Seismic reflection evidence for a Dangerous Grounds mini-plate in the South China Sea and implications for extrusion tectonics in SE Asia

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The collision of India and Asia has caused large strike-slip faults to form in East Asia, resulting in the "extrusion" of crustal blocks towards the southeast since the Eocene as a result of the indentation of rigid India into Asia (Peltzer and Tapponnier 1988, Tapponnier et al. 1982). It has been suggested that the South China Sea opened as a result of relative motion between a rigid Indochina (Sundaland) block and China (Briais et al. 1993). Alternative models propose that rifting and seafloor spreading were driven by trench forces to the south (Morley 2002, Taylor and Hayes 1980). We test these competing models by analysis of seismic reflection profiles across the boundary between Sundaland and the southern rifted margin, known as the Dangerous Grounds. We show that the southern boundary of the Dangerous Grounds is a subduction zone that jammed in the Middle Miocene (Hutchison et al. 2000). To the west the Dangerous Grounds is bounded by a strike-slip zone, also active until ~16 Ma, that becomes diffuse south of the now inactive South China Sea seafloor spreading centre. We place the western edge of the Dangerous Grounds just to the east of the Natuna Arch (Lupar Line). The West Baram Line is confirmed as originating as a major strike-slip fault within the Dangerous Grounds and continuous with Red River Fault Zone. Because the Dangerous Grounds were independent of Sundaland until ~16 Ma its motion cannot have been constrained by motion of this block, making extrusion impossible as a mechanism to rift the South China Sea. SE motion by both the Dangerous Grounds and Sundaland suggests subduction forces were the primary trigger for plate motions. Our reconstruction places a ~280 km upper limit on the motion on the Red River Fault, and a ~1400 km width to the paleo-South China Sea. This value is intermediate between the low estimates of Searle (2006) and the higher values of >1000 km (Tapponnier et al. 1990).

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