

Holocene intra-estuarine deltas of south-western Australia –testing and extending delta classification

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An *intra-estuarine delta* is a delta that occurs wholly within an estuary. The prefix 'intra' emphasises that these deltas are sedimentary accumulations *within* the estuary. They are relatively small in comparison to open-coastal deltas. South Western Australia provides excellent examples of relatively large estuaries with numerous inflowing rivers and a large number of intra-estuarine deltas which can be used for testing and exploring the classifications of deltas.

In the estuaries of south-western Australia, with asymmetric distribution of wave climates, and/or differential shelter from wind and wind-waves, intra-estuarine deltas do not readily conform to the idealised pattern of delta development and cannot be readily classified using traditional delta classification. For instance, they may show geomorphic asymmetry in response to their orientation to wave climates and wind, so that they may be wholly wave-dominated, or partly wave-dominated in one part, and fluviially dominated in another part of the delta system. In an estuary with symmetrical delta-land development a symmetrical stratigraphy usually develops but with asymmetry in evolutionary development the deltaic stratigraphy may be laterally asymmetrical.

To deal with such variations and to highlight them, we have developed a classification approach for intra-estuarine deltas, an approach that we believe also can be applied to open-coastal deltas. The classification involves identifying the delta attributes and systematically applying descriptors for these attributes in terms of delta size (megascale, macroscale, mesoscale), plan-form (lobate, cusplate, digitate, birds-foot, palmate, elongate, crenulate, rectangular, fretted, symmetrical, asymmetrical), internal landforms, , delta origin or genetics (*viz.*, wave-dominated, tide-dominated, fluviially-dominated, and whether the delta is monogenetic, *e.g.*, wholly wave-dominated, or poly genetic, *e.g.*, part wave-dominated and part fluviially-dominated), and homogeneity/heterogeneity of the stratigraphy. A full classification of an intra-estuarine delta is achieved by including all the attributes described above as adjectival descriptors. In south-western Australia, for instance, the Deep River intra-estuarine delta is a mesoscale, monogenetic wave-dominated, internally geomorphically asymmetric and stratigraphically asymmetric. The Preston River intra-estuarine delta, another example, is macroscale, polygenetic tide- and fluviially-dominated, internally geomorphically asymmetric, and stratigraphically asymmetric. The Harvey River intra-estuarine delta is macroscale, monogenetic fluviially-dominated, internally geomorphically and stratigraphically symmetric. As such, an intra-estuarine delta system, or even an open-coastal delta system can be classified systematically to separate and expand the diversity of delta types worldwide.

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