



Geological Understanding of Plate Tectonics: Basic Concepts, Illustrations, Examples and New Perspectives

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Abstract

The advent of the plate tectonics theory ~ 50 years ago has revolutionized Earth Science thinking and provided a solid framework for understanding how the Earth works. The observations and statistics by Forsyth & Uyeda (1975) showed the subducting slab pull to be the primary force driving seafloor spreading. This driving force readily explains the Pacific type seafloor spreading connected to subduction zones but is not straightforward to explain the Atlantic type seafloor spreading and continental drift. This has led to the general perception that “we still don’t know what drives plate tectonics”. In this presentation, I emphasize with illustrations and demonstrations the decisive role of subduction as the ultimate (dominant) driving force of all the plate tectonics phenomena. Plate motions are driven by plates themselves without the need of an internal force such as “mantle convection” in a narrow sense. In a broad sense, the oceanic lithosphere (plates) formed at ocean ridges, its moving, accretion and ultimate subduction back into the mantle such as in the Pacific is both surface expression and actual driving force for mantle convection. That is, the Pacific type oceanic lithosphere (plates) is an active and dynamic limb of the convecting mantle. Associated with the Pacific seafloor subduction is the trench retreat under gravity. The western

Pacific trench retreat towards east making the overlying Eurasian plate to passively follow, whereas the eastern Pacific trench retreat making the overlying South American plate (the composite continental and oceanic plate) to passively follow the trench retreat, which explains the westward drift of south American continent and south Atlantic ocean growing. Hence, continental drift and Atlantic-type seafloor spreading are simply passive response to seafloor subduction such as in the Pacific.

Biography:

Yaoling Niu obtained his BS from Lanzhou University (1982, China), MS from University of Alabama (1988, USA) and PhD from University of Hawaii (1992, USA). He was Lecture/Senior Lecture at the University of Queensland (1993-2001; Australia), a NERC Senior Research Fellow at Cardiff University (2001-2003; UK), Associate Professor at the University of Houston (2002-2004, USA). Since 2004, he has been Professor of Earth Sciences at Durham University (UK). Since 2003, he has also been Guest Professor at several Chinese institutions, including the Institute of Oceanology of Chinese Academy of Sciences (Qingdao). He uses petrology and geochemistry of igneous and metamorphic rocks from seafloor and on land as tools to study global tectonics and mantle dynamics. He has published over 170 peer-reviewed publications with > 7500 citations and H-index of 51.