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Tectono-sedimentary history of marine forearc basins linked to the evolution of the south central Chilean margin (33º30'-37ºS); insights from seismic data and analogue simulations.

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The origin and tectono-sedimentary development of marine forearc basins on both, slope and shelf, is strongly linked to the evolution of material transfer at a convergent margin and consequently with the morphology of accretionary prisms. A better understanding of parameters which control the evolution of forearc basins is not only important for unraveling the long-term tectonic development of a convergent margin and the conditions for potential accumulation of hydrocarbons, but also seems important to understand variations in seismicity.
Along and across the south central Chilean margin the size and the structural style of the accretionary wedge varies considerably, showing differences in the ratio of frontal to basal accretion as well as in the uplift of the prism at different latitudes. These variations are strongly linked with differences in the distribution, width and depth of forearc basins. Moreover, as the slope basin deposits constitute strain recorders for the deformation of forearc region, the size and distribution of accommodation spaces allow drawing conclusions about the present or past material transfer modes. High resolution seismic data show that slope basins mostly are half-grabens controlled by subvertical bordering faults, governing differential uplift and subsidence. Basin fill displays characteristic and widely distributed depositional pattern identified as basal pre-kinematic, interme-diate syn-kinematic, and upper post-kinematic units.
By means of scaled sand box experiments we investigated the nature of the relationship between these tectonic episodes and the mechanisms controlling the creation of accommodation spaces. We tested two key parameters, (i) variable trench sediment thickness and (ii) alternating basal patches of high and low friction along the plate interface. We found that the geometry and structural style of the experimental wedges may change significantly as a consequence of changing basal mechanical conditions. The shift from high to low friction offers a mechanism to develop subvertical thrust faults and their potential reactivation during further convergence, which is consistent with the geometry of basin bounding faults observed in seismic data. Testing different lengths and periodicities of high and low basal friction, we found that different mass transfer modes (frontal accretion to basal accretion or underplating) occurred during wedge evolution, influencing the size of forearc marine basins in both, slope and shelf.
If a long segment of low basal friction is followed by a long segment of high basal friction, this results in com-plete underplating of incoming sediments (comparable to a subduction channel) with the concomitant propagation of deformation and fault reactivation towards the backstop. It is suggested that differences observed in the degree of uplift and extension of the wedge, as well as in size and deformation of marine forearc basins at different latitudes of South Central Chilean margin, could be linked with different positions of basal underplating towards the backstop.