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The Banda Arc subduction enigma

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The spectacularly curved Banda arc comprises young oceanic crust enclosed by a volcanic inner arc, outer arc islands, and a trough parallel to the Australian continental margin. Seismicity defines a spoon-shaped lithospheric fold in the upper mantle for which there are two contrasting explanations: deformation of a single subducted slab, or two different slabs subducted from north and south. We show that the Banda arc resulted from subduction of a single slab. Based on geology and seismic tomography, we argue that the arc formed since 15 Ma by subduction of a Jurassic oceanic embayment within the Australian plate. Viewed in an Atlantic–Indian hotspot reference frame, the stationary E-W striking Java trench propagated ESE into the Banda embayment by hinge rollback. Extension of the upper plate formed oceanic crust in the present Banda Sea between stretched continental crust of Australian origin. Slab morphology depends primarily on the geometry of the continental margin enclosing the embayment. Our model explains the first order tectonic development of the Banda region and links slab deformation to absolute plate motion.