DATA TO THE EARLY JURASSIC FAUNA (GASTROPODA, BIVALVIA, BRACHIOPODA) AND FACIES RELATIONSHIPS OF THE SCHAFBERG AREA (SALZKAMMERGUT, AUSTRIA)

EIN BEITRAG ZUR FAUNA (GASTROPODEN, BIVALVEN, BRACHIOPODEN) UND ZUR FAZIES DES LIAS IM SCHAFBERG-GEBIET (SALZKAMMERGUT, ÖSTERREICH)

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INTRODUCTION

Mt. Schafberg belongs to the classical areas of Liassic research in the Northern Calcareous Alps and several monographies dating back to the 19th century deal with the rich macro-, but also microfauna from various lithologies.
From among the various Lower Jurassic formations, known at the famous geological highlight Schafberg, the biodetrital, crinoidal-brachiopodal limestones of Hierlatz facies is of extraordinary interest. This and the associated formations were studied by in situ collecting work carried out in the years 2000, 2001 and 2002 during joint Austrian-Hungarian field-trips, while our friend from Munich contributed to the microfacies analysis.
The most comprehensive description of the geology of Schafberg – situated within the "Schafberg-Tirolikum" tectonic unit – was published by Spengler (1911). Spengler initiated also the first microfacies study of the Schafberg region by Leischner (1969). The area may comfortably be divided into two main tectono-sedimentary units, separated by a large-scale overthrust at the northern foot of the Schafberg, recognized and named by Spengler (1911) as the „Grünsee Überschiebung" or „Grünseescherfläche" (Plöchinger, 1973).
The upper unit forms the bulk of the Schafberg consisting chiefly of Hierlatz limestones of extremely great thickness and grey, siliceous limestones of Lower Jurassic (mainly Sinemurian) age. The Hierlatz limestones are exposed on the southern slope of Schafberg in the form of coarse, not well-defined beds dipping roughly concordant with the slope. It represents the „bed-like" type of Vörös (1991) and can be interpreted as a wide belt of submarine, biodetrital talus of 200-300 m thickness. The source area of the biodetrital material may be sought toward the north, near or beyond the peak region of Schafberg, whereas the interfingering with more distal, basinal sediments can be seen nearly 1 km to the south (e. g. at Schafbergalpe).

HIERLATZ LIMESTONE

Microfacies

The lithologies of the Sinemurian Hierlatz limestone samples are inhomogenous and reveal a very differentiated sedimentation-regime during Liassic times. Besides crinoidal limestones and strongly condensed facies-types, the following microfacies types could be distinguished so far:

Crinoidal-biomicrite to sparite (wacke- to packstone)
Densly packed, often abraded crinoids (30-60%) and mostly broken brachiopod shells (up to 20%) are the main biota in this rock-type. Occasionally also spicula (below 5%) and rare foraminifera (*Involutina liassica* (Jones), *Reophax* sp.) occur. The micritic matrix can be replaced by syntaxial rim-cements.

Microlithoclastic pelbiomicrite to -sparite (pack- to grainstone)
Besides angular to rounded microlithoclasts and peloids (30-40%) echinoderms (-30%), thick-shelled ostracodes and some brachiopod shells are characteristic for this facies. Foraminifera are rare and represented by some undeterminable Nodosariids. The matrix is often recrystallised into microspar or replaced by syntaxial rim-cements.

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Condensed facies
This lithofacies is characterized by a high amount of Fe/Mn-crusts, mostly in a mm-scale, but sometimes up to several centimetres. The crusts are sometimes bored, or associated with ammonites or serpulids. The "normal-sediment" can often be classified as a foraminifera biomicrite (wacke- to packstone with predominant Involutinids) with a variable amount of echinoderms (10-30%).

Fauna of the Hierlatz Limestone

The **bivalve assemblage** of the Upper Sinemurian Hierlatzkalk of the Schafberg (a few dozen specimens) is less diverse than that of the type locality and consists exclusively of epifaunal taxa. Shallow burrowing heterodonts forming more than one third of the specimens of the Hirlatzwand-assemblage (Szente 1996a) are strikingly lacking. The bivalve taxa identified are listed as follows: *Praechlamys palosus* (Stoliczka), *P. rollei* (Stoliczka), *P. subreticulatus* (Stoliczka), *Praechlamys* sp., *Oxytoma (O.) inaequivalve* (J. Sowerby), *Limea (Pseudolimea)* sp., *Placunopsis* ? sp.

The **brachiopod fauna**, collected from the Hierlatz Limestone at Schafberg and its surroundings, is very rich: 62 taxa are represented by 815 determined specimens from 15 different collecting points. Most of these localities are situated along the southwestern slopes of the Schafberg. Some other important Hierlatz Limestone localities are at the Mondsee, Schwarzensee and Suissensee. The most common genus in the studied material is *Zeilleria* (282 specimens, 10 taxa), while the most diverse is *Liospiriferina* (250 specimens, 15 taxa). In addition to these genera, *Prionorhynchia*, *Cirpa*, *Calcirhynchia*, *Cuneirhynchia* and *Lobothyris* belong to the significant brachiopods. At the same time *Salgirella*, *Homoeorhynchia*, *Piarorhynchia*, *Gibbirhynchia*, *Orthotoma*, *Viallithyris*, *Linguithyris*, *Securina* and *Bakonyithyris* are represented by only a few specimens. Some badly preserved ammonoids were found in the Hierlatz Limestone of the Schafberg area which refer to the Semicostatum Zone (*Adnethiceras* ? sp., *Arnioceras* ? sp.; J. Pálfy, pers. comm.).

RED PLIENSBACHIAN "ADNET-TYPE" LIMESTONE

This unit is exposed in a narrow belt along the northern foot of Schafberg and consists of Upper Triassic „Plattenkalk", penetrated by vertical neptunian dykes filled with red, crinoidal-brachiopodal limestones of Pliensbachian age. This unit can be interpreted as a remnant of an Early Jurassic submarine horst. In the Pliensbachian, due to repeated distensive tectonic movements, gigantic fissures opened along the rim of the submarine horst. These trapped most of the biodetritus and lime mud what was previously swept and carried down to the southern basin. Our main collecting points were at Suissensee, Mittersee, along the road from Schwarzensee to Feichtingeck and at Meislalm.

Microfacies

Filament-crinoid-biomicrite (wacke- to packstone)
The characteristic debris of thin-shelled bivalves ("filaments", up to 30%) can be orientated either randomly or rather parallel to the bedding planes. Beside crinoids (10-30%) also detritus of thick-shelled bivalves and brachiopods, rare scattered bryozoans (in part with phosphatic crust), ostracodes, and a small rhyncholith occur.
The scarce foraminifera are represented by *Trochammina alpina* (Kristan-Tollmann), *Reophax* sp., *Textularia* sp., *Opthalmidium leischneri* (Kristan-Tollmann) and undeterminable Nodosariids and Lagenids.
Besides small, angular lithoclasts of unknown origin also subangular debris of Fe-Mn-crusts, but also small Fe-Mn- and phosphatic-knolls occur.

Ostracod-echinoderm-biomicrite (wacke- to packstone)
Although ostracodes (up to 10%) reach not the amount of crinoidal debris (15-25%), they are the characteristic fossil group of this facies-type. Thick-shelled, mostly disarticulated valves together with bivalve- and brachiopod-debris (together up to 10%), are orientated more or less parallel to the bedding planes.
Besides the foraminifera-fauna mentioned above, there occur also *Planiinvoluta carinata* Leischner, *Lingulina* sp. and *Lagena* sp. In addition also scattered bryozoas were found.

Echinoderm-spicula-biomicrite with forams and ostracodes (wackestone)
The main biota consists of echinodermal remains and spicula (each 15-20%). Besides ostracodes, also

foraminifera occur, being represented by *Trochammina alpina* KRISTAN-TOLLMANN, *Ammobaculites* sp., *Aeolisaccus* sp., *Opthalmidium leischneri* KRISTAN-TOLLMANN, *Nodopthalmidium* sp., *Trocholina turris* FRENTZEN and common, but in thin-section undeterminable nodosariids and lagenids. Of special interest are up to several cm large sponges, respectively their fragments. The interspace between the spicula-meshwork is filled by a micritic peloidal-packstone. Stromatactis-cavities are frequent, that are filled either with a blocky calcite or sometimes even with a peloidal packstone, the latter one often surrounding also these cavities.

Echinoderm-spicula-biomicrite (packstone)
Besides echinodermal remains (30-40%) and spicula (up to 20%), also micritic microlithoclasts (about 2,5%) and rare, badly preserved shells of brachiopods and bivalves occur.

Fauna of the red Pliensbachian „Adnet-type" limestone

From the fissure-filling limestones, in spite of the relatively low specimen number, a highly diversified **gastropod fauna** has been identified. The available material (44 specimens), consisting of new finds and Stoliczka (1861) originals, belongs to 14 genera and 18 species. The fauna is predominated by archaeogastropods, however, just the earliest occurrence of an aporrhaid species in the Alpine faunas gives one of the curiosity of the composition [*Pietteia (Trietteia) fischeri* (Stoliczka, 1861)]. Presence of the sinistral *Cirrus hoernesi* (Stoliczka, 1861) means also first ocuurrence of Cirridae in the Alpine Jurassic gastropod faunas.
Six species (8 specimens) are member of five pleurotomarioidean genera (*Cyclostomaria, Anodomaria, Pleurotomaria, Bathrotomaria, Laevitomaria)* that possibly belong to the carnivore group. Most of the remaining species are related to herbivore groups [*Anticonulus*, *Ataphrus*, *Crossostoma* (Trochoidea) and *Eucyclus* (Eucycloidea)], the latter genus indicates unconsolidated substrate, the trochoideans probably lived on hard ground.
A single identifiable specimen represents the usually bad-preserved gastropods from the Hierlatz Limestone: *Discohelix reticulata* Stoliczka, 1861 that is one of the four known specimens of four different localities.

The **bivalve fauna** of the red fissure-filling limestone (a few dozens of specimens) is dominated by the peculiar species *Praechlamys rollei*, reported as a frequent form at the Schafberg by Stoliczka (1861). It seems to be much probable that the syntypes whose whereabouts are unknown were also collected from Pliensbachian which can be thus considered as the stratum typicum of *P. rollei*. The abundance of *P. rollei* encountered at the Schafberg recalls the composition of some Upper Pliensbachian assemblages of the Bakony Mts. (Hungary) (Szente 1996b). Other bivalve taxa: *Praechlamys subreticulatus* (Stoliczka), *Entolium* ? sp., *Oxytoma (O.) inaequivalve* (J. Sowerby), *Limea (Pseudolimea)* sp., *Placunopsis* ? sp.

The **brachiopod fauna** collected from the Pliensbachian red limestones is very diverse: the 383 specimens belong to at least 27 taxa. In most localities the fauna is dominated by the large-sized species *Securithyris adnethensis* (Suess), what may suggest that the brachiopod associations rather closely reflect the composition of the original communities. The state of preservation is medium (or poor at Meislalm), but the inarticulated (single) brachiopod valves are subordinate; this also speaks against a longer transport of the shells. All but three of the 19 identified species were known previously from the Schafberg area (Böse 1898). The composition of the fauna shows great resemblance to the Late Pliensbachian brachiopod fauna of the Bakony Mts.: except *Cirpa briseis* (Gemmellaro), *Prionorhynchia* aff. *hagaviensis* (Böse), *Cuneirhynchia* aff. *dalmasi* (Dumortier) and *Liospiriferina semicircularis* (Böse), the other 15 species are known also from the Bakony. In conclusion, the Schafberg fauna belonged definitely to the Mediterranean province but shows transitional features between the Appennino-Transdanubian and the Carpatho-Sicilian subprovinces of Vörös (1987).

In conclusion, the Pliensbachian, red, crinoidal-brachiopodal limestones of Schafberg are very similar to their counterparts in the Bakony Mts. (Hungary), not only in their fauna, but also in their facies and paleotectonic setting. They represent the depositional environment „A" of Vörös (1986), i. e. the top regions of „seamounts" (submarine horsts), dissected by neptunian dykes. The Hierlatz limestones correspond to the depositional environment „B" of Vörös (1986), i.e. the slope and foot of submarine horsts. The most important difference lies in the scale of the phenomena: in the Bakony, the width of neptunian dykes is lesser (few metres as a maximum) and the thickness of the submarine taluses (Hierlatz limestones) never exceeds 100 m.

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