



Changing theory, changing role of Coriolis effect – The East-West asymmetry of the Wadati-Benioff seismic zones

Giancarlo Scalera

I.N.G.V. - Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy (giancarlo.scalera@ingv.it)

It is a long history the tale of the recognized asymmetries of the Earth. In 1600 William Gilbert (1544-1603) published *De Magnete* in which the North and South geomagnetic pole are described. In 1620 Francis Bacon (1561-1628) in the XXVIIth aphorism of the *Novum Organum* (second part) describes the southern tips of the continents, and many other asymmetries were later described. In 1975 Samuel Warren Carey (1911-2002) stated: *Neither north and south, nor east and west are tectonically equivalent.*

A non exhaustive list of asymmetries of the Earth is: The magnetic polarity; The land-hemisphere and the water-hemisphere; Southern tips of the continents; Larger extension of expanding mid-oceanic ridges on the southern hemisphere; South-eastward trend of younger ages in the long Pacific seafloor volcanic chains; A larger width of the seafloor isochrones bands on the Nazca region; A pear-shaped Earth; etc.

It is a few decades that the different slopes of the Wadati-Benioff zones oriented towards the east and west has been enclosed in the list. Under the Americas they have angles of about 30 degrees, while under the Pacific east coasts (Asia, Japan) the angles are steeper (Luyendyk, 1970; Isacks & Barazangi, 1977; and many others). The cause of this difference has been identified in the tidal drag that would cause a global shift of the lithosphere towards west – the so called *westward drift* (Bostrom, 1971; Stevenson & Turner, 1977; among others). This solution has been many times criticized on the basis of the irrelevance of the tidal forces with respect to viscous friction (Jordan, 1974; Ranalli, 2000; Caputo & Caputo, 2012). Moreover, a simplistic evaluation of the regime of the convective motion in the mantle and of the order of magnitude of the involved forces (viscous, buoyancy, inertial) hastily judges as negligible the role of the Coriolis effect in producing the observed slope differences of the Wadati-Benioff regions.

Instead, it is possible to show that changing the assumptions implicit in the adopted geodynamic theory, or in other words, by adopting a different theory of global geodynamics, the role of the fictitious inertial forces can become substantial. In a different framework Coriolis effect value can rise of several magnitude orders, becoming the main cause of the east-west asymmetry of the Wadati-Benioff zones, which might be ascribed entirely to internal causes of the planet (its rotation) and not to external causes (influence of other celestial bodies). Some clues supporting the new geodynamic scenario are scrutinized.