

SOME EARLY CONTRIBUTIONS TO THE HISTORY OF GEOMAGNETISM—VII

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João de Castro was a Portuguese naval commander and explorer, born in Lisbon in 1500, the son of Alvaro de Castro, governor of that city. As a young man he distinguished himself in the campaigns against the Moors in North Africa. In 1545 he was sent to the "Indies" with six ships where he overthrew Mahmud, King of Gujarat, relieved the besieged town of Diu, and achieved a number of other military successes.¹ In 1547 he was appointed Viceroy of India by João III, but soon after receiving his full commission he died at Ormuz, June 6, 1548.² His ashes were later brought to Portugal and repose today in the Dominican Convent at Bemfica, near Lisbon. Among the illustrious captains sent out to India by Portugal, only Vasco da Gama and João de Castro are said to have been honored by statues erected to their memory. The statue of the latter is over the principal entrance to Goa.

In order to test the two methods first tried by Pedro Nunes at Evora in 1533, the Infante Dom Luiz, who had himself received mathematical and astronomical instruction from Pedro Nunes and was greatly interested in all nautical questions, turned over an instrument³ to his fellow student and friend João de Castro, who was in command of one of the 11 ships that sailed in 1538 to India, and enjoined him to test and investigate carefully the instrument as well as the new method of latitude-determination, a commission which he executed most brilliantly. He not only determined the magnetic declination as often as possible but also made all kinds of observations of the method itself, of the effects of the magnetic needles and their magnetization on the observed declination-values, of magnetic storms, of the deviation of the compass, etc. He even discovered the magnetization of rocks regarding which we find no mention in other European literatures before the 17th century. De Castro also continued his observations on the voyage along the west coast of India and into the Red Sea so that we possess for the years 1538-41 a series of 43 declination-values, the first series of its kind that has come down to us. De Castro kept very extensive journals regarding all his nautical, magnetic, meteorological, and hydrographical observations and these certainly contain the largest and most valuable collection of such observations from the first half of the 16th century and deserve the zealous study of all who intend to write the history of the physical geography or navigation of that period. Hellmann considered João de Castro as the most

¹As an indication of the high esteem in which de Castro was held by the Portuguese, attention may be called to the great national epic "*Os Lusíadas*" of Luiz de Camões, in which de Castro is mentioned a number of times, as for example in the following (Canto 1^a, est. 14^a):

Nem deixarão meus versos esquecidos
Aquelles que nos reinos lá da Aurora
Se fizeram por armas tão subidos . . .
Albuquerque terrível, Castro forte,
E outros em quem poder não teve a morte.

[Never shall my verses leave forgotten those who, with high martial valor, established our dominions in the East—terrible Albuquerque and brave Castro and others over whom death had no power.]

²According to the inscription on the monument erected to de Castro's memory by his grandson—"Obit octavo Id. Jun. anno M.D.XLVIII. Aetatis XLVIII."

³Terr. Mag., 48, 197-199 (1943).

outstanding representative of scientific oceanography during the closing years of the age of discovery.

The log-books or "Roteiros" kept by João de Castro on his voyages during the years 1538-41 which he transmitted to his sovereign, the Infante Dom Luiz, remained for three centuries in the archives of Portugal practically unused until they were brought to light and published by Nunes de Carvalho, Diogo Köpke, and João de Andrade Corvo. These publications are as follows:

(1) *Roteiro de Lisboa a Goa por D. João de Castro*. Annotated by João de Andrade Corvo. Lisboa 1882. 8°, with maps and illustrations.

(2) *Primeiro Roteiro da Costa da Índia desde Goa até Dio: Narrando a viagem que fez o Vice-Rei D. Garcia de Noronha em socorro deste ultima cidade. 1538-1539. Por Dom João de Castro, Governador e Vice-rei, que depois foi, da Índia, Segundo MS. Autographo*. Published by Diogo Köpke. Porto 1843. 8° with portraits and illustrations, as well as an atlas of charts and plans.

(3) *Roteiro em que se contem a viagem que fizeram os Portuguezes no anno de 1541, partindo da nobre cidade de Goa atee Soez, que he no fim, e stremidade do Mar Roxo. Com o sitio, e pintura de todo o syno arabico por Dom Ioam de Castro, decimo terceiro governador, e quarto viso-rey da Índia . . . pelo Doutor Antonio Nunes de Carvalho . . . Paris 1833*. 8°, with portraits and one map, as well as an atlas of maps and plans.

These journals contain a detailed record of de Castro's magnetic measurements of which selections are given below. As a rule, several determinations of azimuth were made both before and after noon; those corresponding to equal solar altitudes were combined and thus many values of the deviation of the magnetic needle were obtained. These agreed very well with one another since the differences vary between only 0° and 3/4°. These differences may not be regarded wholly as errors of measurement, since, indeed, apart from other inaccuracies, those real differences in declination resulting from the forward movement of the ship could not be taken into account.

The above information is derived largely from Hellmann's introduction to No. 10 of his "Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus."

We are indebted to Dr. J. de Sampaio Ferraz, of Rio de Janeiro, for the following translations. Dr. Sampaio Ferraz had the advantage of consulting especially the rare books of the Naval Library of Brazil. His friend Commander Radler de Aquino, well known for his navigation tables, was kind enough to read the translations. Dr. Sampaio Ferraz makes the following comment: "The author (in the copies at Evora Library on which the text is based) is confusing in the naming of the rose's sectors NW and NE, written in different ways. I adopted the following basis: 'Noroestear' and 'norestear' are the two forms employed in the text to designate northwestern and 'nordestear' is the only form used to name northeasting. But only a check of the individual sets of observations will show if our basis has failed. As I point out in one of my notes, the most authoritative commentator of de Castro's log-books, Commander Fontoura, has apparently been a victim himself of the variable forms for designation of sectors. Commander Radler de Aquino agrees with my note on Fontoura's seeming error."