

Deep Earthquakes Isolated from Present-Day Active Wadati-Benioff Seismic Zones:
Seismogenesis in Detached and Fragmented Slabs associated with the M7.9 Bonin Deep Event
of 30 May 2015 and Similar Examples

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The Mw 7.9 earthquake of 30 May 2015 at 680 km in the vicinity of the Bonin subduction zone was more than 150 km distant from the nearest deep earthquake in the active Bonin Wadati-Benioff (WB) earthquake zone that is well west of the big event of 30 May. Moreover, well-located deep events in the Bonin system dating as far back as 1925 show that the WBZ system in this latitude deep events are limited to depths of 500-600 km and extend as much as 200 km to the west of the deepest events of the inclined section of the Bonin W-B zone and occur in high-wave-speed, high-Q, stagnant slab material previously described by others (Fukao et al., 1992; van der Hilst et al. 1993; Okal, 2001).

Events in this class of deep earthquakes that are isolated from active W-B zone earthquakes are reported in other localities worldwide, including *Tonga*, *Vityaz* (North Fiji Basin), and possibly *southern Spain*. Such deep events have been considered as seismogenesis in detached or fragmented slab material that has foundered to near the bottom of Earth's transition zone (Kirby et al., 1996; Okal and Kirby, PEPI, 1998; Okal, PEPI, 2001) where stresses may be generated by heterogeneous volume changes associated with the metastable olivine->spinel metamorphic reaction. How and why slab fragments become detached has been suggested to be a possible consequence of collisions of oceanic plateaus or island arcs with oceanic forearcs leading to arc reversal and/or fragmentation of normal oceanic lithosphere from plateau lithosphere. The *Igasawara Plateau* is currently colliding with the Bonin forearc just to the south of the 30 May 2015 deep event. The *Bonin Ridge* may represent a thick section of thick remnant crust that detached its slab that later foundered in mantle fall free to the bottom of the mantle transition zone in the source region of the 2015 shock. This ridge is an unusual feature of the Bonin forearc with its steep scarp-like western margin and rift between it and the Bonin arc massif to the west. The most straightforward interpretation of the above facts is that the Bonin Ridge is a collisional arc remnant accreted to the Bonin forearc and that the western part of the Pacific Plate detached via normal faulting and foundered to mantle transition zone depths.

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