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Integrated Stratigraphy of the Tertiary Upper Austrian Molasse Basin – dating basin wide events and correlation to the global stratigraphic framework

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Stratigraphic correlation between the Paratethys and the global stratigraphic framework remains a challenge because formation and stage boundaries are based on facies-dependent benthic foraminifera resulting in contradictory stratigraphic concepts and a lack of independent controls on ages. The Austrian Molasse Basin is covered by a 3D seismic-reflection data set, but correlation across the highly erosive Puchkirchen Channel (a basin-axial, submarine channel belt, active for c. 5 Ma) is challenging. Sedimentation within the channel from eastward-directed turbidity currents and debris flow starts within the Lower Puchkirchen Formation (LPF), continues forming the Upper Puchkirchen Formation (UPF) and terminates within the Base of the Hall Formation. After the cease of channel sedimentation, the basin rapidly shallowed. There are two basin-wide unconformities of unclear origin: The Northern Slope Unconformity (NSU), separating Zupfing Formation and LPF, and the Base Hall Unconformity (BHU) marking the top of the UPF.
Correlation within the basin and to the global stratigraphic framework was achieved through an integrated bio- and chemostratigraphic approach: benthic foraminifera, TOC, $CaCO_3$ and S values for the identification of formation boundaries, while an analysis of calcareous nannoplankton and carbon-isotope stratigraphy allowed for a correlation to the global stratigraphic framework. We analyzed 314 drill-cutting samples from three borehole locations, one on the northern overbanks of the channel and two on the southern basin slope.
Our results extend and improve the stratigraphic concept for the Oligocene/Miocene Austrian Molasse Basin. The NSU cuts into the Zupfing Fm., so the unconformity is older than the LPF (24.5 Ma), but younger than the Base of the Zupfing Fm (28.09 Ma). According to our stratigraphic correlation based on 13C-isotopes, the oldest deposits of the Puchkirchen Group are 24.5 Ma, the youngest are 19.6 Ma. The biostratigraphy based on nannoplankton is consistent with results of 13C-isotope analysis. This implies that there was only a minor time lag of migration from the ocean to the western Paratethys. We identified the Oligocene/Miocene boundary in two locations and show, that the onset of the LPF was diachronous. We showed, that the seismic reflector of the BHU, commonly used as indicator for the base of the Hall Fm., is not the actual base of the Hall Fm. The first sediments of the Hall Fm. are deposited during the final stage of the channel, up to 0.5 Ma before the BHU. The BHU correlates with a major sea-level drop in the basin and has an age of 19.6 - 19.0 Ma. The Hall Formation spans c. 19.6 to 18.1 Ma. The southern sites show great lateral variation of sedimentation: very proximal sources result in high, but local sediment input.
With the formation ages derived from nannoplankton analysis and 13C-isotope stratigraphy in combination with 3D seismic-reflection interpretation of submarine depositional environments, we improve correlation of the development of the Austrian Molasse Basin with the global stratigraphic framework and other Paratethys subbasins, such as the Vienna Basin and the Carpathian Basin, which must have received some of the masses of sediment transported through the Puchkirchen channel system.