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Depositional environment of the Bächental bituminous marl: Evidence for local and global controls of Pliensbachian to Toarcian organic matter accumulation

NEUMEISTER, S.¹, ALGEO, T.J.², GRATZER, R.¹, GAWLICK, H.-J.¹, NEWTON, R.J.³, SACHSENHOFER, R.F.¹

¹ Montanuniversitaet Leoben, Department of Applied Geosciences and Geophysics, Peter-Tunner-Straße 5, 8700 Leoben, Austria

² University of Cincinnati, Department of Geology, Cincinnati, OH 45221, USA

³ The University of Leeds, The School of Earth and Environment, Woodhouse Lane, Leeds, West Yorkshire, LS2 9JT, UK

The Bächental bituminous marls (Bächentaler Bitumenmergel) belonging to the Sachrang Member of the Lower Jurassic Middle Allgäu Formation were investigated using a multidisciplinary approach to determine environmental controls on its formation. The marls are subdivided into three units on the basis of mineralogical composition, source-rock parameters, redox conditions, salinity variations, and diagenetic processes. Redox proxies (e.g., pristane/phytane ratio; arylisoprenoids; bioturbation; ternary plot of iron, total organic carbon, and sulphur, trace element enrichment) indicate varying suboxic to euxinic conditions during deposition of the Bächental section. The strongest anoxia and highest total organic carbon content (up to 13%) occur in the middle part of the profile, coincident with a sea-level lowstand that induced salinity stratification in a stagnant basin setting. Thus, redox variations were controlled by minor sea-level fluctuations with the tectonically complex bathymetry of the Bächental basin determining watermass exchange with the Tethys ocean. Correlation of the thermally immature Bächental bituminous marls with the Posidonia Shale of SW Germany on the basis of C₂₇/C₂₉ sterane ratio profiles suggests that deposition of organic matter-rich sediments in isolated basins in the Alpine realm commenced earlier (late Pliensbachian; *margaritatus* zone) than in regionally proximal epicontinental seas (early Toarcian; *tenuicostatum* zone). The late Pliensbachian onset of anoxic conditions in the Bächental basin accords well with the early stages of the Karoo-Ferrar magmatism, suggesting that eruption of this large igneous province had a rapid impact on global climate and oceanic conditions in the Early Jurassic.