

***Interactive comment on “Natural versus anthropogenic genesis of mardels (closed depressions) on the Gutland plateau (Luxembourg); archaeometrical and palynological evidence of Roman clay excavation from mardels” by J. M. van Mourik et al.***

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Natural versus anthropogenic genesis of mardels (closed depressions) on the Gutland plateau (Luxembourg); archaeometrical and palynological evidence of Roman clay excavation from mardels J. M. van Mourik, D. J. G. Braekmans, M. Doorenbosch, W. J. Kuijper and J. van der Plicht.

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the critical comments. and detailed remarks (Shelley) that we can use to improve the quality of this paper improve our paper.

This paper aims to contribute to the questions about the genesis of closed depression (mardels) on the Gutland plateau in Luxembourg (NW-Europe). Previous research results (1963-1999) indicated dissolution of gypsum lenses, occurring in the Keuper marls as responsible. In more recent publications (2011-2015) the CD's were explained as (Roman) clay excavations based on the observation that the (present) mardel fillings were dated as Post Roman. These researchers did not pay (any) attention to the soil processes, responsible for soil erosion and colluvial deposition in mardels on the plateau.

We tried to contribute to the mardel discussion by following a sequence of research steps. 1. Description of the controlling soil processes, responsible for colluvial deposition in mardels (development of stagic Alisols, lateral clay leaching). On the gentle slopes of the plateau, mardels are sediment traps; mardel sediments have a higher clay content than the soils in the surrounding. 2. Dating of the colluvial deposits by (pollen analysis, including pollen density). Special attention was paid on the (palynological) properties of the boundary between mardel deposits and the underlying (paleo)sol. 3. For the interpretation of the pollen diagrams of mardel deposits, we had to create a reliable schedule of the palynological time markers because dated palynological references for Luxembourg are hardly available. For that reason we resampled Dauwelsmuur. Previous investigated and published by Schwenniger, but the vertical resolution of that diagram was insufficient and radiocarbon dates were not available. The present diagram has a much better resolution and a perfect registration of the relevant palynological time markers, sustained by reliable radiocarbon dates; the horizontal distance to the Strassen marls mardels is less than 10 km, to the Keuper mardels less than 20 km. 4. Close to a Keuper mardel cluster, east of Michelbouch was an archeological Roman excavation spot(Biischtert). This provided us the unique possibility to test the probability if Romans really used mardel clay for the production of pottery. Of

course we tried to find more samples of pottery, but on the Gutland plateau was in 2015 the only available spot.

We agree with the reviewers that the structure of this paper can be improved by following strictly the four mentioned steps. Dauwelsmuier (location must be added in fig.1) is not a mardel on the Gutland plateau (altitude  $\approx$  400 m) but a small basin in the debris of a landslide on a sandstone escarpment (altitude 244 m). The controlling soil process in weathered sandstone is tends to podzolizing, not clay leaching. In this depression pure peat could accumulated from  $\approx$ 6500 BP till  $\approx$ 550 BP. Purified leaf particles were used for reliable radiocarbon dating. In the next version of this paper we will use the pollen diagram (fig.4) just for a correct description of the palynological time markers that we can use to date the mardel sediments. Also the period that Romans were present in the region needs more attention. In contrast to the study of Schwenninger, our aim is not a description of the local vegetation development, so this part will be skipped. Organic matter in mardel sediments are not reliable for radiocarbon dating because of the accumulation of (upslope) eroded soil organic matter. This concerns all humic fractions, including (very scares) macro remains. An exception was the thin peat layer that we found in the Beaufort4 mardel (one of a cluster of five mardels on the Strassen marls) between the quarry floor and the colluvial strata. We used this peat for reliable radiocarbon dating. OSL dating cannot be applied on clayey sediment. What about the amount of samples, used for the XRF analyses, we will specify better the sample size and add more data to the set. From the Biischtert spot we have pottery samples as well as brick stone. However, we have to accept that this is the only available spot for samples. We used this unique possibility for the XRT analysis to try to confirm the anthropogenic origin of mardels on the marls.

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