



Paleogene microfaunas and stratigraphy of the Allschwil-2 and DP-202 boreholes from the Southern Upper Rhinegraben and faunal reworking problems.

Pirkenseer C. (1), **Spezzaferri S.** (1), **Berger J.-P.** (1), **Roussé S.** (2) and **Fischer H.** (3)

(1) Dept. Geosciences-Geology, University Fribourg, CH-1700 Fribourg- E-mails:

claudiusmarius.pirkenseer@unifr.ch, silvia.spezzaferri@unifr.ch,

jean-pierre.berger@unifr.ch

(2) CGS / EOST, University Louis Pasteur, F-67084 Strasbourg, E-mail:

srousse@illite.u-strasbg.fr

(3) Kuntmattring 7, Ch-41107 Ettingen

The Mediterranean Sea and the Paratethys lost efficient connections with open oceans in the period from the Late Eocene to the Late Miocene. This isolation produced the proliferation of endemic planktonic foraminifers or planktonic foraminiferal assemblages different in richness and composition from those from open oceans. Therefore, regional biostratigraphic schemes have been developed for these restricted basins.

We present here the stratigraphic study of the two boreholes Allschwil-2 and DP-202 drilled in the Rhinegraben (Western Paratethys) and we document the presence and distribution of some Oligocene micro-faunas and -floras in the region.

Overview:

Borehole Allschwil-2 was drilled in 1927 to the Southwest of Basel (Switzerland). Two short lithological/lithostratigraphical overviews have been published since then (Hotz 1928, Fischer & Hauber & Wittmann 1971). The hole was drilled down to 922 m with an approximate dip of 10°. A more detailed sedimentological description of the retrieved cores has been recently performed.

The total thickness of the recovered Tertiary sediments, overlaying a Malm surface, reaches 892 m and includes ?Early/Middle Eocene to Chattian sediments. The characteristic “Serie Grise”, with the “Foraminiferen-Mergel” and “Fischschiefer” beds is particularly well developed. The deposits originate from a small graben-like sub-basin, separated from the main basin by the so-called Mulhouse Horst.

The upper 550 m of the sedimentary sequence include a more or less clayish facies (e.g. “Septarienton”), which was difficult to core. Therefore, samples representing this part are only 65 over a total of 283.

The washed residues contain abundant microfossils (ostracods, planktonic and benthic foraminifers, bolboforms, gastropod and bivalve fragments, occasionally otolithes, charophytes and echinoderms).

Hole DP-202 was drilled in 1963 near Mulhouse (France) in the central Alsatian Potash Basin. Ninety-two samples were taken from 190 to 722 m (the total thickness of the cored sediments was 532 m). The sedimentary sequence includes the “Haustein” beds, the “Serie Grise” and the lower part of the “Freshwater Beds” and their thickness is comparable to that observed in Allschwil-2.

Borehole Allschwil-2:

About 138 of 283 samples were available and have been studied (ca. 50% barren of microfossils). The preliminary results can be summarized as follows (from the bottom to the top of the hole):

- The bottom 150 m of sediments overlying the Malm surface (914 to 750m) are barren of microfossils.
- From 730 to 700 m, a marly calcareous series probably corresponding to the “Plattiger Steinmergel” and to the “Middle Pechelbronn Beds” contains rare benthic forams but is particularly rich in shallow marine ostracods, with a mass occurrence at its top (samples A-128 to A-130). This corresponds to the first Lower Oligocene marine ingression of the Upper Rhinegraben.
- From 610 to 480 m, the “Serie Grise” is rich in foraminifers with a mass occurrence of benthic forms between 610 and 600 m (samples A-72 and A-68). In particular, calcareous benthic species include, among others, abundant lenticulinids, polymorphinids, *Neouvigerina oligocenica*, *Pullenia bulloides*, *P. quinqueloba*, *P. quadriloba*, *Sphaeroidina bulloides*. Agglutinated forms are also abundant in some levels and include *Spirorutilus carinatus*, *Textularia laevigata*, *Sabellivoluta humboldti* and *Reticulophragmium* sp. *Sphaeroidina*

bulloides is associated with the deep marine ostracod *Henryhowella asperima*. These assemblages indicate the quick development of a second Lower Oligocene marine ingress into the Upper Rhinegraben.

- Sample A-39 at 491.5 m contain planktonic foraminifers such as *Zeaglobigerina ampliapertura*, *Globorotaloides* and *Catapsydrax* groups indicating Zone P20.
- The top of the “Serie Grise” and its transition to the “Molasse alsacienne” is well represented in samples A-31 to A-8a (from 300 to 220 m). They are rich in ostracods and foraminifers (with planktonic forms such as *Paragloborotalia opima opima*, *Chiloguembelina cubensis*, *Subbotina utilisindex*, *Catapsydrax* sp. and very abundant *Globigerina praebulloides* probably indicating the “middle” Oligocene Zone P21). These samples contain also charophytes, probably corresponding to the *Chara microcera* - zone. The ostracod assemblages (including *Cytheridea pernota*, *Loxoconcha favata*, *Pterygocythereis ceratoptera*, *Hemicyprideis helvetica*) indicate a transition from fully marine to a brackish / freshwater environment.
- Planktonic foraminifers are still present near the top of the borehole (Sample A-3 at 81.3 m contains abundant specimen of the *G. praebulloides* group, and *S. utilisindex*), even if these sediments correspond to the “Freshwater Beds” or “Molasse alsacienne”.

Borehole DP-202:

The micropaleontological study on this borehole is in progress, however, the percentage of the fossil bearing residues seems to be lower than for Allschwil-2:

- From 722 to 702 m sediments consist of mainly layered dolomites with occasional marl intercalations and is devoid of microfossils. They can be attributed to the “Haustein” beds.
- The lowest part of the “Serie Grise” (702 to 300 m) contains an abundant benthic foraminifer fauna. Species diversity in the “Foraminiferen-Mergel” beds is not as well developed as in Allschwil-2. Only a few planktonic foraminifers could be identified in the samples from the “Serie Grise”. From 340 to 300 m the abundance of microfossils increases dramatically and indicate a change from fully marine to a shallow brackish environment (“*Meletta*-Beds” to “*Cyrena*-Marls”) as it was observed also in Allschwil-2. High diversity of ostracods (308.0 m), planktonic and benthic foraminifers together with a mass occurrence (338.7 m) of skeletal elements of Ophiuridea (sea stars) and other echinoderms characterizes this part of the profile.

- From 300 to 190m only two sample with charophyte oogonias (200.3 m, 293.5 m) indicate the presence of the so called “Freshwater Beds”.

Reworked foraminifers:

Reworked planktonic foraminiferal genera from the Late Cretaceous (*Globotruncana*, *Heterohelix*), Paleocene (*Igorina*) and Early and Middle Eocene (*Acarinina*, *Morozovella*, *Truncorotaloides*, *Turborotalia*) have been found in both drillings. Their biostratigraphic and quantitative distribution as well as their paleogeographic significance are still in study. In Allschwil-2 the reworking starts in the Lower Oligocene with the so called “*Meletta*-Beds”.

Summary:

In both boreholes, microfossils allow to trace the upper Rupelian ingression (i.e. “Serie Grise”) spanning about 400 m of sediment. The lowest (“Foraminiferen-Mergel”) and the uppermost part of the “Serie Grise” (transition to the “Freshwater Beds”) are particularly rich in microfossils. About approximately 100 species of benthic and planktonic foraminifers and 15 species of ostracods allow a preliminary paleoecological and biostratigraphical interpretation.

Additional studies are focused on the development of the microfaunas and on the integration of outcrops and additional boreholes.

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