

The early voyages of the Catalans to the north coast of Scotland and the western shores of tropical Africa (Don Jayme Ferrer reaching the mouth of the Rio de Ouro, in the month of August, 1367), and the discovery of the Azores (the Bracir Islands, on the Atlas of Picigano, 1367) by the Northmen, remind us that the open Western Ocean was navigated long before the time of Columbus. The voyages prosecuted under the Roman dominion in the Indian Ocean, between Ocelis and the coasts of Malabar, in reliance on the regularity of the direction of the winds,\* were now conducted by the guidance of the magnetic needle.

The application of astronomy to navigation was prepared by the influence exercised in Italy, from the thirteenth to the fifteenth centuries, by Andalone del Nero and John Bianchini, the corrector of the Alphonsine tables, and in Germany by Nicolaus de Cusa,† George von Peurbach, and Regiomontanus. Astrolabes designed for the determination of time and of geographical latitudes by meridian altitudes, and capable of being employed at sea, underwent gradual improvement from the time that the astrolabium of the Majorcan pilots was in use, which is described by Raymond Lully,‡ in 1295, in his *Arte de Navegar*, till the invention of the instrument made by Martin Behaim in 1484 at Lisbon, and which was, perhaps, only a simplification of the meteoroscope of his friend Regiomontanus. When the Infante Henry, duke of Viseo, who was himself a navigator, established an academy for pilots at Sagres, Maestro Jayme, of Majorca, was named its director. Martin Behaim received a charge from King John II. of Portugal to compute tables for the sun's declination, and to teach pilots to "navigate by the altitudes of the sun

azar, *Discurso sobre los Progresos de la Hydrografia en España*, 1809, p. 7.

\* See *ante*, p. 172.

† Regarding Cusa (Nicolaus of Cuss, properly of Cues, on the Moselle), see *ante*, p. 109, and also Clemens's treatise, *Ueber Giordano Bruno und Nicolaus de Cusa*, s. 97, where there is given an important fragment, written by Cusa's own hand, and discovered only three years since, respecting a three-fold movement of the earth. (Compare, also, Chasles, *Aperçu sur l'Origine des Méthodes en Géométrie*, 1807, p. 529.)

‡ Navarrete, *Dissertacion Historica sobre la parte que tuvieron los Españoles en las Guerras de Ultramar ó de las Cruzadas*, 1816, p. 100; and *Examen Crit.*, t. i., p. 274-277. An important improvement in observation, by the use of the plummet, has been ascribed to George von Peurbach, the instructor of Regiomontanus. The plummet had, however, long been employed by the Arabs, as we learn from Abul-Hassan-Ali's description of astronomical instruments written in the thirteenth century. Sédillot, *Traité des Instrumens Astronomiques des Arabes*, 1835, p. 379; 1841, p. 205.