

Detachment fault at the Godzilla mullion, Parece Vela Basin, Philippine Sea

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The Godzilla mullion, only recently discovered in the Parece Vela Basin, Philippine Sea, is nearly an order of magnitude larger than the megamullions found along the Mid-Atlantic Ridge. Although the origin of the Godzilla mullion has been ascribed to non-magmatic extensional tectonics, its formation is uncertain, as a detachment fault for the proposed oceanic core complex has yet to be identified. Here, we report that the detachment fault occurs on the actual surface of the Godzilla mullion. Rock samples analysed in this study were collected in 2003 from longitudinal dredge hauls across the Godzilla mullion by JAMSTEC research vessel (R/V) Kairei on cruise KR03-1. Samples consist dominantly of peridotite, serpentinite and gabbroic rocks. Peridotite samples are typically mylonitized, indicating intense shearing below the brittle-plastic transition within the mantle lithosphere. Gabbroic samples are also mylonitized, with brown hornblende that replaces pyroxene locally dynamically recrystallized into finer grains, whereas chlorite that replaces brown hornblende is undeformed. Two types of talc schist were also sampled: one that represents a complete replacement of peridotite ultramylonite, and another in which well-developed schistosity occurs with partially developed shear band structures. This indicates that shearing occurred up to the amphibolite facies but did not continue into the greenschist facies possibly during progressive retrogression. The occurrence of ultramylonite and mylonite in both mantle and crustal rocks indicates that the surface of the Godzilla mullion represents a detachment fault that extends into the mantle lithosphere. We propose that the Godzilla mullion formed via footwall exhumation along the deeply seated detachment fault.