Reservoir Characteristics of Tropical Sub-humid Fluvial and Deltaic Deposits Inferred from Modern and Holocene Sediments of NE Australia and Some Ancient Examples

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This paper aims to highlight the important differences between the lithosomes produced in sub-humid, tropical cyclone-influenced environments and those conventionally regarded as typical of fluvial and deltaic systems in general. The modern landscape of sub-humid tropical northeast Australia is drained by several large rivers, some of which have formed sizeable Holocene deltas. One such system is the Burdekin, which we have studied intensively over the past 15 years. The Burdekin system is characterized by strongly seasonal runoff with significant inter-annual variability. The sedimentary deposits of the Burdekin River display a number of characteristics that are not consistent with extant facies models for fluvial systems: 1) erosionally-based channel-fill lithosomes that exhibit complex lateral facies changes, with 2) abundant, pedogenically-modified mud partings, 3) complex internal architecture that may lack the macroform elements typical of other fluvial sediment bodies, 4) an abundance of sedimentary structures formed under high flow stage, and 5) an abundance of in situ trees that colonize channel floors and are adapted to inundation by fast-flowing water. A new facies model is presented for fluvial deposits of strongly seasonal, hot climates. The structure of the Holocene and modern Burdekin River Delta also reflects the climatic setting. The delta platform is composed largely of sharp-based, linear or lobate, coarse-grained channel and mouth bar sand bodies 5-8 m thick some of which show gently seaward-dipping internal bedding surfaces. The moderately-sorted, coarse-grained sand bodies are amalgamated in the upper delta plain, becoming separated by coastal mud beds downdip. The entire Holocene deltaic section is <25 m thick, and typically comprises a basal transgressive lag above a continental omission surface, overlain by a transgressive mud unit, in turn overlain by a sharply-based, composite sand unit of the highstand systems tract. At least 13 discrete deltaic lobes are recognized, representing the interval from c. 10 ka BP to present. The oldest lobes are the largest, with lobe area decreasing through time. These changes are probably due to a combination of decreasing accommodation and changing climate from a pluvial early Holocene regime to the ENSO-dominated climate of the past 4 ka. Ancient examples of comparable fluvial and deltaic deposits from the Pennsylvanian of Atlantic Canada and Cretaceous of Utah will be presented.