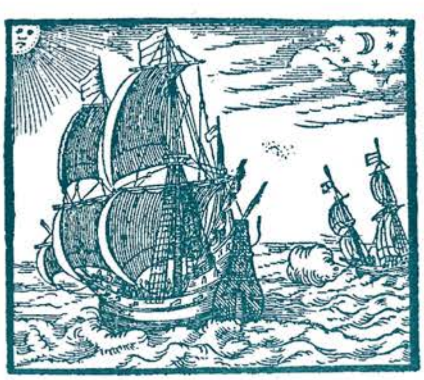
10. Carington Bowles
English, 1724-1793
A New Chart of the Vast Atlantic or Western Ocean
Copper engraving, hand-colored, 44.7cm x 55.1cm
London, 1762

11. Benjamin Franklin
American, 1706-1790
A Chart of the Gulf Stream
Copper engraving, 20.7cm x 25.5cm
In: *American Philosophical Society Transactions*, vol. 2 (Philadelphia: Robert Atkien, 1786)

12. John Elliott Pillsbury, Lieutenant U. S. Navy, later Rear Admiral
American, 1846-1919
Chart of the Gulf Stream
Lithograph, 44.8cm x 34.2cm
In: United States Coast and Geodetic Survey, *The Gulf Stream: Methods of the Investigation and Results of the Research* (Washington: Government Printing Office, 1890)

12a. Jenifer Clark
Jenifer Clark's Gulfstream
6/11/97
http://users.erols.com/gulfstrm/

12b. Rosentiel School of Marine Atmospheric Science
East Coast Direct Broadcast
SST Image Daily Composite
University of Miami
www.rsmas.miami.edu



Depths

During the great Age of Discovery, as mariners began to traverse the Atlantic and were beyond the sight of land, many fears beset them.

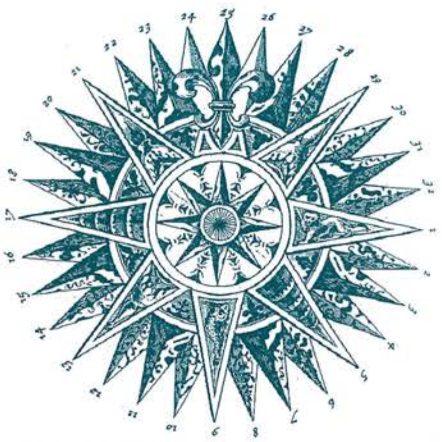
But the dangers uppermost in sailors' minds were the hidden rocks and uncharted reefs that, with seeming malice, lay in wait to destroy their frail vessels. The approach to land was always filled with apprehension, and a careful watch was kept to avoid any peril. Lest they should run aground, depths were determined by tossing a line weighted with lead, forward of the ship. Markings on the line in fathoms (one fathom = six feet) enabled the navigator to know whether or not it was safe to proceed farther on the present course. These soundings were carefully noted and marked on charts to aid future navigators.

13. Cyprian Southack
English, 1662-1745
M. Sartine
French, fl. 1769-1780
Plan de la Baie et du Havre de Casco
Copper engraving, 41.0cm x 58.1cm
From: *Neptune Americo-Septentrional* (Paris: Dépôt Général de la Marine, 1779)

14. John Anderson, Lt. Col. U. S. Army Engineers
B. Pool, Lieut. U. S. Army Artillery
Map of Portland Harbor . . . 1833
Lithograph, 45.8cm x 51cm
From: ***Report of the Survey of Stanford's Ledge, Portland Harbor, Maine, 1832,*** Congressional Series 259 (23rd Congress, 1st Session), House Document 491 (Washington, DC: Government Printing Office, 1834).

15. John Thornton
English, 1641-1708
William Fisher
English, fl.1669-1691
Part of New England
Copper engraving, 42.4cm x 47.1cm
From: *The English Pilot. The Fourth Book* (London, 1689)

16. Charles Wilkes, Lieutenant U. S. Navy, later Rear Admiral
American, 1798-1877
Chart of Georges Shoal & Bank
Copper engraving, 99.1cm x 111.1cm
Washington DC: The Navy Commissioners, 1837



The Compass

North Seeking–but Never Finding

In navigating long distances, the compass was as important an instrument for indicating direction as the sandglass was for marking time. The compass was developed in China around AD 1100, and independently in northern Europe shortly thereafter. By the end of the twelfth century the compass was used for navigation by mariners in the Mediterranean.

As long as voyages in the Atlantic were confined to routes along the west coasts of Africa and Europe, the compass served mariners well in guiding their course. But when they began to venture west across the ocean, it no longer seemed to read correctly. Until then, everyone believed that "magnetic north" coincided with "true north" at the geographical pole. They soon found out this was not so. Not only did the two norths not coincide, but the difference between them increased the farther west and north they sailed. In northern waters east of Ireland, the change was in the opposite direction. The closer one approaches the magnetic north pole, the greater is the amount of difference between the two norths. This discrepancy between magnetic north and geographic north is called "magnetic variation," and it varies in different parts of the world according to regional influences. Furthermore, it changes over time in a given region.

Until the mid-sixteenth century, mariners were unaware of this variation; consequently, as they sailed west they found their position did not correspond with their location according to the charts. If a navigator departed England and followed his compass due west, his course would take him on a gradual curve south; instead of arriving in Newfoundland as intended, the landfall would be somewhere along the mid-Atlantic coast of the United States.

17. Edmund Halley
English, 1656-1742
A New and Correct Chart Shewing the Variations of the Compass
Copper engraving, hand-colored,
58.5cm x 49 cm
From: *The English Pilot. The Fourth Book*
(London, Mount & Page, 1701/1720)

18: U. K., H. M. Admiralty Hydrogaphic Office
America East Coast / Portland Harbor From The United States Coast Survey Published in 1854
Steel engraving, 63.5cm x 47.9cm
London: J. D. Potter, 1857

An Ocean Divided

To make open ocean voyages, the navigator had to know his exact position at sea, and, its corollary, be able to return whence he started in order to bring back information about his discoveries. As voyaging increased into the uncharted regions, the mariner brought back his findings to be added in written records and represented on maps.

To create accurate charts, cartographers needed more than recounted tales and estimated distances. It became apparent that a grid system dividing the earth into coordinates of latitude and longitude was necessary.

19. Charles Pierre Claret de Fleurieu
French, 1738-1810
A New General Chart of the Atlantic or Western Ocean and Adjacent Seas
Copper engraving, 49.1cm x 69.9cm
London: Sayer and Bennet, 1777

20. Vincenzo Coronelli
Venetian, 1650-1718
Mare Del Nord
Copper engraving, hand-colored,
44.9cm x 59.9cm
Venice, 1690

21. Jacques Bellin
French, 1703-1772
Carte Reduite des Costes Orientales de L'Amerique Septentrionale
Copper engraving, 54.6cm x 88.6cm
Paris: Department de la Marine, 1757

22. John Seller
English, d.1697
A Chart of the Coast of America
Copper engraving, hand-colored,
42.2 x 54cm
London, 1675

23. Antonio de Herrera y Tordesillas
Spanish, 1559-1625
Descripción de las Yndias Ocidentalis
Copper engraving, 22.5cm x 31.8cm
From: Descripción de las Yndias Ocidentalis (Spain, 1622)

Navigation

The most basic method used by the navigator to plot the course on a chart is called "deduced" (or "dead") reckoning. Continuous records were made of the direction traveled, provided by the magnetic compass. Distance was determined by multiplying the estimated speed by the elapsed time (measured using a sand-glass). The course was calculated hourly. When conditions were right for taking celestial sightings, the dead reckoning course was updated and corrected.

Another method is known as "latitude sailing" or "running down your easting (or westing)." Once the navigator reached the latitude of his destination, which he determined by sightings of a celestial body (Sun or the Pole Star), he maintained his course on that latitude by sailing due east or west. Latitude sailing enabled the mariner to reach his objective without having to know the longitude.

With a grid pattern to mark their positions on the surface of the earth, and the means to plot a course, mariners confidently moved across the trackless, open ocean.

Celestial navigation—determining one's position from observations of the sun or stars—provided greater flexibility. To the end of the fifteenth century, the celestial body most often used was Polaris, the North Star, for this was the easiest to use and required no tables of declination. At first, only the meridian altitude of Polaris was used—that point when it reached its zenith in the sky. Later, navigators were able to use Polaris at any time of the night without having to wait for it to reach its zenith. By the end of the fifteenth century, mariners could use astronomical tables to determine their latitude position from the sun as well as from the stars. And finally, with the development of the marine chronometer in 1761, navigators could also determine longitude.

24. Willem Janszoon Blaeu
Dutch, 1571-1638
[Illustrations]
Woodcuts
From: Le Flambeav de la Navigation, (Amsterdam, 1619)

Compass

By the fourteenth century, the eight primary points of the compass were subdivided into sixteen and then thirty-two points; each point equally spaced at 11° 15'. By the end of the sixteenth century, compass cards carried a dual system of points and degrees. Any good sailor could "box the compass," giving the name of each point in turn: north, north by east, north northeast, northeast by north, etc., until all thirty-two points were covered. This arrangement of compass points remained until the first half of the twentieth century when it was replaced with the degrees of a circle.

25. Stanley London Brass Compass
White Star Line Gimbaled Boxed Compass
Brass and Wood 16cm.
Modern Replica

Sand-glass

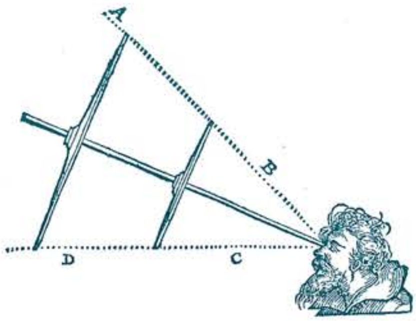
In navigating long distances across the open ocean, the sand-glass was as important an instrument for making time as the compass for showing direction. Filled with the amount of sand to measure a half hour of time, each emptying of the sand was called a "glass," and eight glasses (four hours) made up one "watch." The compass and sand-glass, along with a chip-log to measure speed, enabled the navigator to plot his ship's position on a chart. Speed times gave the distance, and the compass showed the direction of the course sailed. This simple method of navigation is called dead-reckoning, short for deduced reckoning.

26. Authentic Models, Inc
French Admiralty Glass ca. 1800
Brass and Glass
Modern Replica

Astrolabe

In the Middle Ages, the instrument used for measuring the angular height of a celestial body above the horizon was the planispheric astrolabe. This instrument was modified to one more suitable for "taking the height" while at sea—the nautical astrolabe. Consisting of a perforated disc made of bronze or brass, which gave it weight, the astrolabe was suspended from a ring at the top. Affixed to the center of the disc was a sighting bar called the alidade, which could be turned in a complete circle. The navigator aimed the alidade at the heavenly body, either the sun during the day or the pole star at night, aligning it by sighting through holes or notches in plates at each end. He read the altitude in degrees directly off a scale inscribed around the circumference of the disc.

27. Anonymous
Mariners Astrolabe
Brass
Modern replica



Cross-staff

The cross-staff, originating sometime in the thirteenth or early part of the fourteenth century, was used for taking readings of the altitude of a celestial body. The ultimate in simplicity, it was but a long stick with a movable cross-bar called the trans-versary. The navigator aimed the lower point of the cross-bar at the horizon and moved the cross-bar until its upper tip touched the celestial body; then he read the altitude on the scale inscribed along the length of the staff.

28. Harriet Wynter Ltd
English, 20th Century
Cross Staff
Rosewood and Cherry
Modern replica

Back-staff

Essentially, the back-staff was a modification of the cross-staff, having a sliding half-transom in the form of an arc, and a horizon vane at its proximal end. Instead of looking directly at the sun, the observer turned his back toward the sun (hence the name back-staff) and moved a cross-piece along the arc. When the shadow cast by the sun was aligned with the horizon on the horizon vane, a reading was taken off a scale.

29. William Hart
American, 1734-1812
Backstaff
Rosewood, Walnut, and Mahogany
Portsmouth, NH, 1767

Octant

Invented in 1731, the octant (also known as the Hadley quadrant) was the most accurate angle finding instrument yet devised and became a popular tool of the navigator far into the nineteenth century, both for determining latitude and for coastal surveying.

30. Anonymous
Octant (Hadley's Quadrant)
Rosewood with ivory scales and brass fittings
46.4cm
English, ca. 1780

31. Joseph Moxon
English, 1627-1691
The Use of a Mathematical Instrument Called a Quadrant
15.2 x 9.9cm
London, James Moxon or Heirs, 1708

Astronomical Tables

As early as the eighth century, the Arabian geographer Msha'allah described how to determine latitude from the meridian altitude and declination of the sun. By the late fifteenth century, the daily declination of the sun had been recorded on simplified solar tables derived from these early works.

32. John Henry Amshewitz, RBA
British/South African, 1882-1942
Vasco da Gama Leaving Portugal
Mural
Photograph courtesy of the Archives of the University of the Witwatersrand, Johannesburg

33. Abraham Ben Samuel Zacuto
Sephardic Jew, ca.1452-1515
[tables of declination of the sun]
Manuscript
From: *Ha- Hibbur ha-Gadol,*
(Salamanca, 1491)
Photograph courtesy of the Library of the Jewish Theological Seminary

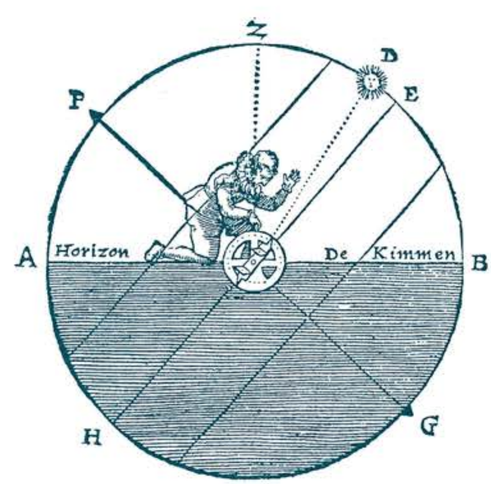
34. Samuel Lambert
American, fl. 1820
Information useful for navigation
31.7 x 22cm
Salem, MA: T.C. Cushing, 1820

Profiles

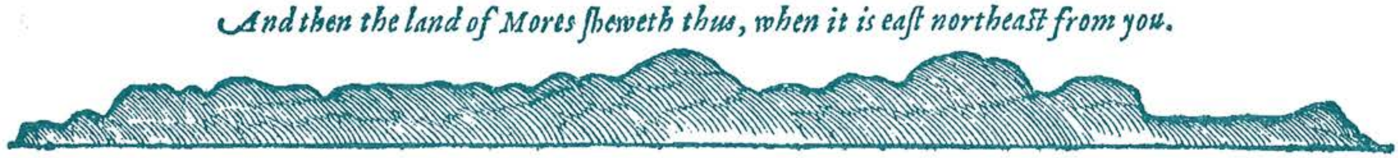
Bird's-eye views of land on nautical charts in pilot books were often accompanied by horizon profiles of the coast. These small scenes depicted the land as a mariner would see it when approaching from seaward, aiding him in identification to assure a proper landfall. In the centuries following their introduction they were sometimes elevated to exquisitely rendered works of art, far surpassing in aesthetic appeal their original function.

35. **Mount Desart Hills**
Wood cut, 1.5cm x 20.0cm
From: *The English Pilot, Fourth Book*
(London: W. and J. Mount, T. Page, and Son, 1760)
Facsimile

36. Joseph F. W. DesBarres
Swiss/English, ca. 1729-1827
[untitled view of Wolves Islands, Passamaquoddy Bay]
Copper engraving, hand-colored, 9.2cm x 71.3cm
From: The Atlantic Neptune
(London, 1781)
Reduced facsimile



And then the land of Mores ſheweth thus, when it is eaſt northeaſt from you.



Transitory Features

Contrary to what one might expect after centuries of exploration, the charting of Neptune's Realm is not complete. It is still an ongoing process; indeed, there is an explosion in the amount and kind of new information now available. Up until the mid-1970s there was a delay of weeks, if not months, for the data acquired by mariners to reach cartographers. Then, more time was needed to collate the material, engrave new plates, print, and finally dispense charts to the waiting public.

Now, satellites commonly circle our globe, taking photographs and measuring many of the ocean's characteristics with special sensors. Much of this material is then organized and transformed by computer. Data that at one time was too transitory in nature to be disseminated in a timely fashion is instantly accessible electronically. Commercial shippers, commercial fishermen, research scientists, and recreational sailors all benefit from this new era in marine cartography.

Sea Surface Temperature

Throughout the centuries, mariners have used their knowledge of the ocean currents to plan speedy voyages. This body of knowledge grew slowly; dependent on many voyages over the years before general patterns were discerned. Today, government agencies continuously moniter all the major cold water and warm water currents of the ocean with great accuracy. Each meander and eddy of the Gulf Stream is mapped almost as quickly as it develops. The procedure for defining these currents is no different than that used by Benjamin Franklin—differences in water temperature are measured.

Today, however, instead of a thermometer being placed in the ocean to record temperature (as Franklin used), satellite infrared imagery and altimetry, combined with color enhancement by computer, measure and display the currents' location. A wealth of data on sea surface temperature is now available to oceanographers and marine biologists. Commercial fishermen, as well, have a vital interest in the unceasing shift of warm and cold water currents. Cold water is more nutrient rich, sustaining greater populations of phytoplankton and zooplankton. These microscopic plants and animals are at the base of a long food chain for all of life in the seas.

T1. Johns Hopkins University
Space Oceanography Group
Applied Physics Laboratory
http://www.jhuapl.edu/weather/

T2. National Oceanic and Atmospheric Administration (NOAA)
Water Temperature Chart: N.E. Atlantic Coast, 6 June 1987
http://www.noaa.gov

T3. Canada Space Agency's Center for Remote Sensing
Sea Surface Temperature, 13 January 1999
http://ingrid.ldgo.columbia.edu/SOURCES/IGOSS/nmc/climatology/sst/

T4. Canada Space Agency's Center for Remote Sensing
Sea Surface Temperature, 13 January 1999
http://ingrid.ldgo.columbia.edu/SOURCES/IGOSS/nmc/climatology/sst/

T5. NOAA Coastwatch Northeast Node
Gulf of Maine Sea Surface Temperature, Thumbnails, 5 August 1999
http://rossby.sr.unh.edu/test/thumbnails/aug99/aug05.html

T5a. NOAA Coastwatch Northeast Node
Gulf of Maine Sea Surface Temperature, Thumbnails, 5 August 1999
http://rossby.sr.unh.edu/datasets/sst/1999/aug/aug05g08.gif

El Niño/La Niña

The importance of changes in sea surface temperature was dramatically thrust into general public awareness by the 1997-1998 *El Niño* phenomenon. Oscillations in the locus of normal water temperatures in the equatorial Pacific, along with attendant changes in sea level height and wind patterns, are normal occurrences. Periodically, these changes become exaggerated; when they do they result in the condition called *El Niño*, characterized by unusually warm temperatures along the west coast of South America at the equator, and its corollary, *La Niña*, with abnormally cold temperatures there. When these anomalous conditions occur, climate systems around the entire globe are affected. In some areas the result is excessive rainfall with destructive flooding, in others, severe drought and extensive forest fires. Commercial fishermen are also affected. Higher water temperatures reduce the supply of nutrients, which in turn adversely affect marine ecosystems and fish populations.

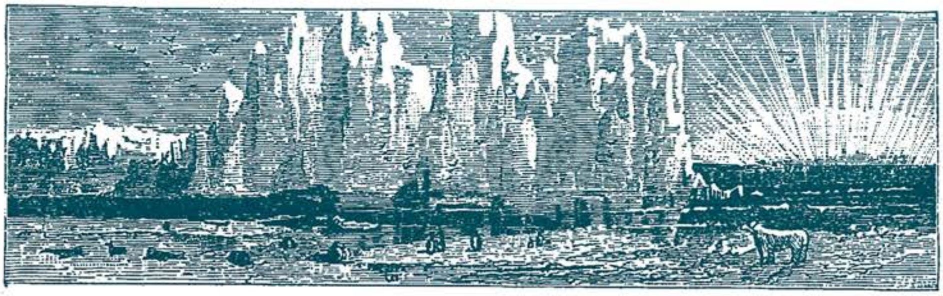
T6. El Niño/La Niña Watch
Measuring the Ocean's Height and Temperature
http://www.jpl.nasa.gov.elnino/
Image provided by TOPEX/Poseidon
Courtesy of NASA/JPL/California Institute of Technology

T6a. El Niño/La Niña Watch
Measuring the Ocean's Height and Temperature
http://www.jpl.nasa.gov/elnino/
Image provided by TOPEX/Poseidon
Courtesy of NASA/JPL/California Institute of Technology

T7. Institute of Global Environment and Society
Center for Ocean-Land-Atmosphere Studies/(COLA)
Sea Surface Temperatures
http://grads.iges.org/cola.html

T8. NOAA, TAO Project
Tropical Atmosphere Ocean (TAO)
Sea Surface Temperature and Winds
http://www.pmel.noaa.gov/toga-tao/home.html

T9. University of Wisconsin at Madison
Ice Sea Surface synoptic OBS
http://ftp:ssec.wisc.edu/gopher/gsdc



Scene in the Arctic Region.

Icebergs

Every spring, icebergs calve off the Greenland glacier and drift into the Labrador Sea where they are carried south along the coast of Labrador and Newfoundland by the Labrador Current. When they reach southeast Newfoundland their path splits to either side of the Grand Banks. At this point they are far enough south to pose a serious threat to trans-oceanic shipping. Environment Canada Ice Centre, in conjunction with the U.S. Coast Guard International Ice Patrol, issues daily bulletins of the distribution and limits of icebergs between latitudes 40°N and 52°N, and longitudes 39°W and 57°W. Ships transiting this region report all sightings of icebergs, sea surface temperature, and weather. This information, along with satellite observations, is used to produce charts of iceberg locations.

Radar is an unreliable means of detecting icebergs. Since they are composed of water, albeit in a solid state, radar signals tend to pass right through icebergs, rather than reflecting off them. With varying degrees of clarity, radar will pick up icebergs only if their surfaces are particularly corrugated or rough, or if large amounts of gravel are embedded in them.

T10. USCG, International Ice Patrol
Analysis for 1200UTC, 06 March 1998
http://www.uscg.mil/lantarea/iip/home.html

T11. Vector Plot of IIP Mean Currents (1977-1996)
International Ice Patrol
http://www.uscg.mil/lantarea/iip/home.html

T12. USCG, International Ice Patrol
Historical Currents Grid/Current Plot
http://www.uscg.mil/lantarea/iip/home.html

T13. USCG, International Ice Patrol
Contour Plot of IIP Historical Buoy Database Observation (1977-1996)
http://www.uscg.mil/lantarea/iip/home.html

Wind and Wave

The earth's seasons are produced by its annual orbit around the sun, while the rotation of the earth on its axis is responsible for the alternation of night and day; both influence wind regimes of the earth. Within the major general flow of air about the planet are numerous smaller masses of air, all in constant motion, both horizontally and vertically. This flow, at the same time, creates changes in pressure, with concomitant low pressure and high pressure cells.

Everything is in motion, everything is flowing, trying to reach some state of equilibrium. Wind, pressure, temperature, and the amount of moisture in the air, are all interrelated and part of one large cyclical pattern. To understand that basic pattern is to understand its variations, which, in turn, is to understand weather.

T14. Oceanweather Inc
Significant Wave Height and Directions
http://www.oceanweather.com/data

T15. Oceanweather Inc.
Significant Wave Height and Directions
http://www.oceanweather.com/data

T15alt. NOAA National Hurricane Center
Hurricanes of the 1996 Season Tracking Chart
http://www.nhc.gov/1996.html

Atlantic Tropical Cyclones

Tropical cyclones, more commonly called hurricanes, are the ultimate winds with which mariners in the North Atlantic must contend. Spawned in the warm equatorial waters, most often near the coast of Africa, they begin as weather disturbances—thunderstorms and strong surface winds. Fed by latent heat released from the water vapor, they are given a spin by the Coriolis force,* and when other conditions are proper they increase in strength. When the winds in these storms reach a constant speed of 74 miles per hour or more, they are termed hurricanes; their greatest wind speed can be too high to be recorded. Pushed westward by the flow of upper atmosphere winds (10-40,000 feet) cyclones eventually die out when they reach land, or when their paths take them into the colder waters of the North Atlantic, where they are robbed of their warm-water source of energy. Hurricanes at sea have the power to destroy any vessel unfortunate enough to come within their range; upon mainland coasts and islands, they leave a path of destruction and death.

During the time of early exploration and colonization in the New World, hurricanes have been responsible for events that changed the emerging balance of power. Had the ability existed then to chart hurricanes and predict their path, France, instead of Spain, might have controlled the southeast coast of North America. In 1564, French Huguenots established Fort Caroline, near present-day Jacksonville, Florida—the first European settlement on the mainland of North America. Without warning, in September of the following year, a hurricane dispersed France's fleet and destroyed most of its vessels.

**The Coriolis force is the deflection of a moving body relative to the earth's surface, produced by the earth's rotation. This causes winds in the northern hemisphere to be deflected to the right. This accounts for direction in circulation for both water and major air currents.*

This enabled the Spanish fleet, under command of Pedro Menedez de Avila, to capture Fort Caroline. And in 1640 a Dutch fleet would have survived to attack Havana, as originally planned, and Cuba would not have been relinquished to the Spaniards. The seventeen ships, with 2,000 troops of Lord Willoughby (Governor of Barbados) was almost totally lost to a hurricane in 1666, allowing the control of Guadeloupe to be taken by the French.

T16. Atlantic Hurricane Satellite Imagery title, 26 August 1996
http://www.intellicast.com

T17. National Hurricane Center
Edouard Advisory #43, 1 September 1996
http://www.nhc.noaa.gov/ftp/graphics/at05/al0596w.gif

T18. NOAA, National Hurricane Center Advisory #43, 1 September 1996 6:38:06: Probability that center of Edouard will pass within 75 statute miles during the 72 hours starting at 5AM EDT Sun Sept 1 1996
http://www.nhc.noaa.gov/ftp/graphics/at05/al0596p.gif

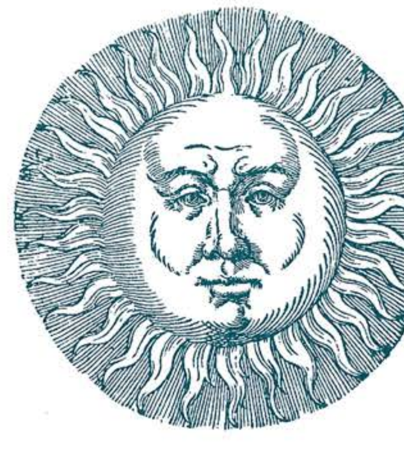
T18a. NOAA, National Hurricane Center
Tropical Storm Dennis Warning
http://www.nhc.noaa.gov/1999.html

T18b. University of Hawaii - Manoa/SOEST
Satellite Image of Tropical Storm Dennis
http://lumahai.soest.hawaii.edu/

T18c. Environment Canada
Hurricane Edouard, 1 September 1996
http://www.ns.ec.gc.ca/images/photos/3hrgi.jpg

T19. NOAA
Hurricane Mitch, 26 October 1998
http://www.noaa.gov

T20. Hurricane Mitch
Roy Sterner and Steve Babin, Johns Hopkins University Applied Physics Laboratory
http://www.jhuapl.edu/weather/



Global Weather

This composite global view (T22) of temperature, visible cloud, and water vapor was produced by the University of Hawaii at Manoa, Department of Meteorology. Using infrared photographs received from a GOES satellite, the image is color enhanced to clearly distinguish temperatures of various features. Compare the colors of mid-range temperatures here, with those in the center of Hurricane Dennis on chart T18b; in the center of Dennis, temperatures are in the 167° to 176° Fahrenheit range.

T21. Global View Temperature
21 January 1999
University of Hawaii-Manoa
Department of Meteorology
http://lumahai.soest.hawaii.edu/

T22. Global Weather Chart
University of Hawaii-Manoa
Department of Meteorology
http://lumahai.soest.hawaii.edu/

T23. Global Weather Chart
University of Hawaii-Manoa Department of Meteorology
http://lumahai.soest.hawaii.edu/

THE OSHER MAP LIBRARY AND THE SMITH CENTER FOR CARTOGRAPHIC EDUCATION AT THE UNIVERSITY OF SOUTHERN MAINE

The Osher Map Library and Smith Center for Cartographic Education is the only separately established rare map library in northern New England. The cartographic collections comprise fine examples of original maps, atlases, geographies, and globes spanning the years from 1475 to the present. They constitute a rich and multifaceted resource for the study and teaching of a number of subjects, especially geography, history, and art. These materials offer such compelling insights that anyone, regardless of age or educational level, can enjoy and learn from them. For the University, the people of Maine, scholars, students, and visitors, the collections are indeed a treasure.

The Collections

The cartographic collections were formed from two major gifts, the first from the late Lawrence M. C. and Eleanor Houston Smith, and the second from Dr. Harold L. and Mrs. Peggy L. Osher. Other generous gifts from several individual donors, notably Professor Peter H. Enggass and Tony Naden, have substantially augmented the collections. The combined collections contain approximately 30,000 maps, as separate sheets or bound in books and atlases. These books include works on cosmography, astronomy, and navigation, as well as geography and cartography. While the collections possess a global scope, they emphasize the discovery, exploration, and mapping of North America. The original materials are supplemented by many facsimile maps and atlases in reprint editions, together with a reference collection containing monographs and journals on the history of cartography, cartobibliographies, regional histories, and exhibition catalogs.

The Mission

As an integral part of a comprehensive urban university, the Osher Map Library is committed to sharing its collection with a broad constituency by means of exhibitions, publications, lectures, conferences, and other special events. It encourages collaborative efforts with other institutions including museums, historical societies, and teaching institutions ranging from primary schools to the university level. It serves the University community and residents of Maine and northern New England, including the general public and local school systems. Indeed, by means of its Internet web site, it serves the global community of scholars and researchers.

The Facilities

The Osher Map Library is located on the ground floor of the Glickman Family Library on the Portland campus of the University of Southern Maine. In addition to the collections and reference materials, the Osher Map Library contains exhibition areas, a seminar room, and facilities for research and study. The Osher Map Library provides access to its resources to the general public and scholars alike.

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http://www.usm.maine.edu/maps

University of Southern Maine