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The large Bonin deep Event of 30 May 2015: Seismogenesis in a Detached and Fragmented Slab

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The earthquake of 30 May 2015 in the Bonin Island was exceptional in many respects: it was the fifth largest deep earthquake ever recorded (7.8 E27 dyn*cm; Mw = 7.9); at h = 680 km, it was 100 km deeper than any known event in that subduction zone and 150 km distant from its nearest neighbor (including relocated historical events dating back to the 1920s); it was displaced as much as 150 km East of the prolongation of the mapped Wadati-Benioff Zone; and finally its focal mechanism was close to the opposite of the down-dip compression prevailing for the deepest known earthquakes. Other cases of "detached" deep earthquakes occurring in highwavespeed, high-Q slab material, have been described in front of subduction zones, notably by Fukao et al. [19092], Van der Hilst et al. [1993] aand Okal [2001]. The geometry of the 2015 Bonin event is reminiscent of that of the cluster of (much smaller) seismic events beneath the North Fiji Basin, which appear be unrelated to presently active W-B systems, but rather express seismogenesis in detached or fragmented slab material that has foundered to the bottom of the transition zone [Kirby et al., 1996; Okal and Kirby, 1998], 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 possibly involve collisions of oceanic plateaux or island arcs with oceanic forearcs, leading to arc reversal and/or fragmentation of normal oceanic and plateau lithosphere. In this context, the Igasawara Plateau is currently colliding with the Bonin forearc just to the South of the 2015 deep event. The Bonin Ridge to the North may represent a section of thick remnant crust that otherwise detached from its slab and later foundered in the mantle all the way to the bottom of the transition zone, stagnating to this day in the source region of the 2015 shock.