

SEDIMENTARY BASIN DEVELOPMENT ABSTRACTS

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Relationship Between Small and Large Sedimentary Basins: The Scale Spectrum

Realizing that detachments influence lithospheric extension helps us define the fundamental elements responsible for basin formation. In addition to strain rate, crustal thickness, and lithospheric thickness, these factors are (1) stretching distribution within the upper plate of the detachment, (2) stretching distribution within the lower plate, and (3) depth distribution of the detachment(s), where lateral strain must be balanced within the lithosphere during extension. Intracrustal duplex systems may reflect previous compressional events, or they may be produced by upper-crustal flaking in strike-slip regimes. Basin initiation represents a mechanical process (e.g., hanging-wall collapse), whereas subsequent basin development is primarily an isostatic process controlled by the thermal and mechanical properties of the lithosphere. However, subcrustal lithospheric involvement and, hence, heating are minimal until flexure becomes unimportant, which depends on basin wavelength, lithospheric temperature structure, and hence, rigidity.

This wavelength or scale dependency may help explain the difference between the abrupt but short-lived subsidence of small basins, such as the Ridge basin of southern California, and the general negative exponential subsidence characteristic of passive continental margins. Further, the rheological implications of depth-dependent stretching, with thermal modification of the lithosphere during extension, ultimately controls lithospheric strength and, hence, the actual rift/breakup configuration. Together, factors 1 and 2 generate rift and thermal subsidences, the final form of which depends on the flexural properties of the lithosphere. The exact relationship between factors 1 and 2 determines the spatial configuration between rift and sag basins and temporary uplifts. We illustrate these concepts and their implications with examples from California, Nevada, Brazil, Turkey, and Australia.