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# Lithospheric flexure and the evolution of sedimentary basins

A. B. Watts

Department of Earth Sciences, University of Oxford, Parks Road, Oxford OX1 3PR, UK.
tony@earth.ox.ac.uk

The principal evidence for the strength of the lithosphere has come from studies of the way that it responds to long-term ($> 10^5$ yr) submarine volcanic loads. These loads are large enough to have deformed the lithosphere by up to 4 km over distances of up to a few hundred km. The pattern of deformation is similar to what would be expected for a load emplaced on the surface of a thin elastic plate that overlies an inviscid sub-stratum. By comparing the calculated flexure profiles based on simple models to bathymetry, gravity anomaly and seismic data it has been possible to estimate the effective elastic thickness of oceanic lithosphere, $T_e$, and its relationship to load and plate age. Sediments constitute a load that also deforms the lithosphere. The thickness of sediment that can accumulate, however, is the combined response to "tectonic driving forces" (e.g. due to thermal contraction and uplift), sediment and water loading, and compaction, making it difficult to evaluate the role of flexure. Stratigraphic models that incorporate tectonics suggest flexure contributes significantly to the large-scale "architecture" of sedimentary basins. Moreover, aggradation and progradation onto a lithosphere that increases its strength with time explains a number of features of the internal structure of sedimentary basins, such as their onlap and offlap patterns. The problem is that the spatial and temporal distribution of $T_e$ in a particular basin is generally unknown. One parameter that is a strong function of $T_e$ is the gravity anomaly. The application of 3-dimensional combined flexural backstripping and gravity modeling techniques to the Mozambique, NE Brazil, Namibia and East Coast, USA continental margins show that some basins are characterized by a $T_e$ structure similar to oceanic lithosphere whereas others have a $T_e$ structure more typical of continental lithosphere. Since the Wilson cycle implies that the $T_e$ structure of continental margins may be inherited during subsequent orogenic events, it is important to clarify how the continental lithosphere responds to loads on a range of time-scales. Post-seismic relaxation, glacial isostatic adjustment, and spectral gravity anomaly and topography studies suggest that continental lithosphere is characterized by a $T_e$ structure that varies both temporally and spatially. This paper explores the relationship between continental $T_e$ and plate and load age and examines its consequences for the development of sedimentary basins.