New Paleo-Surface Geology and Paleogeography Model for the Devonian Carboniferous of North America

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Abstract

New, high resolution palaeogeographic and palaeosurface geology reconstructions for the Devonian and Carboniferous of North America are presented. These epoch level reconstructions are compiled using a fully integrated workflow, utilising numerous different data sets. Palaeosurface Geology maps provide detailed information on the types and lithologies of rocks that may be weathered and eroded. Combined with source to sink relationships identified in the palaeogeographic maps, critical insights to the type and calibre of sediment transported to a basin may be determined, which is highly critical for basins with shale targets of this age in North America. The palaeogeographies are underpinned by our revised structural dataset and new North American plate model. Structural mapping was undertaken using Getech's extensive Gravity and Magnetic database, supplemented with SRTM data and published seismic and literature. Structures were mapped at a scale of 1:1,000,000 and detailed activation histories were established for each, providing crucial information on the role these played in controlling basin and depositional system evolution, as well as hinterland uplifts. Defined and constrained within the Getech Global Plate Model, a new plate model for North America has been generated using this structural history and kinematics, along with interpreted crustal architecture, plate boundary positions and a global palaeomagnetic reference frame. Extensive outcrop and well databases, plotted in their palaeoposition, constrained the depositional systems and the hinterland

areas for each palaeogeographic timeslice. The palaeosurface geology for each timeslice is reconstructed using detailed geological maps of the area. Geology younger than the mapped time period is removed and underlying areas reconstructed with extensive published literature and internal databases. This is done synchronously with the paleogeographic mapping to facilitate feedback into the depositional cycles, lithology and erosional surfaces, generating a more integrated and precise interpretation for both facets. The paleogeographies then form the basis for drainage and digital elevation model (DEM) construction. Integrating analysis of present-day drainage systems and their geomorphology with the tectonic history allows a detailed drainage evolution to be ascertained. New methodologies have been applied to DEM reconstruction, using revised present-day analogues for tectonic uplift and denudation rates.