Lower Paleozoic

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Proposals and discussion
Lithostratigraphy
Chronostratigraphy

2.3.10 Madot Formation - MAD

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Authors: From the Madot hill east of the canal, SE of the Fauquez canal bridge. Informally mentioned in Van Grootel et al. (1997) and formally in Verniers et al. (2001). Described in detail by Verniers et al. (2005). Volcanic rocks of the Bois des Rocs have been described since Omalius d'Halloy (1808, 1828) and after by Dumont (1848) and Malaise (1873). A detailed historical overview can be found in Verniers et al. (2005, pp. 160-164).

Description: Unit containing many volcanic rocks (volcano-sedimentary rock, volcanic breccias containing shale fragments), interstratified with greenish-grey heterogeneous coarse siltstone and mudstone rich in macrofossils such as bryozoans, brachiopods, crinoids, trilobites, rugosa corals and pelmatozoans. Also interstratified are black, dark grey to bluish shale and fine siltstone that often contain dispersed single crystals of volcanic origin. Subdivided in the Sennette valley into 7 members (Verniers et al., 2005). Member 1: dark grey to bluish shale and fine siltstone, with no stratification observed and characteristic presence of large, coarse sandy grains, single or in clusters up to 25 cm long, interpreted as volcano-clastic material incorporated in the mud matrix; contact with member 2 is quite sharp. Member 2: at least 7 fining or coarsening upwards sequences of poorly sorted grey greenish siltstone, sandstone and conglomeratic levels of volcano-clastic origin with a thin marine shale interval. The conglomerate contains centimetric to sub-centimetric shale clasts. Member 3: homogeneous black to dark grey shale; the contact with the underlying member 2 is clear and with the overlying member abrupt. Member 4: greenish-grey heterogeneous coarse siltstone with at the base a 10 cm thick coarse, breccia-like interval with clasts of pelite or volcanoclastic rock; no stratification observed; numerous macrofossils such as bryozoans, brachiopods, crinoids or trilobites; gradual transition over 10 m to the covering member. Member 5: dark grey to black shale dotted with clusters of light grey grains. In the upper part of the member a coarse, sandy bed is present. Within this unit a large boulder (>1 m) of volcanic origin can be observed. There is an abrupt transition to the coarse volcano-sedimentary rock of the overlying member. Member 6: dacite, dacitic volcanic breccia, sometimes containing shale or slate fragments, volcano-sedimentary rock and black shale. The volcanic complex of the Bois des Rocs, part of member 6, is described in more detail by André in André et al. (1991). Member 7: dark grey to black silty shale dotted with brownish to orange alveoli, the remnants of dissolved calcareous fossil fragments or of the alteration of volcano-clastic grains or minerals.

In the Senne valley numerous small outcrop of volcanic and volcano-sedimentary rocks are observed (Ittre-Rebecq map, Herbosch et al., in press). The only good section described in detail by Mortelmans (1952) show about 180 meters of tuffs and « tuffites » interstratified with shale and shale with fossils debris. The presence of cross-stratification in the tuff attests for a shallow deposition. This is also show by the observation of in-place corals that have grown on dacitic submarine flow (P. Van den haute, ms 1974 and L. Andre, pers. comm.).

The lower boundary with the Fauquez Fm. is not observed, but supposed to be gradual. The upper boundary of the formation is unobserved in the Sennette valley because of the presence of a large fault and not well observed in the Senne valley.

Stratotype: Sennette valley, south of the Fauquez bridge, close to the locality Madot, in sections along the east side of the canal between km 38.06 and 37.81, and on the west flanc of the Sennette valley in the hamlet of Fauquez and in large outcrops in a side valley at a locality called Bois des Rocs.

Area: Senne and Sennette valleys, Nivelles area and Orneau valley. Probably also in many boreholes in the central part of West-Flanders and southern East-Flanders. The Lichtervelde Fm. in the Lichtervelde borehole (-291 to 415,10 m) is equivalent in definition (Legrand, 1964, 1966 in Martin, 1969a). The latter formation is not kept as a valid unit, because unfortunately only a few core samples are kept at the Belgian Geological Survey, a prerequisite for formal status of a unit.

Thickness: About 100 m on the east side of the Sennette valley and >300 m on the west side of the valley, due to a marked thickness increase of the volcanics of member 6 (only 10 m in the east and estimated at >130 m in the west in the Bois des Rocs). Member 1: estimated at 85 m, Member 2: 24 m, Member 3: 7-10 m, Member 4: about 52 m, Member 5: 28-45 m, Member 6: >50 m and Member 7: tentatively estimated at >40 m. More than 180 m in the Senne valley (Mortelmans, 1952).

Age: Macrofauna and flora include crinoids, bryozoans, brachiopods, trilobites, corals and pelmatozoans. The trilobites determined by Richter and Richter (1951), possibly deriving from this formation in the Orneau valley indicates an upper

Katian (early Ashgill) age. Graptolites are absent in the outcrop area but were found in several levels in the Lichtervelde borehole and were restudied by Maletz and Servais (1998). Graptolites in the middle part of the formation in the borehole indicate the *D. complanatus* biozone and graptolites in the top of the formation in the borehole indicate the *D. anceps* biozone (coarsely the middle part of the Ashgill). Chitinozoans are the only (micro)fossil group providing an age for the outcrop area. By the presence of *Tanuchitina bergstroemi, Lagenochitina baltica, L. prussica* and *Belonechitina robusta* found in a first study by Van Grootel & Verniers 1998 and by Samuelsson & Verniers (2000), found possibly the Upper Vormsi or lowermost Pirgu of the Baltoscandian stages, latest Caradoc to early Ashgill age, was indicated, correlated with the upper *linearis* and *complanatus* graptolite biozones. A more detailed study on the chitinozoans by Vanmeirhaeghe et al. (2005) placed the formation in the *spinifera* (and possibly also in the *bergstroemi*) biozone which give an Onnian (latest Caradoc) age for the lower part of the Madot Formation (members 1 to part of 4) and a Pushgillian to Cautleyan age (early to mid Ashgill) for the upper part of the Madot formation (upper part of member 4 and members 5 to 7). All of it is situated in the Katian stage.