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НОВЫЕ МЕТОДЫ И РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЙ ЛАНДШАФТОВ В ЕВРОПЕ, ЦЕНТРАЛЬНОЙ АЗИИ И СИБИРИ

Монография в 5 томах

Том I Ландшафты в XXI веке: анализ состояния, основные процессы и концепции исследований

В содружестве с Академией почвенного плодородия Митчерлиха (МИТАК), Паулиненауэз, Германия

Москва 2018
NOVEL METHODS AND RESULTS OF LANDSCAPE RESEARCH IN EUROPE, CENTRAL ASIA AND SIBERIA

Monograph in 5 Volumes

Vol. I  Landscapes in the 21th Century: Status Analyses, Basic Processes and Research Concepts

With friendly support of the Mitscherlich Academy for Soil Fertility (MITAK), Paulinenaue, Germany

Moscow 2018

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This monograph shall inform you about up to date methodologies and recent results in landscape research. It is intended as a guide for researchers, teachers, students, decision makers, stakeholders interested in the topic of landscape science and related disciplines. It provides information basis for decision makers at various levels, from local up to international decision bodies, representing the top level of landscape science in a very short form.

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ISBN 978-5-9238-0246-7
ISBN 978-5-9238-0247-4 (Tom 1)
DOI 10.25680/7920.2018.82.47.001

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ABSTRACT. During the Late Middle the countryside of Brabant saw a profound transformation. One of which was the development of plaggen cultivation, an intensive form of farming in which organic material from outlands were used for fertilization of an infield, allowing it to be cultivated for a prolonged period of time. The system of plaggen cultivation led to the forming of convex fields and the man-made soils which have become a characteristic element of the Brabantic landscape. To understand this development and the wider agricultural practice in which is embedded, archaeological research was carried out at an open field complex in Veldhoven, the Netherlands. This included extensive micromorphological analysis of plaggenic anthrosols to get a more detailed understanding of the formation process of the man-made plough soils, the origins of the plaggen used and the various forms of tillage. Analysis of the selected examples revealed a gradual degeneration of the outfield as a result of repetitive stripping and showed, apart from the plaggen, the use of additional organic material from different sources, such as household waste, to supplement the available manure.

KEYWORDS: Plaggic Anthrosol, Middle-Age, Archaeopedology, Soil-Micromorphology, Netherlands

INTRODUCTION

In the late Middle Ages the rural landscape of present-day North-Brabant (the Netherlands) underwent a profound transformation [1]. Within a seemingly short timespan settlements were relocated, farmhouse construction changed and fields were rearranged, restructured and extended. In addition, farmers adopted an intensive infield-outfield strategy in which sods (plaggen) cut from the marginal (heath)lands were used for fertilization of the infield.

The use of plaggen enabled the farmers to complement the scarce amount of manure and increase the available nutrients and was combined with a more intensive form of husbandry. The sods were used as bedding in the byres where they could soak up the manure of the livestock which were kept indoors for longer periods at a time. The mixture of sods, manure and household waste was then applied to the fields.
Because the plaggen included the plant roots they contained a substantial amount of sand. This sand obviously does not decay and accumulated on the fields. Overtime plaggen-manuring would lead to the in the forming of convex fields and the thick man-made soils which have become a characteristic element of the Brabantic landscape. In some areas these humous soil horizons could grow up to 1.5 m thick. These so called plagge horizons are characteristic for the soil type Plaggic Anthrosol [2]. Outside North-Brabant these soils are commonly found in the eastern parts of the Netherland and certain parts of Germany, Scandinavia and Great Britain.

The development of agriculture and the rural landscape in the Middle Ages and early Modern Period were the focus of archaeological research at an open field complex in Veldhoven [3,4]. To get a more detailed understanding of the formation process of the man-made plough soils, the origins of the plaggen and the various forms of tillage a micromorphological study was incorporated in this research. For this analysis Plaggic Anthrosols from nine locations (fig. 1b) in the field complex were analyzed. In this paper one example from this study is presented (fig. 1a).

MATERIAL AND METHODS
The substrate of the area consists of Pleistocene sand. The Podzols that once formed in the top have been largely absorbed in the plough soil through tillage. As a result of the use of plaggen the composition of the soil matrix of the Anthrosols deviate from the substrate and show subtle variations throughout the field complex.

At various locations in the open field complex test trenches were dug to study the soil stratigraphy and collect samples and datable finds from the layers. At location 2 six soil samples were collected for micromorphological analysis (Fig. 1).

In the micromorphology laboratory of Frankfurt University the samples were prepared to thin sections. After the impregnation with polyester resin the monoliths were ground to large-sized soil thin-sections (90 × 60 mm) with a thickness of 30 μm [5]. The thin sections were described at the Zeiss Axioskop 40 in
linear and crossed polarized transmitted light. All microphotographs shown here were recorded in linear polarized light. The description is based on Stoops [6].

Figure 2 – a) Charcoal b) melted highly burned material; rimmed quartz grains from Bs-horizon (arrows) c) organic-rich groundmass d) excrements of fauna e) crescent pedofeature due to earthworm activity f) Dung remain with diatom (arrow) g) iron impregnation of the matrix; quartz grains rimmed by sesquioxides h) coatings of sesquioxides
RESULTS AND DISCUSSION

Composition of the horizons: In all plaggen-horizons (Fig. 1, sample 1-4) the anthropogenic influence is reflected in form of charcoal fragments (Fig. 2a), heat-influenced (vitrified) material (Fig. 2b), bone fragments and the overall high content of strongly decomposed organic material (Fig. 2c). Excrements of the meso-fauna (Fig. 2d) and refilled earthworms ways (Fig. 2e) are evidences of the high biological activity. Excrements of cattle or sheep (ruminants) (Fig. 2f) show the intermediate use of the sods as stable bedding. Diatoms, which can be seen in the dung remains (Fig. 2f), cannot be found in the parent glacial cover sands. Therefore it is most likely that the diatoms were taken up with the drinking water or fodder by the livestock and have been excreted again.

Sample 5 (Fig. 1) shows the mixing of the fossil Podzol E horizon with the Plaggen covering. Dung remains are mixed in the overlaid horizon.

Sample 6 (Fig. 1) was taken from the Bs-horizon of the original soil, the Podzol buried by the added sods. In situ impregnation of the matrix (Fig. 2g), undisturbed lining of the pores with iron oxides (Fig. 2h) and enrichment with sesquioxides around mineral granules (Figs. 2g & 2h) are signs of soil formation.

Sod removal: In the upper plaggic horizons (samples 1-2), quartz grains with sesquioxide enrichment (Fig. 2b) are visible. This pedogenic feature allows to draw conclusions about the origin of the cut soils. Thus it can be assumed that these horizons originated from sods, which were cut from Bs-horizons of Podzols. In the underlying plaggic horizons (samples 3-4; Fig. 1), these pedogenic features are not recognizable. This could indicate that these early taken sods were collected from more intact soils, which had not yet been capped. Most likely the added sediment is material from A- or E-horizons.

A pollen profile from the site shows clear evidence of heath vegetation that existed before the plaggen manuring. Calluna vulgaris is also present in the sod cover, which indicates the use of sods from places with heath vegetation [7], which is known as indicator vegetation for Podzols.

CONCLUSIONS
1. Anthropogenic elements in plaggic horizons stemming from sods include charcoal fragments, heat influenced material, bone fragments and decomposed organic material.
2. The origins of the sods can be deduced from pedogenic features preserved in the sediments. An inverted order of Podzol-horizons mixed with dung and households waste was found in the Plaggic Anthrosol.

REFERENCES