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Ultra High Resolution Correlation using Coal Seam Micro-Stratigraphy

Coal seams are highly sensitive indicators of changes in accommodation and organic productivity and enable extremely high-resolution correlation of parasequence-scale base level changes many kilometres landward of the coeval shoreline. The Sunnyside coal seam of the Cretaceous Blackhawk Formation in Eastern Utah contains two laterally extensive splits which open basinward into packages of shallow-marine sediments. Increases in the inorganic mineral and pyrite content of the coal combined with reduced vitrinite reflectance, provide clear signatures of the flooding surfaces related to these splits at least 15km back up depositional dip into the unsplit coal. The coal constrained by these flooding surfaces is therefore the coastal plain equivalent of the marine shoreface parasequence bounded by the same two surfaces further into the basin. Furthermore, changes in coal composition and vitrinite reflectance within this 2m thick package of coal enable us to identify a complete record of very high-resolution accommodation changes throughout the formation of this parasequence.

Vitrinite reflectance is especially useful as even small rises in base level which do not result in inundation of the mire can significantly suppress reflectance values. Similarly, falls in base level produce enhanced reflectance values due to slight oxidation of vitrinite precursors. In a single vertical section, mean reflectance values may reach 0.8% where high inertinite content indicates dry conditions, and then rapidly fall to around 0.5% at the points where base level rose. These sharp kicks in the reflectance profiles enable centimetre scale correlation of flooding surfaces between sections spaced over 15km of depositional dip.