

Basement Control on Basin Evolution in Northwestern Australia

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The basement of any basin provides the foundation onto which the sediments are deposited. The rheology, or mechanical behaviour, of the basement controls the rate of subsidence and geometry of each phase of the evolving basin. The composition of the basement determines its strength or stiffness. The age and early history of each basement terrane dictates the intensity and character of the structural fabric. This inherent fabric plays a major role in the manner in which the crust deforms during major periods of extension or compression.

Basement Terranes of NW Australia, interpreted from gravity, magnetic and geological data, include at least 4 major Archean to Early Proterozoic cratonic blocks separated by younger mobile belts. The cratons tend to resist deformation causing extensional strain and associated accommodation space to preferentially partition into surrounding mobile belts. Thus the thickest sediment accumulation tends to develop over mobile basement. The orientation and effective length of internal mobile belt fabric controls the direction and amount of extension that can be accommodated for a particular tectonic event. For example, NE-SW directed extension during the Devonian focused in the Canning and Petrel basins with minor, if any, extension of the intervening Kimberly block. Compressional strain is also preferentially partitioned into mobile belts such that basin cores tend to be inverted. In major compression events mobile belts are exhumed with foreland sedimentation and older basin preservation localised over adjacent cratonic basement.

In this paper we present an overview of the basement terranes of Northwestern Australia from the OZ SEEBASETM project demonstrating the difference in rheological behaviour of cratonic blocks and mobile belts, and their predicted control on basin evolution through time.