



Understanding Meandering River Evolution Through Combined Analysis of an Ancient Outcrop and Modern Analogues

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An assessment of ancient fluvial morphodynamics is made from the study of the depositional architecture, channel geometry and paleoflow pattern of the Middle-Jurassic Long Nab Member within the Scalby Formation of the Ravenscar Group (Yorkshire, UK). In this integrated study, drone/UAV data, field-based interpretations as well as geostatistical analysis from selected modern analogues, are used to improve the understanding of the development of the geology of Long Nab exposure. Modern analogues have been selected to match the depositional environment and degree of confinement of the predominant fluvial Long Nab member. Geostatistical attributes are extracted from these modern analogues of meandering rivers that represent both confined and non-confined meandering point bars deposits, in addition to the geostatistics derived from the Long Nab member itself. The parameters derived from the modern systems are channel width B_m , amplitude a_m , radius of curvature r_c , sinuosity s_i , wavelength λ_m , meander width ratio MWR, meander length ratio MLR, channel length L and migration rate M_r . Measurements of attributes were carried out across four case-studies using high resolution satellite-image datasets, with 3170 measurements from recent imagery, and 1390 measurements being collected from the available historical imagery. The geostatistical data derived from modern analogues is multi-dimensional in nature, which makes it difficult to undertake an analysis. Against this backdrop, applying data mining techniques such as parallel coordinates in order to investigate and identify the key relationships within the modern analogues data is vital. The implications of channel migration rate were also elucidated in this study.

Satellite imagery provide as wealth of information about modern systems, which can be used to improve the understanding relationships of both ancient fluvial morphodynamics and the evolution of point bar deposits with the modern rivers. Additionally, forward modelling studies can be implemented using the averaged geostatistical values with a view to generate an object-oriented channel model.