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マントルの地球化学的な東西半球の存在とその意味
East-west geochemical mantle hemispheres and their implications on mantle dynamics

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Oceanic basalts, including mid-ocean ridge basalts (MORB) and ocean island basalts (OIB), have been extensively studied as geochemical messages from the mantle to decipher differentiation and convection within the Earth [Hofmann, 2003]. However, the spatial coverage of MORB and OIB is insufficient for resolving even a global feature of the compositional variability. We analyze the oceanic basalts together with the arc basalts in subduction zones that extend over a long distance comparable to mid-ocean ridges and cover the areas with a few mid-ocean ridges or hotspots. Combining the arc data with those from oceanic basalts, and by using Independent Component Analysis [Iwamori and Albarede, 2008; Iwamori et al., 2010] to remove influences from the subducted materials, global geochemical domains appear primarily as east-west hemispheres, rather than north-south hemispheres as has been long argued for [Hart, 1984]. The eastern hemisphere, ranging roughly from the Mid-Atlantic Ridge to Eastern Eurasia and Australia, is underlain by a subducted component-rich mantle being created possibly by extensive subduction beneath the supercontinent Pangea. The primary feature of this spatial pattern and relationships is that the geochemical domains have been anchored to asthenosphere for at least 300 m.y. in the past, and the continents dispersed without significantly disturbing the asthenospheric structure, possibly due to mechanical decoupling between lithosphere and asthenosphere. The second (thus less obvious but important) feature is as follows: distribution of a subducted component-poor domain beneath the western hemisphere, including the American Plates that had been a part of the supercontinent, suggests eastward flow of asthenosphere once located under the Panthalassic Ocean, i.e., migration over several thousands km during the last ~300 million years. The flow pattern and velocity seem consistent with the westward lithospheric rotation against the asthenosphere [Ricard et al., 1991] that exhibits internal deformation.
Keywords: mantle, isotope, hemisphere, supercontinent, lithosphere, subduction