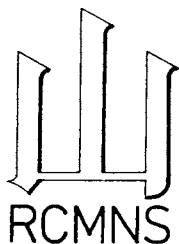


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## BURDIGALIAN AND HELVETIAN IN WESTERN SWITZERLAND

(Fig. 1, Tab. 1)



**Abstract:** The main faunal groups which occur in the Upper Marine Molasse (Lower Miocene) of Western Switzerland are given. Their study has led to a first biostratigraphical synthesis, which allows the integration of this molassic unit into the chronostratigraphic scales used in the Tethysian and Paratethysian domains.

**Резюме:** Предлагаются основные группы фауны из Верхней Морской Молассы (нижний плиоцен) западной Швейцарии. Их изучение привело к первому биостратиграфическому синтезу позволяющему включение этой единицы в хроностратиграфические шкалы использованные в тетидной и паратетидной области.

This note presents the most recent biostratigraphical results about the OMM ("Obere Meeres Molasse", i.e. Upper Marine Molasse) of Western Switzerland (Fig. 1). It is a stratigraphical group, of Early Miocene age, which is composed of about 1000 m of clastic sediments. Limited at his base by a sharp transgressive contact (Burdigalian transgression), this group is overlain by fluvial and lacustrine facies of the Upper Freshwater Molasse. Its lower part corresponds to the "*Burdigalian facies*". It is built of a tide- and wave-dominated sandy unit in which sedimentological (Homewood et al., 1981) as well as paleontological (Berger, 1985) analyses have been carried out. The upper part of the OMM, corresponding to the so-called "*Helvetian facies*", is represented by conglomerates, sandstones and marls laid down under fluvial, gravity, tidal and wave control. This series is characterised by the development of fan deltas (Schoepfer, 1987) and interfan areas on the southern margin of the molassic foreland basin.

At the base of the "*Burdigalian facies*", the benthonic foraminifera [90 species, which include *Pararotalia canui* (CUSHM.), *Uvigerina parviformis* PAPP, *Uv. posthantkeni* PAPP, *Elphidium ortenburgense* (EGGER)] point to an Eggenburgian age. The planktonic foraminifera collected in the same stratigraphical interval [with *C. dissimilis* (CUSHM. & BERM.), *Gs primordius* BLOW & BAN., *Gs altiapertura* BOLLI] belong to the N5 Zone.

Mammals from the levels of La Chaux, Vully 1 and Brüttelen 1 (i.e. NM2a, NM2b and NM3a) have been found at the top of the USM (Lower Freshwater Molasse) and at the base of the OMM. The diachrony observed in the Mammal-levels depends of the position of their localities within the basin (whether proximal or distal, East or West).

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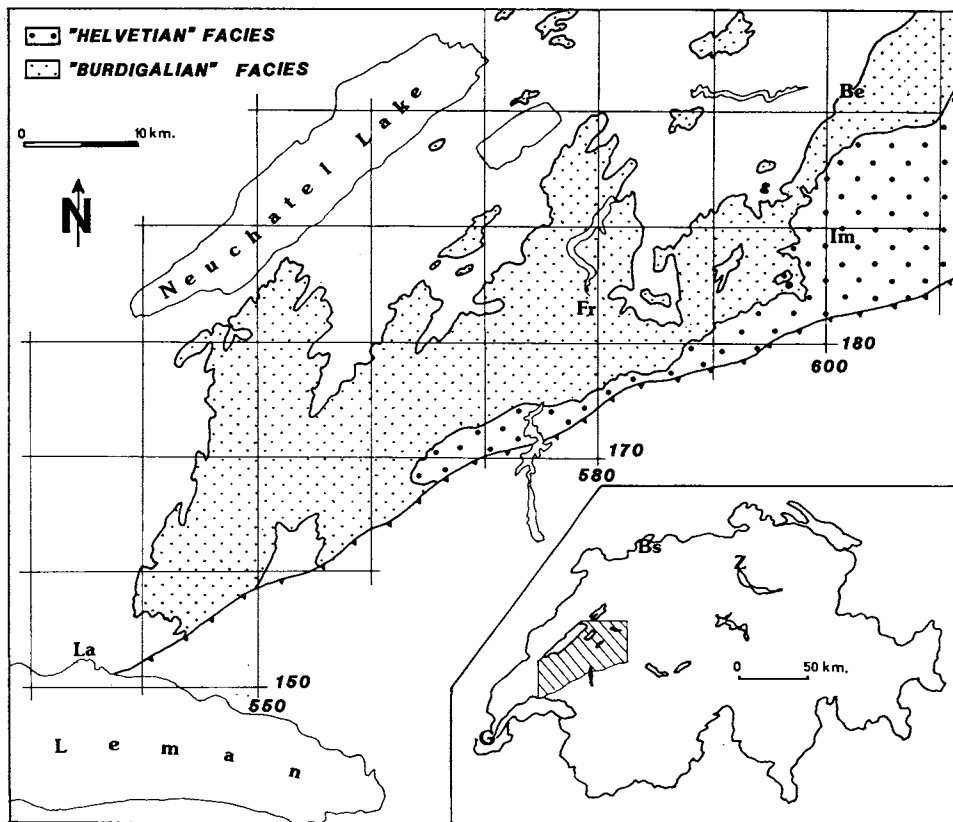


Fig. 1. The OMM (Upper Marine Molasse) in Western Switzerland.  
Be — Bern; Bs — Basel; Ge — Genève; Im — Imihubel; La — Lausanne, Z — Zürich.

The “*Helvetian facies*” has been dated by using four faunal groups. Despite very contrasted ecological conditions and faunal migrations, we do manage to obtain a good biostratigraphical adjustment by comparing the distribution of all groups.

The calcareous nannofossils indicate, for this facies, a time-interval comprised between the top of NN2 and the base of NN4 Zones. The older part of this interval is marked by the first occurrence of *Sphenolithus belemnus* BRAM. & WIL. and *Reticulofenestra pseudoumbilica* GART. and by the presence of *Helicosphaera ampliaperta* BRAM. & WIL. and *carteri* (WALL.) KPT. The last occurrences of *Sphenolithus belemnus* BRAM. & WIL. and *Helicosphaera* cf. *ampliaperta* BRAM. & WIL. point to the top of the interval.

Among the pectinids, the first occurrence of *Flabellipecten hermansenni* DKR, *Pecten helvetiensis* RUT. & STEIN. and possibly *Chlamys albina* V. TEP., and the presence of *Chlamys palmata* LAM., *Chlamys scabrella* LAM. and *Pecten hornensis* DEP. & ROM., delimitate the beginning of the stratigraphical

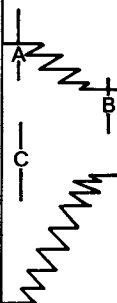
range of the "*Helvetian facies*". The youngest part of the latter should correspond to the last occurrence of *Pecten hornensis* DEP. & ROM. and *Pecten helvetiensis* RUT. & STEIN., and possibly that of *Chlamys palmata* LAM. and *Flabellipecten hermansenni* DKR.

In the group of benthonic foraminifera, *Stilostomella ottnangensis* (TOULA), *Hopkinsina bononiensis primiformis* (P. & T.), *Sigmoilopsis ottnangensis* C., C. & Z. and *Elphidiella cryptosoma semiincisa* WENGER, have been found typically. Whereas the first species is already present in the "*Burdigalian facies*", the last three seem to have their first occurrence in the "*Helvetian facies*".

Finally, the main planktonic foraminifera occurring in the "*Helvetian facies*" are *Globigerinoides trilobus immaturus* LEROY, *Globigerina ciproensis ottnangensis* ROEGL and *Globigerina dubia* EGGER. They seem to indicate an age included between the middle of the N6 Zone and the middle of the N7 Zone, at least not older than the last occurrence of the last two species.

Table 1

Stratigraphical position of the Upper Marine Molasse (OMM) of Western Switzerland

ABSOLUTE AGES in m.y. MAGNÉ & al. (1987)	NANNOPLANKTON MARTINI (1971)	PLANKTONIC FORAMINIFERA BLOW (1969)	MEDITERRANEAN STAGES	PARATETHYSIAN STAGES	MAMMALS		STRATIGRAPHICAL POSITION OF THE OMM
					MEIN (1975)	ENGESSER (1987)	
16	NN 5	N 8	LANG.	BADEN.	La Romieu	NM 5 Vermes 1	
17	NN 4	N 7	BURDIGALIAN	KARPAT.		NM 4b Hirschthal	
18	NN 3	N 6		OTTNAN.	NM 4a Wattwil Hintersteinbruch		
19				EGGENBURGIAN	NM 3b Bierkeller Brüttelen 1		
20	NN 2	N 5			Estrepouy Laugnac	NM 3a Vully 1	
					NM 2b La Chaux		
			AQUIT.		NM 2a		

Note: the different ages obtained for the top of the OMM:

A — according to Rutsch-Salaj (1974); B — according to Keller (1989, in prep.); C — according to Schoepfer (1989, in prep.).

To conclude, Tab. 1 summarizes all the results we have obtained. The correlations between absolute ages, nannofossils and planktonic foraminifera zones, and Mediterranean stages are taken from data published by Magné

et al. (1987). The correlations between the Tethysian and the Paratethysian stages are those presented by Steininger et al. (1982). According to all our biostratigraphical data, the stratigraphical position of the OMM is the following:

— the base of the OMM must be placed in the N5 Zone (possibly up into the N6 Zone in certain regions), between the 2 mammal-localities of La Chaux and Brüttelen, that is Early Burdigalian and Middle to Late Eggenburgian;

— the top of the OMM has to be placed in the N7 Zone, between Wattwil and Hirschtal, that is Late Burdigalian and Late Ottnangian to Karpatian.

The youngest marine beds occur in distal parts of the basin, therefore to the North (for example in the Jura Mountains). In the more proximal regions, the top of the OMM seems to be older, as shown by our results (Schoepfer, 1989, in prep.: C) and those obtained by Keller (1989, in prep.) in Eastern Switzerland (B). But in the area where the Helvetian stage has been defined, which is also in a proximal position, the youngest marine beds preserved at this place seem to be younger (A) than in the neighbouring areas that we have studied. That is because Rutsch & Salaj's datation is based on the discovery of *Globigerinoides bisphaericus* TODD, of which a single specimen has been found in Imihubel and two others at Gerzensee, 10 km further east. However, these specimens are no longer available for analysis because they have disappeared. In our present state of knowledge, there are no signs of occurrence either of *Globigerinoides bisphaericus* TODD or of some *Praeorbulina* in all the samples that we have studied.

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#### REFERENCES

- BERGER, J. P., 1985: La transgression de la Molasse marine supérieure (OMM) en Suisse occidentale. Münchner geowiss. Abh. (München), 5, 206 pp.
- BLOW, W. H., 1967: Late Middle Eocene to Recent planktonic biostratigraphy. 1st int. Conf. on Planktonic Microfossils, Geneva, 1, pp. 199—422.
- ENGESSER, B., 1987: Biostratigraphie mit Säugetieren in der Molasse. Mit Beispielen aus der OMM. Versamml. der SGG, Luzern 1987, Zusammenfassung.
- HOMEWOOD, P. — ALLEN, P., 1981: Wave-, tide- and current- controlled sandbodies of Miocene Molasse, Western Switzerland. AAPG Bull., Tulsa, 65/2, pp. 2534—2545.
- KELLER, B., 1989: Fazies und Stratigraphie der Oberen Meeresmolasse zwischen Napf und Bodensee (Schweiz). Diss. Univ. Bern (en prép.).
- MAGNE, J. — GOURINARD, J. — WALLEZ, M. J., 1987: Comparaison des étages du Miocène inférieur définis par stratotypes ou par zones paléontologiques. Strata, 1/3, pp. 95—107.
- MARTINI, E., 1971: Standard Tertiary and Quaternary calcareous nannoplankton zonation. Proc. 2nd Planktonic Conf., Roma, 2, pp. 739—785.
- MEIN, P., 1975: Résultat du Groupe de travail des Vertébrés. In: Report on activity of the RCMNS working groups (1971—1975), Veda, Bratislava, pp. 78—81.
- RUTSCH, R. F. — SALAJ, J., 1974: Eine Foraminiferenfauna aus dem Stratotyp des Helvetien (MAYER — EYMAR, 1858) Eclogae geol. Helv. (Basel), 67/2, pp. 431—434.
- SCHOEPFER, P., 1987: Systèmes de fan-deltas dans le bassin molassique de Suisse occidentale: faciès sédimentaires liés à une progradation. 1<sup>er</sup> Congrès franç. Sédimentol., Paris, Livre des résumés, pp. 301—302.

- SCHOEPFER, P., 1989: Sédimentologie et stratigraphie de la Molasse marine supérieure (OMM) entre Gibloux et Napf (Suisse). Thèse Univ. Fribourg (in prep.).
- STEININGER, F. — RÖGL, F. — CARBONNEL, G. — JIRICEK, R. — HUGUENEY, M., 1982: Biostratigraphische Gliederung und Korrelation: zentrale und westliche Paratethys, Rhone-Thal und Mediterraner Raum. In: JUNG, P. (Ed.): Nouveaux résultats biostratigraphiques dans le bassin molassique depuis le Vorarlberg jusqu'en Haute- Savoie. Doc. Lb. Géol. Lyon, Lyon, H. S. 7, pp. 87—91.

The authors are responsible for language correctness and content.

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