Late Jurassic evolution of the Steinernes Meer (Berchtesgaden, Germany), emplacement of the "Juvavic" Klippen, and the role of Hahn´s Miocene Hundstod overthrust

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Geological field work and rock analysis by the authors during the last 10 years and previous evaluations reveal that the Steinernes Meer (High-Tirolic nappe) consists of following parautochthonous Triassic-Jurassic sedimentary succession: Gutenstein and Steinalm Fms. (Early-Middle Anisian), Reifling Formation (Late Anisian to Late Ladinian), Wetterstein Formation (latest Ladinian to Early Carnian), Mid-Carnian carbonates/siliciclastics with overlying dolomites, carbonates of the Dachstein Carbonate Platform (Norian–Rhaetian), Adnet and Klaus Fms (Early–Middle Jurassic), radiolarites. Whereas in the south shallow-water conditions during Norian-Rhaetian times prevailed, the northern part of the Steinernes Meer is affected in the Rhaetian by Kössen influence. Therefore also the Early Jurassic Adnet Fm. in more southern positions changed to the north to more basinal deposits (Scheibelberg Fm.). In the late Middle Jurassic due to the change in the geodynamic setting mass transport deposits became intercalated into the radiolarites, rarely preserved in the Steinernes Meer. Upsection the radiolarite grades into the basinal to slope sediments of the Sillenkopf Fm. of Kimmeridgian to Lower Tithonian age consisting of a 20–120 m sequence of cherty, bituminous and siliceous limestones with intercalated mudflows, breccias and turbidites with shallow water organism. The shallow-water reefal material was shed from a newly formed carbonate platform on top of the today eroded accretionary prism south of the todays Northern Calcareous Alps.

This whole tectono-sedimentary sequence was in pre-Tertiary times preserved in a down-tilted block along an E-W striking normal fault. This block was inversely backthrusted to the S in the frame of the Miocene Lateral Tectonic Extrusion with an up to 2 km horizontal displacement and became later affected by sinistral strike-slip faults.

The Hundstod thrust system starts in the W with two subparallel S-directed thrusts: the northern one splits off from the strike-slip fault system of the Torrener-Joch-Zone and the southern branch of the Hundstod thrust develops around Weißbach from a swarm of small overthrusts, then strikes along lake Diesbach, and conjugates with the northern fault branch E of Mount Hundstod. Tertiary Augenstein Fm. and Lower to Middle Miocene coals in the overridden foot-wall block prove an at least Late Miocene age for the Hundstod thrust.

At an over-regional scale we interpret the Hundstod overthrust as a reaction on the Miocene N-movement of the Adriatic Indenter, combined on one side with a relative underthrusting movement of the southern part of the Steinernes Meer under its northern part and on the other side by a southward pressure impact from the Torrener-Joch-Zone during sinistral strike-slip movements. Such S-N shortening motions are still going on, accompanied by recent seismic activity along the W-E striking thrust system of the Werfen Schuppenzone, proving a northward shift of the Northern Calcareous Alps as reaction to the impact of the northwards directing Adriatic indentation, with dislocation of 0.5–0.8 cm/year of the Northern Calcareous Alps to the north.