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Plate geometry and kinematics modeling to explain South Central Pacific volcanism and plate re-organization

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We present here a model applied to the Pacific plate for a mechanism governing plate motion related to the plate geometry and kinematics. We start from the observation that from the Kermadec Tonga trench to the Easter microplate, a group of recent and presumed non-deep Pacific hotspots forms a wide east-west channel, and hypothesize that this is not a coincidence. We develop plane strain numerical models of an area corresponding to the Pacific plate from the mid-oceanic ridge to the subduction zone under the Australian plate, with differential velocities applied on the northern and southern part of the plate because of absolute trench motions. Our 2D models indicate a shear band, associated to a change from compressional stresses to the south to tensional stresses to the north, which develop after 10 Myr between the Australian plate corner and the Easter microplate. We propose that the South Central Pacific (SCP) intraplate volcanism is related to this process, and may represent the first step of a future plate re-organization, which will eventually break the Pacific plate in a southern and a northern plate due to intraplate stresses. Lithospheric extension associated with a fertile mantle source is necessary for the presence hotspots when these are not related to a deep mantle plume. To fully explain the SCP volcanism, we show that there is no relation between present-day SCP and the old Northwestern Pacific volcanism, except that it was created over the same mantle region before 70Ma, which represents the very fertile mantle needed.