ABSTRACT:
Characteristics of Low Accommodation Coal Seams, Lloydminster Area, Western Canadian Sedimentary Basin.

G.R.L. Chalmers
M.Sc. 2002 University of Newcastle, Australia.

The characteristics of a low accommodation, amalgamated coal seam were identified by coal petrographic analyses. The investigated coal seam was deposited in the Lloydminster area of the Western Canadian Sedimentary Basin. This area lies adjacent to the cratonic margin of the basin, in a low accommodation setting, where rocks units become condensed. The objectives of this study were to identify accommodation trends or depositional cycles, significant sequence stratigraphic surfaces and the correlation of the coal seams by geophysical properties and also by accommodation trends.

Regional geophysical-log correlation of coal seams, shoreface facies and the identification of incised valleys has produced a sequence stratigraphic framework for coal petrographic results from three coal cores. Sampling focussed on the coal seams of the Lloydminster and Cummings Members of the Early Cretaceous (Aptian to Albian) Mannville Group. Maceral analysis and telovitrinite reflectance and fluorescence measurements were taken from a total of 182 lithotype-based samples. The petrographic data were then used to interpret the depositional environment of the mire in terms of base-level (groundwater table) changes. Based on the changes of base level and the internal significant surfaces identified within the coal, trends of increasing (wetting-upward depositional cycle) accommodation or decreasing (drying-upward depositional cycle) accommodation were interpreted and grouped into units. The coal core 13-3-40-1W4M contains 9 coal units, separated by either paludification surfaces (PaS) or non-marine flooding surfaces (NFS). A sequence boundary was also identified internally, separating the amalgamated Lloydminster and Cummings coal seams. The Lloydminster coal seam is interpreted to have formed under rising base-level conditions, illustrated by the accelerating accommodation trends or wetting-upward coal cycles. The Cummings coal seam due to the internal characteristics of decelerating accommodation trends or drying-upward coal cycles, is interpreted to have developed under falling base-level conditions.

In this low accommodation setting, the non-marine strata are characterised by high frequency of significant surfaces, coal seam splitting, palaeosol and incised valley development. Three sequence boundaries are identified in only 20 metres of strata. The lateral discontinuity of the strata is produced by the removal of sediment by sub-aerial erosion or by a period of non-deposition. Syndepositional, small-scale movements in the underlying basement rock is evident, changing local accommodation trends and the sedimentation patterns of the Mannville strata. A major tectonic event that caused a re-organisation of the basin could be a likely cause of the fault reactivation. Correlation of the Lloydminster and Cummings coal seams using the accommodation trends, has highlighted lateral discontinuity of strata and the

complex nature of the internal organisation of the coal seams. Wetting/drying-upward cycle-based correlations illustrate that each coal seam in this study area was not produced by a single peat-accumulation episode but as an amalgamation of a series of depositional events. This study has shown that coal seams in a low accommodation setting can have a complex organisation and depositional history due to removal of material and because there are more time gaps than actually preserved sediment.