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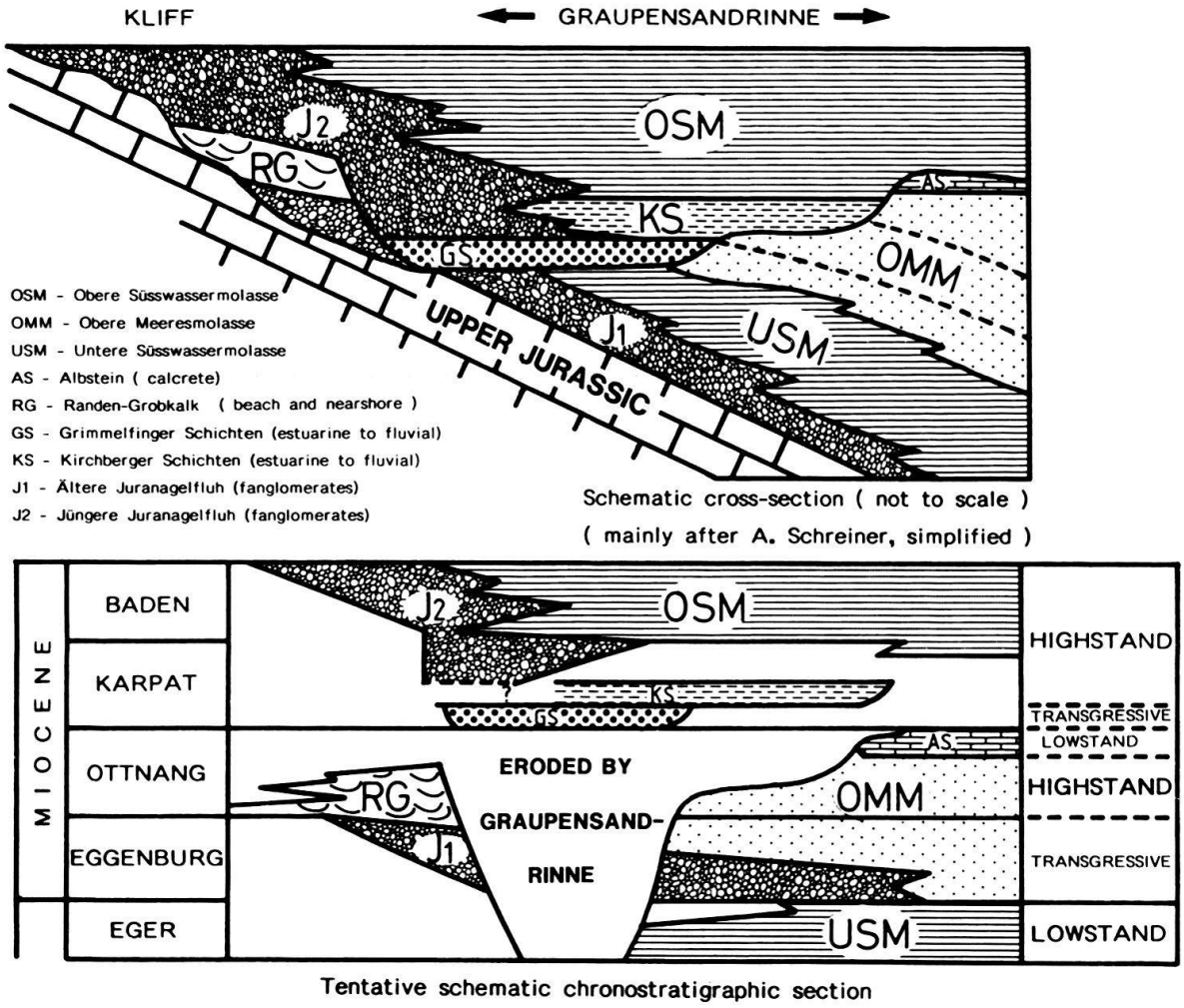

Fig. 3. Schematic cross section and chronostratigraphic section of the northern part of the SW German Molasse Basin.

An Impactite horizon in the Upper Freshwater Molasse in Eastern Switzerland: Distal Ries Ejecta?[1])

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The "Blockhorizont", a horizon in the Upper Freshwater Molasse containing angular fragments of Mesozoic rocks was discovered in 1945 by F. H. and interpreted as a volcanic phenomenon. After the recognition of the Ries as an impact crater, an impact origin was advocated for the Blockhorizont (Hofmann 1973). At that time, an origin from the Ries at 160 km distance seemed impossible and a local impact in the

[1]) Abstract to Poster

Swiss Molasse basin was assumed. The recent discovery of meteorites from Mars and Moon and the recognition of an impactite horizon at a distance of up to 500 km from the Acraman crater, Australia (Wallace et al. 1989), demonstrate that high-velocity ejection (several 1000 ms^{-1}) of only moderately shocked material is possible as a result of stress wave interference in near-surface areas close to impact sites (Melosh 1989). These new insights led to the reinvestigation of the Blockhorizont in order to strengthen impact arguments and to find evidence to prove or disprove a Ries/Steinheim origin.

The Upper Freshwater Molasse NW of St. Gallen, eastern Switzerland, consists of fluvioterrestrial marls with minor conglomerates and lacustrine deposits and a few volcanic ash horizons. The Blockhorizont is located about 70 m below the Bischofszell bentonite, dated with the K–Ar- and U–Pb-method (Fischer et al. 1987) at 14.6 and 14.4 $\pm$ 0.06 Ma, respectively. Assuming a typical Molasse sedimentation rate of 500 m per Ma, the U–Pb zircon age of the bentonite leads to an age of about 14.5 Ma for the Blockhorizont, in excellent agreement with the 14.8 $\pm$ 0.7 Ma age of the Ries crater.

The impactite horizon is contained in yellow-brown smectitic marl and is easily recognized in the field due to the abundant presence of angular blocks and fragments of fossiliferous limestone of Oxfordian to Kimmeridgian age (< 1 to 22 cm in diameter) and of angular red clay fragments, probably of Keuper origin (< 1 to 10 cm). Field observations and sectioning of marl blocs show that ejecta are distributed over a vertical extent of 10 to 15 cm. In the HCl-resistant sand fraction, quartz grains exhibiting several sets of parallel planar features (shock lamellae) were detected, providing clear evidence of impact-related shock metamorphism associated with the Blockhorizont.

The presently available data all are consistent with an origin from the Ries crater (with a possible contribution from Steinheim). At a distance of 160 to 200 km from the Ries, the high density of the ejecta is surprising. We estimate that the average density of Malm fragments is about 4 $kg * m^{-2}$, that of silicate grains 0.1 $kg * m^{-2}$. The high density of ejecta indicates that the Ries impact likely had a significant influence on the Miocene environment in Central Europe.

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