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Impact of Structural and Autocyclic Basin-Floor Topography on the Stratal Architecture of the Deepwater Valparaiso Forearc Basin, Central Chile

The Valparaiso Basin on the central Chile margin is elongated north-south along the base of a seaward-rotated upper slope, and contains a 3–3.5-km thick sediment fill made up of slope, submarine-fan, and basin-plain depositional elements imaged in seismic-reflection profiles. The basin fill has been more strongly deformed in the seaward direction where it rests on a series of outer-arc compressional basement highs formed in response to underthrusting of the Juan Fernández Ridge on the subducting Nazca plate.

The impact of syn-depositionally growing margin-parallel compressional ridges was primarily to direct sediment flows along the axis of the basin, resulting in wedge-shaped depositional sequences that exhibit landward onlap and seaward convergence above the evolving structural highs. The protruding relief of a margin-parallel monoclinical structure may have diverted gravity flows along its landward flank and controlled the formation of sediment waves on its seaward side from flows spilling over the crest of the ridge.

As the intra-basinal highs gradually became buried and tectonic contraction ceased, turbidite elements were deposited from flow transverse to the basin axis. As a result, during the later stages of basin filling, autocyclic depositional controls were more important than tectonic effects. Lower-fan lobe deposition resulted in compensation cycles, and the increasing height of a major levee appears to have progressively restricted overbank sediment flow. Sediment waves on the backslope of the levee exhibit an evolution from rapid upslope wave migration to aggradation and diminishing wave heights up-section suggesting a temporal decrease in overflow energy and grain size.