

Indications of a large eustatic sea-level fall at the Rupelian/Chattian boundary in the German Molasse Basin

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Indications of a large eustatic sea-level fall at the Rupelian/Chattian boundary in the German Molasse Basin

with 2 figures

by Kurt LEMCKE, Munich *)

Abstract

The regression of the sea from the area north of Lake Constance up to about Munich in the lowermost Chattian introduced by the deposition of the Baustein beds at the Rupelian/Chattian boundary is obviously caused by a drastic fall of the sea level. This drop evokes a considerable increase in sediment supply from the Alps and the Bohemian Massif.

Zusammenfassung

Der von der Bausteinschichten-Schüttung an der Rupel/Chatt-Grenze eingeleitete Meeresrückzug aus dem Gebiet nördlich des Bodensees bis etwa München wird offenbar durch eine drastische Meeresspiegelsenkung verursacht. Sie hat eine beträchtliche Steigerung der Sedimentzufuhren aus den Alpen und der Böhmisches Masse zur Folge.

At the final stage of a marine transgression extending from Eastern Bavaria more and more over the northern Alpine Foreland since the Upper Eocene (Priabonian), the shore line progresses westward at the Rupelian/Chattian boundary until far west of the river Iller. At this time the detrital deposition of the sands of the «Baustein beds», which has started during the upper Rupelian age in Switzerland («Horwer Platten»), moves from southwest and south into Bavaria (LEMCKE 1977: Fig. 5) – with a slight diachronism – up to the East of the river Lech in a marine-brackish shallow-water environment, from there moving eastward into a deeper marine facies. Petrographically they can be classified predominantly as limestone/dolomite arenites, relatively poor in quartz and partly conglomeratic (especially at the border of the Alps). They are the erosional products of the sediments covering the rising mountains, whose uplift now is proceeding from its western culmination gradually towards the East.

The prograding of the Baustein beds to eastern Bavaria indicates the prelude to a regression of the sea – locally accompanied by subaerial exposures (GRIMM 1957: 13) – to about the line Freising – Munich – Miesbach (Fig. 1) on the western margin of the East Bavarian Marginal Trough (VOIGT 1954: 22), which originated already during the Mesozoic. Here as a balance between the Baustein beds and the backward following sequence of limnofluviatile sediments of the Lower Freshwater Molasse (LFM) (= «Untere Süßwassermolasse, USM») an alluvial coast develops with a neritic shelf (delta plain) in the East, which remains more or less stationary for a long time. The LFM sediments, derived from the Swiss Alps and at first predominantly pelitic, are transported by a big system of rivers running nearly parallel to the Alps and cover more and more the preoligocene land surface northwest and north of the former shore line of the Baustein beds. This proves that the general subsidence effective since Upper Eocene times continues.

The regression – up to 150 km in an eastern direction – therefore cannot be regarded as a retreat of the sea e.g. by the more rapid and increasing advance of LFM detrital material maybe in consequence of a growing uplift of the supply area in the Southwest and South,

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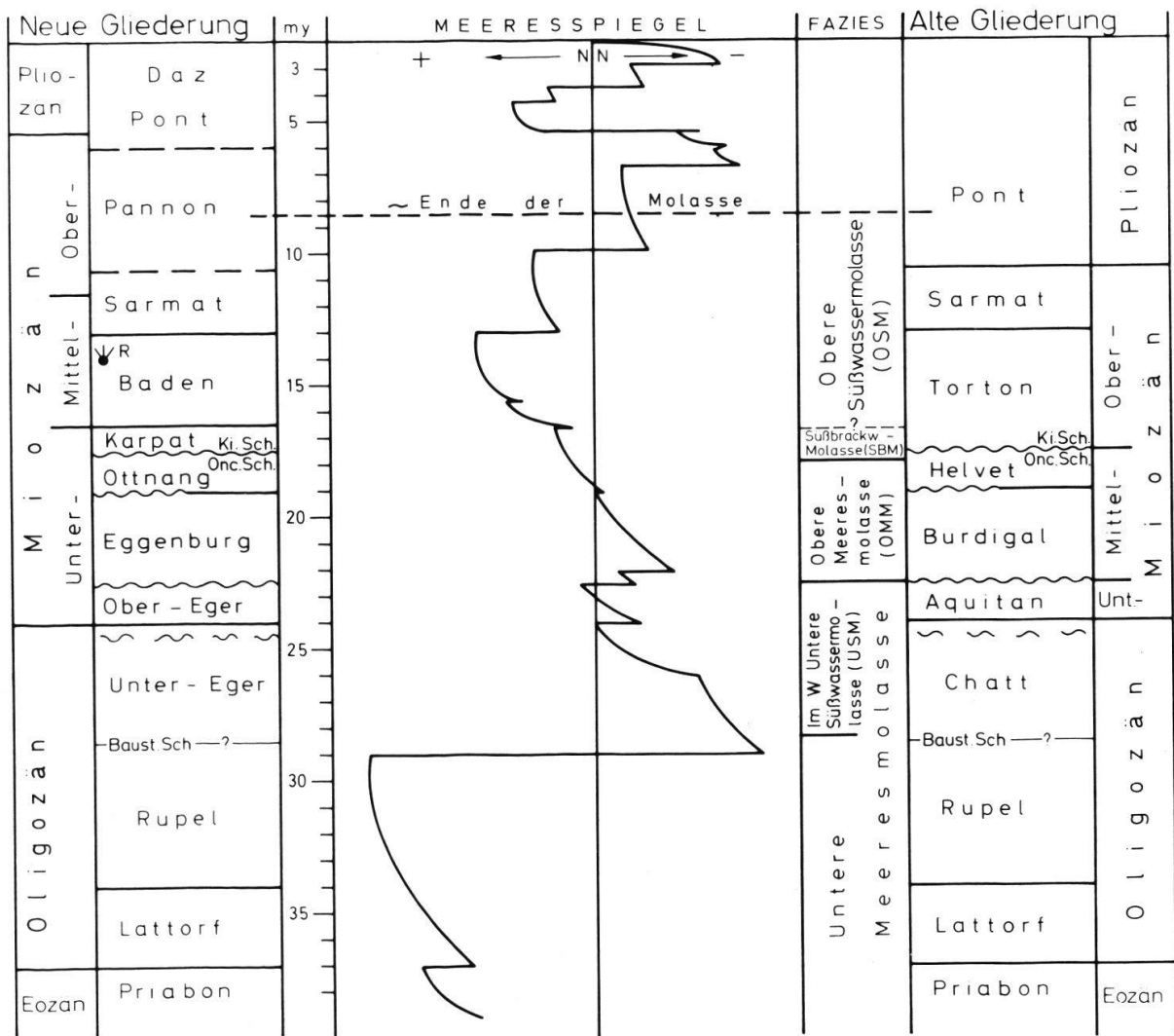


Fig. 1 Regression of the sea presumably due to eustatic sea level fall at the Rupelian/Chattian boundary. – Line with row of dots = NW-borderline of the Baustein beds; diagonally hatched area near Munich = balance land/sea above the Baustein beds; dashdotted line = NW-margin of the Lower Freshwater Molasse (= Untere Süßwassermolasse, USM) in the Chattian (accord. to KIDERLEN 1931: Fig. 2); arrows = main directions of sediment transport; horizontally hatched area east of Munich = approximate eastern border of the Chattian-sands; dots near Melk = Melk sands. Au. = Augsburg, F. = Freising, L. = Linz, M. = Munich, Me. = Melk, Mi. = Miesbach, S. = Salzburg (from Lemcke 1984: Fig. 2).

because the sea could nevertheless have transgressed northward upon its subsiding foreland, which didn't supply more than a few debris. However, the sea is regressing here too! This can probably be explained by a drop of the sea level (Fig. 2), which is indeed evident worldwide at this time – as the largest eustatic single movement since the Cambrian (VAIL et al. 1977: 84; HARLAND et al. 1982). According to VAIL & HARDENBOL (1979: 71, 77) the fall amounts to more than 200 m in 1 to 2 my.

This event likely caused a considerable increase of the erosion in the surrounding mountains as evidenced by the now intensified huge conglomerate fans above the Baustein beds (e. g. the Hochgrat «Nagelfluh» fan, Allgäu), which were deposited from the South in the area of the W – E – trough axis of that time. It is further evidenced by the broad fan of the fluviomarine Chattian-sands of Eastern Bavaria, which began in the lower part of the Chattian and are remarkably poor in gravels. Supplied from a central alpine source area (GRIMM 1965: 93) they extend far northward into the shallow sea – perhaps as a fine-grained rudimentary end member of the inneralpine «Augenstein» deposit.

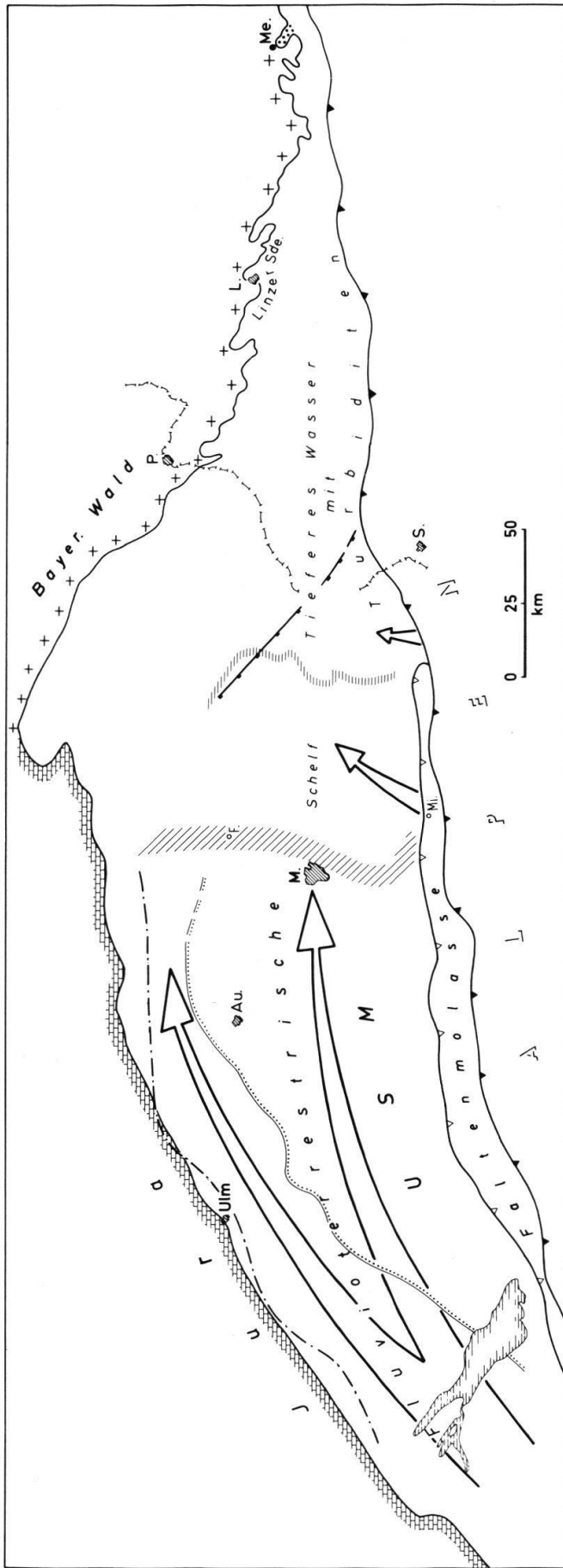


Fig. 2 Stratigraphy of the Molasse and eustatic sea level changes. - Baust. Sch. = Baustein beds, Onc. Sch. = Oncophora beds, Ki. Sch. = Kirchberg beds, R = approx. site of the Ries meteoric impact; wavy line = transgression. Molasse stratigraphy acc. to STEININGER et al. 1976: Tabl. 1, and FAHLBUSCH 1981: Tabl. 1; eustatic diagram from VAIL & HARDENBOL 1979: Fig. 8 (from LEMCKE 1984: Fig. 3).

The coeval turbidites of the Lower Puchkirchen Series which slid down into the deeper sea of SE-Bavaria and Upper Austria (MALZER 1981: 25; SHANMUGAM & MOIOLA 1982: 232) show the same indications as well as the Older Linz and Melk Sands supplied from the Bohemian Massif (GRIMM 1965: 95). Within the Alps the same event could be responsible for the deposition of the coarse gravels of the Oberangerberg beds of Chattian age which form the final member of the Alpine Tertiary in the Lower Inn Valley. TOLLMANN (1976: 456) considers these beds as the remnants of the North trending Augenstein gravels. Their maximum of deposition was in Chattian time and could possibly likewise be referred to the large eustatic drop of the sea level.

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