Interplay of Strike-Slip Tectonics and Eustasy in Coarse-grained Delta Systems, Bohemian Cretaceous Basin

David ULIČNÝ

Department of Geology, Charles University, Albertov 6, 128 43 Praha 2, Czech Republic

Sequence stratigraphic signatures in extensional and strike-slip basins are generally complex because of the influence that local fault activity has on basin topography, subsidence patterns and local sediment supply. The central part of the Bohemian Cretaceous Basin (Czech Republic) provides a combination of outcrop and subsurface (well log) data which allows to interpret the facies, palaeogeographic and sequence stratigraphic framework of shallow-marine/deltaic, Turonian through early Coniacian strata deposited within a system of strike-slip basins and intervening source uplifts.

The Bohemian Cretaceous Basin and its source terrains formed during the mid-Cretaceous, by reactivation of a system of anastomosed strike-slip faults which were inherited from the structural pattern of the Variscan basement of the Bohemian Massif. Individual sub-basins and source terrains formed within this anastomosed fracture system, characterized by NW-trending principal displacement zones and subordinate, NNW-directed shears. The structurally deepest depocentres of individual sub-basins were situated along the most active marginal fault zones. Compared to the classic strike-slip basin systems, this intracontinental setting was characterized by small subsidence rates (20-80 m/Ma during the Turonian).

The depositional style which dominated the sub-basins along the Lužice (Lausitz) and Intra-Sudetic Fault Zones during the Turonian and early Coniacian was characterized by systems of coarse-grained deltas which prograded from the fault-bounded basin margins and pinched out into the distal, offshore facies. The laterally extensive sandstone bodies of the Bílá Hora, Jizera, and Teplice Formations, commonly showing signs of reworking by tidal and wave-induced current action, are excellently exposed in the so-called „rock cities“ of North Bohemia. Some of the coarse-grained deltaic bodies were deposited close to the basin-bounding faults, others prograded as far as 60-70 km basinward, with resulting differences in internal geometry and stacking patterns. Ongoing sequence-stratigraphic research focused on two of these clastic wedges has brought some insights into their behaviour on basinal scale and its long-term and short-term controls.

The long-term shift in locations of the major clastic wedges in the largest sub-basin reveals a migration of the depocentre along the principal bounding fault, in the same direction as the strike-slip displacement of the source terrain. The migration of sediment source area along the basin margin fault zone caused a long-term increase in sediment supply at the end of the sub-basin which it was approaching, and a long-term tendency towards starvation and condensation at the opposite end. This strike-parallel shift in sediment supply interfered with a pattern of dip-parallel clastic wedge progradation. During the course of c. 6.5 Ma, three successive clastic wedges prograded from this basin margin. The individual progradational events were caused most probably by eustatic-driven, forced regressions.

Whereas the long-term controls on the coarse-grained deltaic deposition were strike-slip tectonics (which governed the shifts in sediment input as well as subsidence rates) and low-frequency eustasy, the short-term changes in depositional patterns were apparently driven by high-frequency eustatic fluctuations. Basin margin-detached wedges of the Jizera Formation (Middle-Upper Turonian), deposited during low-frequency lowstands, comprise a number of high-frequency sequences. The geometry and stacking patterns of these high-frequency sequences were influenced by short-term availability of accommodation in a slowly subsiding, distal part of the sub-basin, which resulted in rapid switching of the delta lobes.

The examples of clastic wedges from the Bohemian Cretaceous show clearly how profound influence may be exerted by tectonic-governed shifts in sediment supply on the resulting stratal geometries, which has implications for interpreting sequence-stratigraphic signatures in all tectonically active depositional settings.