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Geophysical Age Dating of Seamounts using Dense Core Flexure Model

Gyuha Hwang (1) and Seung-Sep Kim (1,2)

(1) Dept. of Astronomy, Space Science, and Geology, Chungnam National University, Daejeon, Korea, Republic Of (hgh8349@cnu.ac.kr), (2) Dept. of Geology & Earth Environmental Sciences, Chungnam National University, Daejeon, Korea, Republic Of (seungsep@cnu.ac.kr)

Lithospheric flexure of oceanic plate is thermo-mechanical response of an elastic plate to the given volcanic construct (e.g., seamounts and ocean islands). If the shape and mass of such volcanic loads are known, the flexural response is governed by the thickness of elastic plate, T_e. As the age of oceanic plate increases, the elastic thickness of oceanic lithosphere becomes thicker. Thus, we can relate T_e with the age of plate at the time of loading. To estimate the amount of the driving force due to seamounts on elastic plate, one needs to approximate their density structure. The most common choice is uniform density model, which utilizes constant density value for a seamount. This approach simplifies computational processes for gravity prediction and error estimates. However, the uniform density model tends to overestimate the total mass of the seamount and hence produces more positive gravitational contributions from the load. Minimization of gravity misfits using uniform density, therefore, favors thinner T_e in order to increase negative contributions from the lithospheric flexure, which can compensate for the excessive positives from the seamount. An alternative approach is dense core model, which approximate the heterogeneity nature of seamount density as three bodies of infill sediment, edifice, and dense core. In this study, we apply the dense core model to the Louisville Seamount Chain for constraining flexural deformation. We compare T_e estimates with the loading time of the examined seamounts to redefine empirical geophysical age dating of seamounts.