Geophysical Research Abstracts, Vol. 8, 07532, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07532

Stratigraphic prediction and impact of soft-sediment deformation phenomena in the southwest Karoo Basin, South Africa

D.M. Hodgson, R.J. Wild, W. van der Merwe, S.S. Flint, and C.M. Oliveira

Stratigraphy Group, Department of Earth and Ocean Sciences, University of Liverpool, Liverpool, UK (hodgson@liv.ac.uk / +441517945183)

There are a wide range of soft-sediment deformation processes and products preserved in the geological record, but identifying the controls on their formation and distribution in space and time is problematic. Evidence from the Permian SW Karoo Basin indicates that the type of deformation phenomena is predictable in basin-floor and basin-margin stratigraphy, and controlled primarily by relative sea-level change.

Failure of the basin margin can set up a new slope profile, influences the routeing and storage of sediment from the shelf to the basin-floor, and forms the depositional template upon which the subsequent basin-floor fans evolve. A rare example of such a situation at outcrop is exposed in the Laingsburg Depocentre, SW Karoo Basin, South Africa. The Vischkuil Formation, which sits at the base of a 1.4 km-thick prograding basin margin succession, comprises at least three major phases of slide and slump emplacement. The slides and slumps were generated both from higher on the basin margin, and locally from the limbs of growth folds that deformed the seabed, and show proximal to distal changes in the character of deformation.

The adjacent Tanqua Depocentre began to accumulate deepwater siliciclastic sediment later and does not preserve a basal MTD complex. The preserved basin margin here evolved from a mixed bypass and depositional system (Unit 5, Skoorsteenberg Formation), to a largely accretion-dominated system defined by shelf edge deltas and slope lobes (Kookfontein Formation). The changes in slope morphology (an overall reduction in slope angle and increase in slope length) and usable accommodation through time is reflected by changes in the dominant deformation assemblages. The spatial and temporal distribution of the deformation facies suggests that different deformation as-

semblages occur in distinct palaeogeographical settings governed by a combination of profile position, depositional gradient, sediment flux, and position within the relative sea level cycle.

Integration of the sediment deformation data set with the sequence stratigraphic framework developed for the Karoo submarine slope successions demonstrates a predictable stratigraphic distribution. Emplacement of large-scale MTD's occurred predominantly during the falling stage of 3^{rd} order sequences. Slope 'creep' bodies characterise deposits of lowstand systems tracts of 5^{th} order sequences. Within Cycles 2-5 of the Kookfontein Formation, falling stage systems tracts of 5^{th} order sequences are characterised by the occurrence of slumps/MTD's, whereas foundered mouth bars are more typical of the lowstand systems tract. It is proposed that falls in relative sea level triggered the generation of slumps/MTD's whereas rapid progradation and deposition onto a gradient over the shelf-edge led to gravitational instability, creep and failure of delta front mouth bars. This study contrasts with studies that emphasise seismicity as the trigger mechanism for sediment deformation.