HENRI DE BAKKER

ANTHROPOGENIC SOILS IN THE NETHERLANDS

Soil Survey Institute, Wageningen, The Netherlands

INTRODUCTION

The Netherlands is well-known for having many soils which are strongly influenced by man. There could be a discussion about the question: When must a soil be considered anthropogenic and when normal? In fact, every soil ploughed and fertilized is changed by man and in our country practically all soils are influenced by man, to a greater or lesser degree.

Even our few virgin soils (virgin in the sense of never been ploughed or fertilized) are affected by man. In our humic podzols (compare soil P3 on p. 165 [1]) the black B2h is due to secondary enrichment of humus below the secondary heath vegetation (p. 59 [5]). When seeing the podzol during the excursion of the Polish Society of Soil Science (profile 2, [13]), I agree with Edelman: the striking difference between both soils lies in the organic-matter content (0.9% total C in the A1 of the Polish soil, against 4.2% in the Dutch podzol, and 0.5% in the B2H against 4.2% in the B2H of the Dutch soil). This must be caused by the man-induced heath vegetation on the Dutch sandy soils: this herb vegetation raised the organic-matter content considerably compared with the original forest vegetation.

In our agricultural soils ploughing and heavy application of fertilizers (in 1977 430×10^6 kg N, 92×10^6 kg P_2O_5 and 114×10^6 kg K_2O on 2 million ha of arable, grass and horticultural land) are considered to be "normal", anthropogenic modifying soil forming factors. Even if podzols have been changed into neutral and fertile soils, such soils are considered normal, because most of our podzols are reclaimed and are being limed and fertilized. Perhaps part of these soils fit already in the class of gleby kulturoziemne [7].

However, in the Dutch Soil Survey Institute soils are only considered man-made when they are raised considerably by the addition of mineral material by some agricultural practice. Such soils are called "thick earth soils" in our classification system when having an anthro-
pogenic A1 horizon (coded as Aan) thicker than 50 cm ([4] numbers 9, 18, 51 and 52 in the determination key). Soils with thinner anthropogenic topsoils are classified as intergrading subgroups between the thick earth soils and the buried soils.

The most well-known example of this kind of soil is the so-called plaggen, soil, which will be discussed below and has been shown in a poster session during the meeting of the Polish Society of Soil Science in 1979 in Lublin.

**NAME AND CLASSIFICATION**

The soil is internationally known as a plaggen soil, literally transla-
ted into Polish: *gleba darniowa*, but with a completely different concept and different soil forming process than in the Dutch soil.

The name is derived from the Dutch word *plag* (Eng. turf or sod, French *gazon* or *motte*, Ger. *Plagge*, *Sode* or *Rasen*, Russ. ДёРН); it means the upper part (few cm) of grassland or waste land, the latter means in the Netherlands practically heath land, carrying a *Genisto pilosae-Callunetum*, in which *Calluna vulgaris* (heath) is dominant.

In the Dutch system of soil classification [4] it is an enk earth soil (*enk* being a field name for old arable land in the sandy district of the Netherlands); in the system of the Federal Republic of Germany it is a *Plaggenesch* [8]. On the soil map of Belgium, scale 1 : 20 000 these soils are called *Plaggenbodens*. Although other countries do not have these special kind of soils, thick man-made soils are named in England and Wales man-made humus soils [1]; in France *sol d’apport anthropique* [2]; in the USA *Plaggept* [12]; in Poland it must be *hortisole po­bielicowe*, however the accumulation horizon is not similar tot that of black earth soils [7]; in the system of the German Democratic Republic [6]; there is no class for such soils, although there are some plaggen soils on the boundary of both Germanies (personal communication Prof. Dr. G. Haase).

**SOIL GEOGRAPHY**

Plaggen soils only are found on Pleistocene sandy soils, mostly on eolian sands from the last part of the Pleistocene, but also on fluvioglaciel sands and pleistocene fluviatile sands. In the landscape they are situated on low ridges amidst hydromorphic soils ([3] p. 49-53) or on the foothslopes of low hills ([3] p. 43).

These soils are only known from Belgium, the Federal Republic of Germany and the Netherlands. *Pape* [9] compiled a map with the distribution of plaggen soils (Figure 1). He estimates that within the shaded area on this map 16% of the sandy soils have a man-made humose topsoil thicker than 50 cm.

The northern boundary on this map is formed by the holocene marine and peat deposits, the southern boundary is either the loess area or the low hills in Germany. The eastern boundary, however, cannot be explained by soil or geological conditions. The same landscape continues eastward with predominantly podzols developed from pleistocene sands. The explanation of the eastern boundary of the plaggen soils may be found in the different agricultural practices by the different peoples ([3] p. 44).

**SOILS**

A typical plaggen soil [3] p. 141) has a dark A1 horizon of 70–80 cm
thick with 5–8% organic matter, a C-N-ratio of 16–22, pH-KCl 4–5, mostly a fine sand with practically no clay and 10–20% silt. The buried subsoils are podzols, hydromorphic (*bielice glejowe*) or iron-humuspodzols (*bielice żelazisto-próchniczne*), but also weakly podzolized soils (comparable with *gleby rdzawe*).

An extensive discussion about chemical and physical properties of the Aan horizon is given by Pape [9].

**HISTORY AND GENESIS**

The soils were reclaimed roughly a thousand years ago and until the introduction of the commercial fertilizers (round the turn of last century) there existed an agricultural system which caused a very gradual raising of the surface with dark humose material.

This system was a subsistence farming, more or less in equilibrium with its environment. The heath lands, however poor, constituted an essential element in this system. They were the source of the heather sods (plaggen) that were used as bedding material in the stables. The heath lands were also used as rough grazing land for sheep, the flock had to spend the nights in the sheepfolds so that the droppings could be collected. In these stables also heather sods were used as bedding material. The dung-impregnated bedding was used to manure the arable land; the mineral part of this earth-containing manure stayed back as a kind of weathering residue. Consequently the arable fields were raised very gradually, changing the podzol soil into a plaggen soil. The farmers were probably unaware of the fact that they were raising their soils by manuring them with the plaggen manure.

Based on some assumptions the nineteenth-century Dutch pedologist Dr. W.C.H. Staring (1808–1877) calculated that the raising of one metre would require 750 years, and the agricultural historian Slicher van Bath ([10] p. 258) calculated that 3–7 ha of heath land were needed to cut plaggen to manure one ha of arable land. Taken also into account the area of rough grazing land needed for the sheep, in total 10 ha of heath land were used to maintain a certain (rather low for today’s standards) fertility on one ha of arable land.

After the introduction of the industrial fertilizers (70–90 years ago), this system was completely abandoned. Today nearly all heath lands are reclaimed, mostly to grassland, but partly also to forest.

These newly reclaimed podzols only change chemically under the influence of liming and fertilizing, but the old plaggen soils have changed from podzols into soils which are deeply rootable and have a high water-holding capacity due to the thick man-made surface layer.
LITERATURE


X. DE BAKKER

АНТРОПОГЕННЫЕ ПОЧВЫ В ГОЛЛАНДИИ

Институт почвоведения в Вагенинген (Голландия)

Резюме

Многие почвы в Голландии сильно преобразованы человеком, прежде всего в химическом отношении, однако лишь искусственно насыпные (наносные) почвы зачисляются к антропогенным. Наилучшим примером таких почв являются дерновые почвы (plagen soils) выступающие в южно-западной Европе (рис. 1) на подзолах образованных из песчаных плейстоценовых отложений. Поверхностный их слой тёмной окраски имеет мощность свыше 50 см и содержит 5—8% органического вещества. Его создавали постепенно в течение многих столетий при использовании почвенного материала с примесью удобрений. Удобрение было получено из дернины бросовых земель (вересковых пустошей) с прибавкой песка. Подсчитывается, что для удобрения 1 га угодий нужно было 10 га бросовых земель. Такая система была заброшена, когда в конце минувшего столетия появились минеральные удобрения. В настоящее время большинство бросовых земель вновь обращается в зелёные угодия и леса.
GLEBY ANTROPOGENICZNE W HOLANDII

Instytut Gleboznawstwa w Wageningen (Holandia)

Streszczenie

Wiele gleb w Holandii zostało silnie przekształconych przez człowieka, przede wszystkim pod względem chemicznym, jednak tylko gleby sztucznie naniesione uznaje się za antropogeniczne. Najlepszym przykładem tych gleb są gleby darniowe (plaggen soils) występujące w południowo-zachodniej Europie (rys. 1) na bielicach wytworzonych z piaszczystych osadów plejstoceńskich. Wierzchnia ciemna warstwa ma miąższość powyżej 60 cm i zawiera 5–8% substancji organicznej. Tworzona ona była stopniowo przez wiele stuleci przy użyciu materiału glebo­wego z domieszką nawozów. Nawóz był otrzymywany z darni pochodzącej z nieużytków (wrzosowisk) z dodatkiem piasku. Obliczono, że do użytkowania 1 ha gruntów uprawnych potrzebne było 10 ha nieużytków. System ten został zaniechany w momencie pojawienia się w końcu ubiegłego stulecia nawozów sztucznych. Obecnie większość nieużytków zamienia się ponownie na użytki zielone i lasy.

Dr Henri de Bakker
Soil Survey Institute
Wageningen, The Netherlands