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## Influence of incoming plate relief on overriding plate deformation and earthquake nucleation: Cocos Ridge subduction (Costa Rica)

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We present a 2D p-wave velocity ( $V_p$ ) model and a coincident multichannel seismic reflection profile mapping the structure of the southern Costa Rica margin and incoming Cocos Ridge. The seismic profiles image the ocean and overriding plates from the trench across the entire offshore margin, including the structures involved in the 2002 Mw6.4 Osa earthquake. The overriding plate consists of three domains: Domain I at the margin front displays thin-skinned deformation of an imbricated-thrust system composed of fractured rocks with relatively low  $V_p$ . Domain II under the middle continental shelf is comparatively less fractured, showing ~15 km long landward-dipping reflection packages and discrete active deformation of the shelf sediment and seafloor. Domain III in the inner shelf is little fractured and appears to be dominated by elastic deformation, with inactive structures of an extensional basin consisting of tilted blocks overlain by ~2 km-thick gently landward-dipping strata. The velocity structure supports the argument that the bulk of the margin is highly consolidated rock possibly similar to outcrops in the Osa Peninsula. Thick-skinned tectonics probably causes the uplift of Domains II and III. The incoming oceanic plate shows crustal thickness variations from ~14 km at the trench (Cocos Ridge) to 6-7 km beneath the continental shelf. We combine (1) inter-plate geometry and velocity-derived fracturing degree at the base of the overriding plate, (2) tectonic stresses and brittle strain above the inter-plate boundary extracted from 3D numerical models, and (3) earthquake locations, to investigate potential relationships between structure and earthquake generation. The 2002 Osa earthquake and its aftershocks appear to have nucleated at the leading flank of two subducting seamounts, coinciding with the area of highest tectonic overpressure in numerical models. Both estimated rock fracturing and modelled brittle strain, steadily increase from the leading flank of the subducting seamounts to their top, which we interpret to reflect the progressive damage caused by the incoming plate relief. Therefore, the analysis supports a spatial and temporal relationship between subducting seamount location, upper plate fracturing, brittle strain, tectonic overpressure, and earthquake nucleation.

