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Basin dynamics in the Pampas Plain, Argentina

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The Argentine Pampean foreland or Pampas Plain, located at leading edge of the modern flat slab of the south-central Andes between 31º-33º SL, is examined in order to understand the large-scale subsidence using flexural and gravity studies together with computations of dynamic topography. At scales <300 km, Bouguer anomalies and flexural analysis predicts a foredeep of ∼250 km width and a peripheral bulge amplitude of ∼25 m, which match the regional morphologies of the modern Plain. These calculations assume a tectonic loading placed at the eastern-most Sierras Pampeanas broken foreland (considered as the modern analogue of the North American Laramide). These results, however, do not account for the subsurface Miocene-Quaternary basin preservation, represented by an accumulated sedimentary thickness ∼400 m and with depocenters >400 km eastward with respect to flexural models. The discrepancy suggests that two mechanisms, acting at different wavelengths, might have influenced in the formation of the Argentine Pampas. The basin preservation, generated by the subduction dynamics of this segment of the Andes, is likely the result of large-scale dragging forces. Models of mantle flow, driven by realistic subducting slab geometries and density contrasts, reproduced the depocenter location and the wavelength of subsidence as well as most of the remaining amplitude. However, while the net dynamic subsidence across the Pampas was ∼200-100 m during the early Miocene normal-dipping subduction stage of the Andes, the Pliocene to Holocene slab flattening, in contrast to expected, reproduced very small negative dynamic topography values (<20 m). Consequently, the net change of dynamic topography from Miocene to Present would tend to zero or even to positive signals, suggesting a minor control of the subduction on the Quaternary sediment accommodation. These results agree reasonably well with the subsurface Pampas stratigraphy.