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Detailed correlation of the classic Germanic Triassic with the marine Lower Triassic stages – A multi-stratigraphic approach

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Based on lithological criteria, von Alberti (1834) originally introduced the tripartite Triassic, the so-called Germanic Triassic. It was deposited in the southern part of the epicontinental Central European Basin, which is also referred to as the Germanic Basin in Triassic time. Now, the Germanic Triassic is considered a supergroup comprising: (a) the predominantly continental Buntsandstein, (b) the marine Muschelkalk, and (c) the mainly continental Keuper groups. Today, the term Triassic is used in a chronostratigraphic sense with the formal definition of stages and substages, the building blocks of the geological time scale, being tied to marine strata and defined by their fossil succession, above all ammonoids and conodonts. Thus, for the Triassic, two parallel concepts of subdivision have been established and gradually refined: (a) a high-resolution biostratigraphy for the marine strata and a high-resolution lithostratigraphy for the continental successions (e.g. Germanic Triassic). Using a multi-stratigraphic approach, including facies-independent methods such as magnetostratigraphy and stable isotope stratigraphy, a detailed correlation of both stratigraphic concepts is made. In Central Germany, the about 1 km thick mainly fluvio-lacustrine Buntsandstein succession (Lower Germanic Triassic) shows a pronounced cyclicity, which is interpreted to reflect climatic fluctuation of alternating drier and wetter periods due to solar-induced Milankovitch cycles. Combined with log-stratigraphy (e.g. gamma-ray from wells and outcrops), these cycles can be mapped over large parts of the Central European Basin providing a high-resolution lithostratigrapic framework, which is supported by numerous marker beds. The quasi-isochronous character of this framework has been proven by magneto- and biostratigraphic means, in which the latter is based mainly on conchostracans and sporomorphs as well as ammoniods

and bivalves in the partly marine Upper Buntsandstein. Based on an integrated biomagnetostratigraphy and in agreement with carbon isotope data, the position of the Hindeodus parvus calibrated Permian-Triassic boundary is located within the lowermost Lower Buntsandstein. The base of the Olenekian, which is proposed to be indicated by the first occurrence of Neosphathodus waageni, is located in the upper Lower Buntsandstein. In terms of biomagnetostratigraphic correlation, the Olenekian-Anisian boundary proposed to be indicated by the first occurrence of Chiosella timorensis, is situated in the uppermost Middle Buntsandstein. With respect to global correlation, numerical ages obtained from the marine realm can be imported, so to speak, into the Buntsandstein lithostratigraphy. This implies Buntsandstein duration of about 6 Ma, which is in good agreement with that derived from postulated Milankovitch cycles within the Buntsandstein, supporting this hypothesis.