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On the Pliocene / Pleistocene transition in the Lower Rhine Embayment, Germany, based on magnetomineralogical evidence

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The more than hundred meter thick Pliocene-Pleistocene sediment of the Lower Rhine Embayment (LRE) in Germany and the Netherlands contains one of the most complete paleoclimate archives in North-West Europe. Based on the recognition of the diachronous deposition of sedimentary key layers, most recent lithostratigraphic work in the LRE challenges the traditionally accepted basin-wide chronostratigraphy. Any magnetostratigraphic dating used in the previous chronostratigraphic concept had so far never been backed up by magnetomineralogical studies to assess diagenetically induced remagnetizations and, hence, account for the rapidly changing environmental conditions.

Here we present a detailed paleo- and, for the LRE, first time magnetomineralogical study of a composite interval of Plio/Pleistocene sediment which was temporarily exposed in the opencast lignite pit Hambach. With respect to the paleoenvironment the sediment succession represents the change from Pliocene fine grained clastic backswamp deposits including several soil and peat horizons to deposits of a local river under increasingly cooler conditions to the lower parts of thick Pleistocene coarse grained sediments of the river rhine.

Our magnetic results indicates that: A) the entire section is characterized by a complex lithology independent mixture of secondary remanent magnetic minerals, dominated by iron sulfides and iron oxides reflecting short term variations in the geochemical depositional environment. In this context we introduce an evidence based method to identify the mineral greigite (Fe3S4) which is prominent in the sampled interval, B)

greigite was precipitated shortly after deposition of the sediment and can be used for magnetostratigraphy, despite of the secondary nature of the mineral and C) the G/M boundary is detected, however, in an unexpectedly high stratigraphic position in the sampled interval, which confirms the diachronous sedimentation during the investigated time span throughout the LRE.

With this study we provide the frame for ongoing paleomagnetic studies in order to synthesize a revised chronostratigraphy and paleoclimatic interpretation of the LRE Plio-Pleistocene deposits.