tage of Polynesia." Libyan inscriptions, according to Fell, were found in New Zealand "as late as 1450 A.D."

South America claimed for Ptolemy III

At the Harvard seminar where Fell initially presented his translations, in November 1974, it was concluded that the voyage of Rata and Maui would probably follow a great circle route, according to Eratosthenes' plan. Therefore, it could be expected that the expedition would land on the West Coast of America in 231 or 230 B.C., and that there would be similar inscriptions in American caves. It was thought that the flotilla would probably land around Panama or Baja California, and that the ships would then go both north and south to find a seaway through the land mass.

Learning of the November seminar, geographer George F. Carter, Sr., a professor at Texas A&M University with an interest in ancient inscriptions, recalled a cave inscription that he had copied down from a German-language scientific journal published in Chile, which he found at the Johns Hopkins University Library in Baltimore, in the 1950s, when he was teaching in the geography department there. The inscription was copied in 1885 by Karl Stolp, who had taken shelter in a cave near Santiago during a storm. Carter thought the script was similar to the Polynesian inscriptions. He was right: As Fell was able to translate it, the Santiago inscription gave the date as the "regnal year 16," which would have been 231 B.C., and also had Maui's name:

"Southern limit of the coast reached by Maui. This region is the southern limit of the mountainous land the commander claims, by written proclamation, in this land exulting. To this southern limit he steered the flotilla of ships. This land the navigator claims for the King of Egypt, for his Queen, and for their noble son, running a course of 4,000 miles, steep, mighty, mountainous, on high uplifted. August, day 5, regnal year 16."

The navigators of the Golden Renaissance

by Timothy Rush

The same connection between fundamental Platonic scientific method, and great voyages of discovery to prove the efficacy of that method, which blazed forth in the Eratosthenes-Rata-Maui enterprise, precisely characterized the revival of such voyages in 15th-century Europe.

The pivot point of the revival and further advance of Platonic scientific method in the period was centered in the collaboration of two intimate friends: Cardinal Nicolaus of Cusa (1401-64), and the astronomer, mathematician, and geographer Paolo dal Pozzo Toscanelli (1394?-1482). Their work was installed as the central thrust of European Renaissance statecraft at the great Council of Florence (1438-41). Eratosthenes' work was studied as a crucial feature of this revival.

Prince Henry the Navigator (1394-1460) of Portugal had already begun a systematic project to re-discover deep-sea sailing methods, as of 1415. This became known as Henry's "Atlantic Enterprise," and was centered in Sagres, at Portugal's extreme southwest promontory. By the time of his death, in 1460, his caravels had reached the tropics in equatorial Africa, and (re)-discovered key way stations in the Atlantic: Madeira, the Azores, and the Cape Verde Islands. After his death, Henry's project continued, and provided the foundation for the voyages of the next generation: Diaz, Columbus, and Da Gama.

Here are the crucial connections:

• The personal representative of the Portuguese royal house in Florence for the period 1415-40 was an abbot of the Camaldolese Order, Dom Gomes Ferreira da Silva. Dom Gomes was an intimate of Toscanelli and of the chief organizer of the Council of Florence, Ambrogio Traversari. In 1428, he arranged the meetings of Henry the Navigator's brother, Prince Pedro, with Traversari and Toscanelli in Florence, from which Pedro returned to Portugal with an archive of the Florentine scientific re-discoveries. From 1436-39, Dom Gomes served as the Traversari's "right-hand man" in arranging the Council of Florence; and upon Traversari's death, a few months later, Dom Gomes assumed Traversari's position as head of the Order. Gomes then returned to Portugal to supervise personally the implementation of the Council of Florence directives in Portugal.

• Dom Gomes's successor was Canon Fernão Martins of Lisbon. Spending large portions of time as a churchman in Italy, he assumed duties as confessor to King Afonso V of Portugal. Cusa's esteem for Martins was such that he put Martins as one of the four interlocutors in the last of his dialogue masterpieces, *De Non Aliud* (On the Not-Other). (Martins was referred to in the manuscript as Ferdinando Martin Portugaliensi Natione.) At Cusa's death a year later, in 1464, Fernão Martins and Toscanelli were both named as executors. In 1474, Toscanelli and Martins corresponded on the possibilities of going west to reach the Indies, and Toscanelli sent Martin the map, which was later forwarded to Columbus and which guided Columbus in his voyage.

It was not a question of the *influence* of the Cusa-Toscanelli circle on the Portugal of Henry the Navigator, but of *one single circle of personal collaborators*.

Breakthroughs in deep-sea sailing

The breakthroughs in deep-sea sailing proceeded exactly as they had in the earlier Eratosthenes-Rata-Maui collaboration.

One of the major features, was the use of large-scale wind and current patterns far out from coast-wise "sense-certainty" sailing, to accomplish feats no "linear" approach could pro-

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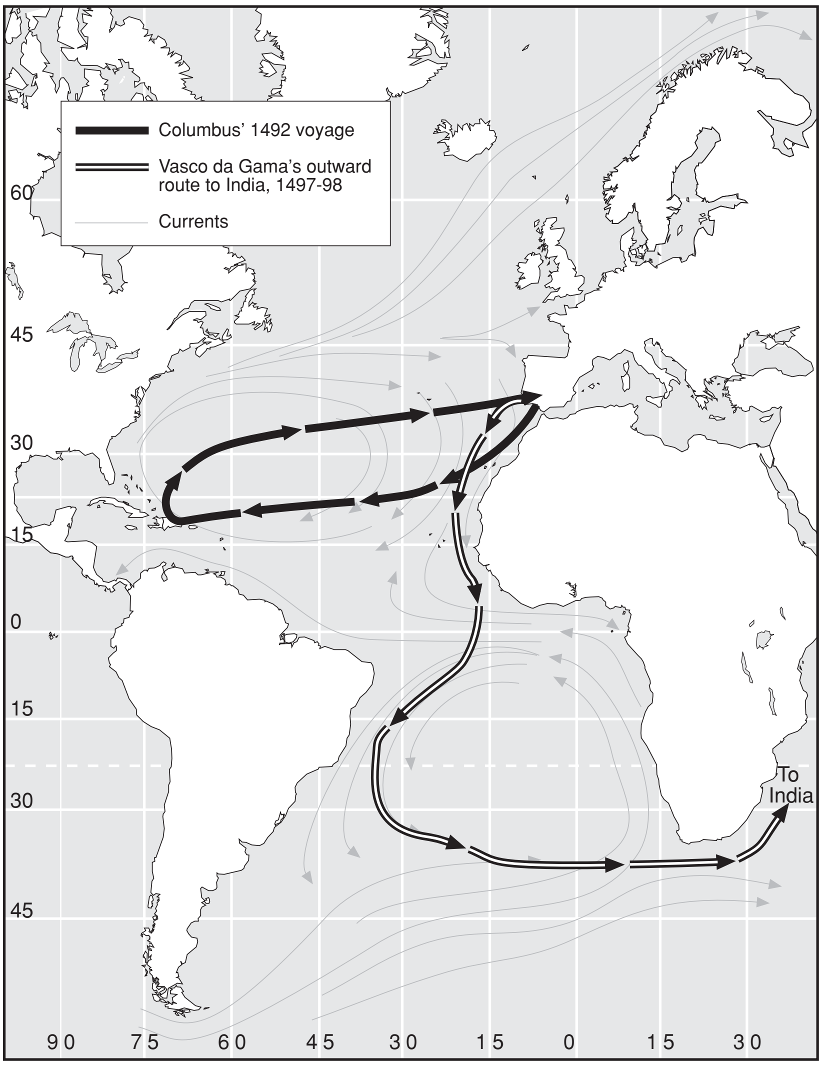
duce. Columbus, who had arrived in Portugal in 1474 and spent 16 years immersed in the most feverish period of Portugal's scientific and nautical breakout, built on the "long-ocean tack" techniques of Henry's captains, to sail "out" to the New World on a southerly route that picked up the westward-flowing tradewinds, and returned on a more northerly route that captured the reverse flow.

Five years later, in 1497, Vasco Da Gama hitchhiked the mirror-image southern-hemisphere circulatory patterns, to turn the Cape of Good Hope and reach India (see **Figure 5**). His "detour" almost to the Brazilian coast, involved being out of sight of land for over three months and 3,800 miles (compared to Columbus's 33 days and 2,000 miles), but it cut the time of the passage in half.

FIGURE 5
The wind and ocean currents used in Columbus's and Da Gama's voyages of discovery



Eratosthenes' Sieve

by Bruce Director

One of Eratosthenes' most important discoveries, was his unique method for finding the prime numbers, now known as the "Sieve of Eratosthenes." Among the whole numbers, there exist unique integers known as prime numbers, which are distinguished by the property that they are indivisible by any other number except themselves and 1. Thus, 2, 3, 5, 7, and 11 are all examples of prime numbers. Numbers such as 8, 9, and 10 can be evenly divided by other integers and are thus called composite.

Eratosthenes' method of finding the primes functions exactly like a sieve, in which the composite numbers fall through the "mesh," and the prime numbers remain. The "mesh" in this case, is the ordering principle by which the composite numbers are generated from the primes. To this day, Eratosthenes' method is essentially the only one for finding the prime numbers. More important, his approach of investigating numbers in characteristic classes, instead of one by one, establishes a crucial method for scientific investigation. This method was later applied in the physical domain by Gottfried Leibniz and Carl Gauss, and laid the basis for Georg Cantor's later development of transfinite numbers.

Greek scientists prior to Eratosthenes had investigated prime numbers, and Euclid (ca. 300 B.C.) recorded that knowledge in the *Elements*. Euclid showed that all numbers are either prime or composite, and that any composite number is divisible by some combination of prime numbers.

You can prove this for yourself, in the following way: Any composite number can, by definition, be divided by some other number, and that other number is either another composite number or a prime number. If it is a