Stratigraphic Architecture of Cenomanian Palaeovalley Fills, Central Part of the Bohemian Cretaceous Basin: Interplay of Base-Level Change and Tectonic Influences

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The relationship between relative sea level (base-level) changes at the shoreline and the changes in adjacent non-marine depositional systems remains one of the main challenges in sequence stratigraphy. Case studies of coastal-plain fluvial systems correlated to coeval shallow-marine strata are needed for better understanding of the controls on fluvial stratigraphic architecture. We present a study of fluvial to estuarine palaeovalley systems of Cenomanian age from the central part of the Bohemian Cretaceous Basin (Czech Republic). The palaeovalley fills were examined in outcrops and boreholes with the aim to interpret the local and regional (autogenic, allogenic) controls on the temporal and spatial changes in regional depositional geometries of non-marine strata as well as the variability in fluvial styles.

The tectonic framework of the study area was governed by three main structural phenomena: (1) The NW-oriented Labe Fault Zone, reactivated as a broad, dextral strike-slip fault zone during the mid-Cretaceous; (2) the NNE-oriented Blanice- Rodl Fault Zone, forming a conjugate (sinistral) fault zone to the Labe Fault Zone; (3) ENE – oriented fold and fault pattern of the Palaeozoic Barrandian terrane. These structural patterns controlled not only the trends and the topography of a palaeovalley system, characterized by a series of tributaries joining one major, NNE-oriented valley, but, in more tectonically active areas, also the clastic supply.

Understanding the spatial and temporal distribution of individual stratal complexes in the fluvial palaeovalley fills involved correlation between scattered outcrops to the south of the Labe FZ and subsurface (core/well log) data. This was attempted by using a combination of sedimentological analysis and outcrop gamma-ray spectrometry as the bridge between the outcrop and subsurface databases. The correlation between well logs spaced between hundreds of meters to 11 km showed that the fluvial palaeovalley fills contain a number of regionally correlatable surfaces of different genetic-stratigraphic significance, which separate stratal packages showing different lithologies, and, in outcrop, different architectures.

Two prominent types of surfaces were distinguished which could be correlated regionally and stood for key stratigraphic surfaces. The first type, termed an expansion surface, is defined by a pronounced fining in the grain size up to mud in well logs and organic rich lacustrine facies in outcrops, and reflects an expansion of the fine-grained floodplain facies at the expense of the coarse-grained channel facies. The second type, an erosion surface, is characterized by an abrupt coarsening in the grain size in well-logs, associated with erosion.

From the viewpoint of architectural changes across the key surfaces, the strata overlying the erosion surfaces are characterized by the dominance of coarse-grained channel fills, laterally and vertically strongly interconnected, interpreted as braided river deposits. Strata overlying the expansion surfaces are characterized by sheet-like sandbodies encased in floodplain fines, interpreted as meandering river deposits, or by mudstones with isolated channel-fills and local splay sandstones, with sparse occurrence of marine microplancton, which are interpreted as anastomosing river sediments.

Based on regional correlation of the above surfaces from proximal (fluvial) to distal (coastal, estuarine) facies, expansion surfaces are correlated with marine flooding surfaces and are interpreted as a result of a flooding of the palaeovalley, caused by an acceleration of the rate of base-level rise. Erosion surfaces are correlated with sequence boundaries caused by base--level falls with regional incision and slope rejuvenation or are coincident with the bottom of pre-sedimentary palaeovalleys. Expansion surfaces were not always identified. This could be caused by erosion of previously existing expansion surface by channel incision leading to channel facies amalgamation or due to persistence of main channels in the axial parts of the valleys.

The regional slope and the activity of local tectonic elements, such as the Kouřim Fault, were the main controls on the incised channel courses. The style and thickness of incised channel fills show a decrease in grain size in the direction away from the active fault, and a transition from a broad braided-stream valley fill, towards more localized, tidally influenced, heterolithic channel fills, in the same direction.

In general, the observed changes in fluvial facies and stratigraphic architecture are interpreted to reflect allogenic controls (base-level change), with local modification by autogenic factors such as local sediment supply, fault activity or depositional topography.

Syndepositional Geometry and Post-Depositional Deformation of the Krkonoše Piedmont Basin: A Preliminary Model

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The Krkonoše Piedmont Basin (KPB) belongs to a system of post-orogenic extensional / transtensional basins which formed in the Bohemian Massif in the early post-orogenic phase, between the Westphalian and Saxonian times (c. 310–280 Ma). Most of the basins in Western and Central Bohemia are aligned along the NE-striking boundary of the Saxothuringian Zone of