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Summary

The present work tries to establish a detailed stratigraphy of the Middle Jurassic Group (Dogger) in the eastern Helvetic Alps of Switzerland (Glarus Alps).

The analysis of numerous stratigraphical profiles in this region has furnished lithological and microlithological criteria which show an enormous complexity in the facies variations, especially in the lower part of the group. The interpretation of these results assists in unravelling the palaeogeographical and palaeotectonic history of a part of the north border of the Tethyan miogeosyncline.

The traditional subdivision into units carrying lithological names, with no regard for facies changes, has been replaced by a subdivision into four «formations», designated by local names from the type locality around Walenstadt (Canton of St. Gall). The following formations are proposed.

1. Molser formation. («Untere Aalenianschiefer»). Dark grey argillaceous shales, smoothly foliated, partly pyritic. Thin sporadic layers of crinoidal limestone or conglomerate at their base («Aalenianspatkalk», «Geissbachkonglomerat»). Age: Upper Toarcian to Lower Aalenian. 0-200 m.

2. Bommerstein formation. («Eisensandstein»). Lower part: sandy slates and slaty iron-sandstones. Middle part: banded iron-sandstones («Haupteisensandstein»). Upper part: red crinoidal limestones; sandy limestone; slate and quartzite. The boundaries of these three parts are not everywhere clear. Age: Lower to Upper Aalenian. 20-150 m.

3. Reischiben formation. («Graue Echinodermenbreccie»). The main part consists of massive crinoidal limestone, locally with sandy or spathic limestones. It contains some thin layers with fossils (mainly Ammonites) in the uppermost part. (Age: (Lower?), Middle to Upper Bajocian. 2-100 m.

4. Blegi Oolite. Mostly red coloured iron oolitic limestone; includes the ages of Upper Bajocian, Bathonian and Lower Callovian. 0-2 m.

In the studied area of the eastern Helvetides, including both the autochthonous and the Helvetic nappes, two distinct sedimentary areas can be recognized in the Dogger. *The north-western sedimentary area* is found in the autochthonous (eastern sedimentary cover of the Aar massif), the Sub-Helvetic and the Lower Helvetic nappes – the Glarus and Mürtschen nappes. Throughout the area the entire group is strongly reduced and does not reach more than about 40 m in thickness. *The south-eastern sedimentary area* of the Dogger is borne mainly by the so-called «Axen-Nappe»; thicknesses attain 150-400 m.

The autochthonous Dogger occurs in the following areas:

a) Tödi and Limmern region. A rather constant layer of sandy crinoidal limestone, with or without conglomerates, and the absence of black shales characterize the Molser formation. The Bommerstein formation here is a complex of shaly iron-shot sandstones with thinbedded white quartzites, spathic and sandy limestones. The Reischiben formation forms an unbedded massive wall, overlain by the Blegi Oolite.

b) Region of Vättis. The black sericitic shales of the slightly metamorphic Molser formation are more frequent, while crinoidal limestones and conglomerates are restricted to a small area. The three parts of the Bommerstein formation, sandy iron rich shales, iron-sandstones with calcarenites and shales are overlain by the spathic limestones of the Reischiben formation. The Blegi Oolite is a green and purple limestone including few deformed ooids.

c) Region of Tamins. All formations are slightly metamorphic; sericitic shales in the Molser formation; fine-grained siliceous and sericitic sandstones in the Bommerstein and recrystallized limestones in the Reischiben formation.

In the Sub-Helvetic Area and the Glarus nappe conglomerates and crinoidal breccias frequently occur at the base; they thin out or disappear completely in the Mürtschen nappe. In both Glarus and Mürtschen nappes the shales of the Molser formation are strongly reduced. The Bommerstein formation contains ironshot sandstones and a red echinoderm calcarenite which increases greatly in coarseness towards the south-east. The essential part of the Reischiben formation is a massive, fine-grained spathic limestone. This is overlain by the striking red bed of a well developed Blegi Oolite.

The most eastern portion of the Mürtschen nappe belongs in its facies to the south-eastern sedimentary area; it is found in the region of Reischiben hill, where the formations reach their

maximum thickness of about 400 m. The Molser formation, in its type locality (Mols), exposes a monotonous mass of slightly carbonatic argillaceous shales. The Bommerstein formation is most typically a fine-grained quartzite («Haupteisensandstein»), separated by shaly spathic limestones from a coarse, cross-bedded crinoidal breccia and the succeeding argillaceous shales. The Reischiben formation is a non-differentiated series of grey crinoidal limestones, exploited in a quarry near Walenstadt. The same facies, reduced to about 150 m, is shown in the north-western part of the next higher tectonic unit, the Axen nappe. Towards Sargans, to the south-east, the red crinoidal limestones of the Bommerstein formation are replaced by grey fine-grained alternations of sandy limestones and spathic sandstones. The Blegi Oolite, quite prominent above Walenstadt, thins out gradually and is lacking entirely in the Gonzen area.

The two main facies districts of the eastern Helvetic Dogger differ mainly in thickness. They are separated by the old border of the Alemannic Land of Liassic time. With the transgression at the end of the Lias this border became a submarine ridge («Dohlen-Rottor-Schwelle»). In the east of the Linth valley this old border is exposed only in the Rottor area, where Dogger transgresses on Verrucano (Permian). Here, the coarseness and high hematite content of the red crinoidal breccia point to the occurrence of a scarp towards the strongly subsiding Reischiben trough in the east, indicated also by the sudden ten-fold increase of sediment thickness. On the west side of the Linth valley, in the Dohlen area, analogous conditions in facies and thicknesses caused by a Mesozoic fault, discovered by SCHINDLER (1958), show the continuation of this ridge towards the west.

The erosion of the Alemannic Land is responsible for the clastic sedimentation of the Molser and Bommerstein formations, while an irregular bottom relief caused the horizontal inconsistency of these formations. With the Reischiben formation and Blegi Oolite, more uniform deposition over wide areas was achieved, and the lack of terrigenous material suggests entirely thalattogenous conditions in a platform extending over the whole region.

The heterochronism of the base of the Middle Jurassic can be confirmed by some new ammonite finds in the Tödi area. The basal crinoidal breccias, previously attributed to the Lias, contain ammonites of *scissum* and *sinon* zones (Lower Aalenian), whereas further to the east the age of the same bed in the Glarus nappe is uppermost Toarcian (*aalensis* zone) and Middle to Upper Toarcian in the basal breccia of the Vättis area. Outside the studied area, the basal crinoidal limestone in the autochthonous region of the eastern Bernese Oberland has furnished ammonites of Lower Aalenian age, further demonstrating that the transgression moved from east to west.

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