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Philippine Sea Plate encroachment onto Australia and Eurasia, from New Guinea to Taiwan

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The Philippine Sea Plate (PSP) has been developing since the Early Eocene by incorporating relics of Circum-Pacific volcanic arcs. From the Eocene, it underwent a clockwise rotation and interacted with both the Sunda Plate and the Australian continent, which was moving northward relative to stable Eurasia. Due to the pronounced obliquity of the convergence of the PSP with these two plates, the subduction ended via a soft collision (docking), where deformation was accommodated by thrusts and left-lateral strike-slip faults. This configuration is remarkably consistent from New Guinea to Taiwan.

The docking of the NW-SE volcanic belt, or Melanesian-Philippine Arc, onto the Australian margin in New Guinea, is marked by a set of E-W thrusts, offset by NE-SW lateral ramps. In the Banda region (Lengguru, Seram, and Lucipara) and in the Molucca Sea (Halmahera to Talaud), the absence of substantial continental basement led to the escape of blocks toward the available free edges. In the Philippines, the docking of the volcanic belt produced N-S thrusts relayed by NW-SE lateral ramps from Mindanao to Luzon. In Mindanao, the collision remains active today in the south and was dated at 2 Ma in the North, around 5 Ma in the central Philippines, and at 7 to 10 Ma around Luzon, i.d., similar to the ages attributed to the collision in Taiwan. The tectonic style is also comparable, including strike-slip faults such as the Cotabato Fault and Sibuyan-Verde Passage Fault, along with the network of faults in Central Luzon, connected to ramp anticlines in the Central Cordillera. The Zambales Ophiolite displays a similar fold-and-ramp structure, inherited from a Middle Miocene shortening phase that predates the late (Pleistocene) N-S folding. In Taiwan, the volcanic arc has been largely subducted and metamorphosed, but the deformation of the Yuli Belt shows remarkable left-lateral wrench faulting under ductile conditions. The obliquity is stronger than that of the Philippines so that lateral ramp faults and folds are almost co-linear. A severe translation of HP material from the south to the Yuli Belt in the North is observed.

In all these regions, where the PSP encroached the continental margins, the subduction was briefly interrupted during the docking phase, resulting in tectonic deformation with thrusts and left-lateral ramps. The docking event, short-lived (less than 2 Myrs), corresponds to the time needed for the subduction jump. The post-tectonic setting always shifts back to oblique subduction, with a rapid onset of shear partitioning.