

navigation of the Spaniards and Portuguese, can not be overlooked. The great instruments of the schools of Bagdad and Cairo were imitated, on a small scale, for nautical purposes. Their names even were transferred; thus, for instance, that of "astrolabon," given by Martin Behaim to the main-mast, belongs originally to Hipparchus. When Vasco de Gama landed on the eastern coast of Africa, he found that the Indian pilots at Melinde were acquainted with the use of astrolabes and ballestilles.\* Thus, by the more general intercourse consequent on increasing cosmical relations, by original inventions, and by the mutual fructification afforded by the mathematical and astronomical sciences, were all things gradually prepared for the discovery of tropical America; the rapid determination of its configuration; the passage round the southern point of Africa to India; and, finally, the first circumnavigation of the globe—great and glorious events, which, in the space of thirty years (from 1492 to 1522), contributed so largely in extending the general knowledge of the regions of the earth. The minds of men were rendered more acute and more capable of comprehending the vast abundance of new phenomena presented to their consideration, of analyzing them, and, by comparing one with another, of employing them for the foundation of higher and more general views regarding the universe.

It will be sufficient here to touch upon the more prominent elements of these higher views, which were capable of lead-

distance sailed over, the appeal is made only to the accordant judgment (juicio) of twenty very experienced seamen ("que apunten en su carta de 6 en 6 horas el camino que la nao hará segun su juicio"). If the log had been in use, no doubt Ferrer would have indicated how often it should be thrown. I find the first mention of the application of the log in a passage of Pigafetta's Journal of Magellan's voyage of circumnavigation, which long lay buried among the manuscripts in the Ambrosian Library at Milan. It is there said that, in the month of January, 1521, when Magellan had already arrived in the Pacific, "Secondo la misura che facevamo del viaggio colla catena a poppa, noi percorrevamo da 60 in 70 leghe al giorno" (Amorelli, *Primo Viaggio intorno al Globo Terracqueo, ossia Navigazione fatta dal Cavaliere Antonio Pigafetta sulla squadra del Cap. Magaglianes*, 1800, p. 46). What can this arrangement of a chain at the hinder part of a ship (catena a poppa), "which we used throughout the entire voyage to measure the way," have been, except an apparatus similar to our log? No special mention is made of the log-line divided into knots, the ship's log, and the half-minute or log-glass, but this silence need not surprise us when reference is made to a long-known matter. In the part of the *Trattato di Navigazione* of the Cavalier Pigafetta, given by Amoretti in extracts, amounting, indeed, only to ten pages, the "catena della poppa" is not again mentioned.

\* Barros, Dec. i., liv. iv., p. 320