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Interplay between compression and extension and its impact on basins evolution along the Europe-Adria suture in the area of Belgrade, Serbia

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The segment of the suture zone between units of contrasting Adriatic and European affinities situated in Belgrade area of central Serbia is composed of a complex tectono-sedimentary setting that was amalgamated during Cretaceous to Paleogene closure of the Neothethys Ocean. We have analyzed this Cretaceous sedimentary succession in the context of broader kinematic and depositional evolution of the Europe – Adria collision zone, where the basinal evolution was governed by the enduring processes of subduction.

A slice of oceanic lithosphere was obducted during the latest Jurassic times far towards the SW over the Adriatic continental margin creating an underlying ophiolitic mélange. This mélange contains radiolarites deposited over oceanic lithosphere, the youngest being of Early Tithonian in age. These radiolarites and the Cretaceous post-tectonic overlying the ophiolites cover define a Middle-Late Tithonian age of the obduction. The obduction was followed by rapid subsidence affecting the European margin during Cretaceous times, which was unconformably covered by a gradual deepening facies. The base of this overstepping sequence, generally referred as the Lower Cretaceous "para-flysch", is composed of thick layered shallow-water limestones that cemented large fragments of re-deposited Tithonian high-organic limestones. These are overlain by a turbiditic alternation of mudstones and sandstones that are laterally replaced by graded calcareous sandstones and breccias containing Lower Cretaceous microfauna and local large olistostromic fragments of re-deposited Upper Jurassic macrofauna. These deposits are overlain into a deep-water carbonatic succession containing often cherts and radiolarites replaced laterally to the S and SW by turbidites that marks the transition to the Barremian. These gradually deepening deposits with a highly lateral variation in paleo-bathimetry define an Early Cretaceous fore-arc basin system, its sediments being deposited over the European margin in the immediate vicinity of the Neotethys subduction zone, which is marked by a narrow accretionary wedge composed of coeval deposited of deep-water trench turbidites.

The on-going subduction during the onset of late Cretaceous times is accompanied by uplift and a gradual shallowing of the Albian-Cenomanian sedimentary facies. This was followed by regional subsidence and a gradual deepening of the sedimentary facies during contraction that was roughly coeval with the onset of back-arc extension in regions situated farther into the European domain (e.g., the Timok zone of the Serbian Carpathians). This coeval contraction and extension possibly reflects a stage of slab-retreat in the Neotethys subduction zone. In the Belgrade area, the sediments are composed of Cenomanian-Turonian coarse limestones and mudstones that are penetrated by numerous basaltic dykes and sills, associated with acid volcanism. It is likely that the emplacement of this bi-modal magmatism was facilitated by small amounts of localized extension affecting the fore-arc basin during the slab-retreat. This was subsequently covered by the typical post-Turonian – Paleogene turbidites of the Sava zone suture, which overlies in this specific situation also the sedimentary and magmatic succession of the fore-arc. We interpret this as a continuation of the fore-arc subsidence and its transition to the subduction trench. The collision of Europe with the Adriatic margin took place during the deposition of these latter turbidites, shallowing and ultimately exhuming the basin. The entire area was subsequently affected by the Miocene extension that created widespread normal faulting and covering with coeval deposits.

These findings infer that the contact area between Europe and Adria is more complex than a simple suture zone containing syn-contractional trench turbidites, explaining the widely observed covering of European margin by Early Cretaceous shallower-water sediments, late Cretaceous turbidites and coeval bi-modal magmatism. The evolution of the subduction zone adjacent to the subduction system affected by moments of roll-back and associated magmatism is a good alternative to existing ideas of multiple oceans in a very narrow area.