SOIL CLASSIFICATION OF THE FEDERAL REPUBLIC OF GERMANY

Short version
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The Soil Classification of the Federal Republic of Germany has been based on the mainly pedogenetically orientated conception of KUBIENA (1953). In the former states of the Federal Republic of Germany it has been developed by the Working Group on Soil Classification of the German Soil Science Society, edited by E. MÜCKENHAUSEN (MÜCKENHAUSEN 1962, 1977; Working Group on Soil Classification 1985). In the former German Democratic Republic a development of its own had started. It is true that it did not vary substantially from the originally common concept, but it had early tried to define the substrate components (parent material, soil strata profiles) in a system (LIEBEROTH 1967). Since Germany was united in 1990, it has been intended to equalize the classification systems of Soil Science including a common substrate classification. The development of modern soil information systems with its computer-logical definition of horizons, its symbols and its consequences means further efforts concerning improvement and precision (AG BODEN = Working Group on Soil Classification1994).

The German Soil Classification is based on a morpho-genetical principle, i.e. the soil profile, its genesis-dependent horizon-sequence, is focussed. In future definition and systematic order of soil units shall be possible only by means of landscape characteristics. This is made easier by the descriptive character of the classification which also at polygenetical soil genesis records the actual status like it can be seen from a profile as a result of the complete former soil genetic processes.

1. FUNDAMENTAL PRINCIPLES

The German Soil Classification is divided into the following hierarchical categories:

- ABTEILUNGEN (ORDERS)
- are differentiated according to their water regime.
- KLASSEN (SUBORDERS)
- are differentiated according to soil dynamics and morphological properties caused by specific-dominant pedological processes.
- TYPEN (TYPES)
- are differentiated according to characteristic horizon sequences, for raised bogs and minor developed soils after geogenetical characteristics of the H- or C-horizon.
- SUBTYPEN (SUBTYPES)
- Norm subtype: has characteristic horizon sequence and properties of the type
- Deviation subtype: with significant supplementary properties
- Transition subtype: additionally with intermediate properties to other soils
- VARIETÄTEN (VARIETIES)
- qualitative modifications of a subtype with additional horizon properties deviating from the subtype (see list in section 4).

\textsuperscript{1)} Symbols of soil units after AG Boden (1994); Intern. soil classification (Spaargaren 1994)
\textsuperscript{2)} Polish soil classification (Marcinek 1997)
• SUBVARIETÄTEN (SUBVARIETIES)
  • Subdivision of subtypes or varieties with quantitative rather than qualitative aspects, e.g. layer
depth or layer thickness of typical horizons, carbon content, pH value.
• BODENFORMEN (SUBSTRATE SERIES)
  • no systematical unit of the hierarchically divided categories, but a combination of pedogenetic and
lithogenetic properties, characteristic of the individually existing soil.

The revised version of the German Soil Classification shall give a view on the soil typical categories.
It represents the actual status of the revised publication of the Soil Classification of the German Soil
Science Society of 1985 (Working Group on Soil Classification 1985) and is derived from the basic
informations, published in the soil classification part of the 4th edition of the Bodenkundliche
Kartieranleitung (AG Boden 1994). The abridged edition is divided in:
Section 2: Listing of the horizon symbols including the rules for users.
Section 3: Description of soil types and subtypes.
Types, norm subtypes and transition subtypes are described with their horizon sequences. If there are
deivation subtypes besides the norm subtype, the diagnostic horizons are typed in bold face.
The characterization of the transition subtypes is only carried out by diagnostic horizons, essentially
containing the differentiating atypical properties. It is necessary to define a type in connection with
the total horizon arrangement.
Section 4: Variety genesis criteria

2. SOIL HORIZON DESIGNATIONS

2.1 Master horizons
  2.1.1 Subhydric horizon
  F horizon at the bottom of lakes or rivers with organic matter content of >1% (if not H)
  2.1.2 Organic horizons (>30wt. % organic matter)
  H originating from residue of peat-forming plants (peat)
  L originating from accumulated or unaltered litter (Förna) at the soil surface, w.<10vol. % of
unstructured humic material
  O originating from decomposed litter
    w.>10vol.% material
  2.1.3 Mineral horizons (<30wt.% organic matter content)
  A mineral horizon of the topsoil (epipedon)
  B mineral subsoil horizon characterized by a change of colour and mineral composition of the
parent material resulting from the accumulation of topsoil constituents, which were removed
from the overlying horizon or/and weathering in situ, contains less than 75% by vol. of
residual parent rock and no lithogenic carbonate (primary carbonate) in the fine-earth fraction
  C unaltered or unweathered material similar to parent material
  P subsoil horizon on claystone or clay, w.>45wt.% clay, prismatic to subangular blocky
structure and temporarily wide cracks (>1cm in 50cm depth) (P from Pelosol)
  T subsoil horizon from the solution residue of carbonate rock, clay content >65wt. %, <5vol.%
carbonate, bright brown. Yellow to brownish red colour and distinct angular blocky
structure (T from terra)
  S subsoil horizon affected by a perched wateratable; surface water stagnation
characterized by certain redoximorphic features (mottles, concretions, bleaching) or
permanently inadequate aeration (air capacity<3% by vol., rH-value ≤19⁹ or free Fe²⁺ can be
mesured)
  G horizon affected by groundwater, which causes the development of redoximorphic features
  M horizon of fluvial, colluvial soils from translocated soil-material, humus content like Ah
  E plaggen-horizon (humus content like Ah)

\[ rH = \frac{2 \cdot Eh}{59mV} + 2pH \]
2.2. Letter suffixes (prefixes) for litho-, phyto- and anthropogenetic properties

a flood-plain dynamics; can be combined with A, C, G, M
b brown by Plaggensche and flood-plain soils; can be combined with E, aAh
c brackish (tidal-brackish); can be combined with F, S, G
d calcareous material (>75 wt. % carbonate or gypsum); can be combined with Ic and mC
e marly (2-75 wt. % carbonate); can be combined with F, H, Ah, Ic, mC, G, M, P, S
f fossil; can be combined with A, H, B, P, T, S, G
g grey by Plaggensche and flood-plain soils; can be combined with E, aAh
h raised bog, moss peat, rainwater bog; can be combined with H
i gravelly, siliceous (<2 wt. % carbonate); can be combined with Ic, mC
j natural substratum, translocated by man; can be combined with Ah, H, C, G
k unconsolidated substratum, can be dug with a spade; can be combined with C
l massive bedrock; solid rock; can be combined with C
m marine (tidal-marine); can be combined with F, S, G
n groundwater peat (fen), blanket bog; can be combined with H
o organic (sedimentary); can be combined with A, C, G
p permarine (tidal-fluvial); can be combined with F, S, G
q spring water affected; can be combined with G
r relic; can be combined with A, B, P, T, S, G
s influenced by slope water; can be combined with S, G
u transitional bog; can be combined with H
x stony, mostly free of fine soil (<5 wt. %), cherts and stones (>2 cm); can be combined with C
y anthropogenic (man made) substrate (e.g. bricks, sludge slag); can be combined with Ic, mC, G
z salt containing material, can be combined with F, A, G

II, III feature symbols for lithologic discontinuities, stratification

2.3 Letter suffixes (affixes) for pedogenic properties

a accumulation of well decomposed organic matter partially under reducing conditions (15-30% organic mat.); can be combined with A
b angular blocky to prismatic structure; can be combined with H
c accumulations in bands or thin pans (plastic); can be combined with B
d secondary carbonate; can be combined with H, A, B, C, T, S, G, M
e dense, impermeable (k<1 cm/d), causing a perched water table, mottled; can be combined with S
f eluvial; Ae bleached by podzolization, Se bleached by water stagnation
f partly decomposed organic matter (10-70 vol%); can be combined with O
g loose structure; can be combined with Bv of Lockerbranerde (e.g. Andosol)
h affected by capillary water, lacking coarse pores; can be combined with S
i humus accumulation (>0.6 (sands), 0.9 silts and loams), 1.2 (clays) wt.% humus; can be combined with A, B, G
j humified = strongly decomposed organic matter (>70vol%); can be combined w. O
k initial; humus content lower than required for h or horizon less than 2 cm thick or discontinuous; can be combined with F, A
l fersiallitic; can be combined with B, C, G
concretions; can be combined with B, C, S, G
enriched with bases and nutrients by fertilizing; can be combined with Ah
eluviated by clay migration; can be combined with A
massive, cemented; can be combined with Bs, Bbs, S, G
strongly humified org. mat., water-repellent (vermulum); combined with H
unweathered (n = new, neu); can be combined with C
oxidized; oximorphic properties, rH>19, can be combined with F, G, Y
ploughed, can be combined with H, A
impermeable horizon in coastal marsh soils; can be combined with S
reduced; with reductomorphic features (has a rH-value of ≤19, a Munsell colour hue of N1 (black) to N8 (white) or 5Y (gray), 5G (grayish green), or 5B (bluish gray), with a chroma <1.5 (if 5G<2.5), and less than 5% of the exposed profile surface are covered with rust-coloured mottles and/or carbonate spots (confined to root channels), can be combined with F, H, S, G, Y
Fe/Al-enrichment (sesquioxides) by podzolization; can be combined with H, G, B
clay illuviation; difference in clay content to Al horizon >3 (sands), >5 (silts and loams), >8 (clays) %; can be combined with B
shrinked; can be combined with H
rubification, soil reddening by hematite formation; can be combined with B, T
weathered, brown, loamy; can be combined with B, C
water-permeable soil horizon above an impermeable soil horizon, conveys subsurface water; can be combined with S
ground water influenced soil horizon; can be combined with F, H; with G without redoximorphic properties
mixed by bioturbation; can be combined with A, E
secondarily enriched with salt; can be combined with H, A, G

2.4 General rules of description

TRANSITION HORIZONS: (with features of different pedogenetic processes) are characterized by
- a master symbol together with suffixes for pedogenetic properties, e.g. Bsv.
- up to 3 different master symbols including the appropriate feature symbols. They are linked by
  a hyphen, e.g. Bv-Go.
INTERLOCKED AND INTERFINGERED HORIZONS: (areas with properties of different
horizons without mixing); are added with +, e.g. Al+Bt, ICv+Bv.
FOSSIL OR RELICTIC HORIZONS: The parts of the symbols are linked by a •, e.g. fAh • Sd =
Stagnic horizon from Ah.
HORIZON SEQUENCES: The symbols for the single horizons are indicated by a /, e.g. Ah/Bv/Cv
ALTERNATIVE POSSIBLE HORIZON COMBINATIONS: are divided by a : e.g. Ah,Ap/Bv/Cv.
HORIZONS IN BRACKETS: can be missing and do not lead to another systematical classification.

A free combination of horizon symbols is not wanted. The possible horizons are described in detail
and, if necessary, defined with help of limits in the draft of the revised Soil Classification of the
German Soil Science Society as well as in the Kartieranleitung.
3 SOIL CLASSIFICATION UNITS

In this chapter the units of the German Soil Classification and their typical sequence of diagnostic horizons as well as their short symbols (abbreviations?) used in maps are described. The international soil units of WRB (World Reference Base of Soils) as well as the short symbols of the Polish Soil Classification (comments see Marcinek in this volume) are printed in *italics* and in brackets. These assignments are not exact, as being based on other definitions of diagnostic properties.

3.1 **TERRESTRISCHE BÖDEN (TERRESTRIAL SOILS)**
Terrestrial soils are mineral soils, which are unaffected by groundwater, at least in the first 40 cm.

F 3.1.1 **O/C-BÖDEN (OC-SOILS)**
O/C-Soils are soils with an organic layer (>30wt% organic matter) above solid rock or gravels, which are only water saturated for some days in a year (like folic h.)

FF Type: **FELSHUMUSBODEN (ROCK-HUMUS-SOIL)**
Soils with O/mC-profile on solid rock

FFn Subtype:
-(Norm-)Felshumusboden
O/mC-profile
no minimum thickness of the O-horizon
(*Foli-lithic Leptosol or Lithi-folic Histosol; IA1a*)

FS Type: **Skeletthumusboden (Skeletic Humus Soil)**
Soil with xC+O/C-profile on gravel and stones; organic matter in cavities

FSn Subtype:
Norm-Skeletthumusboden
xC+O/(xC)mC,IC-profile
(*Skeleti-folic Histosol; IA2a*)

O 3.1.2 **TERRESTRISCHE ROHBÖDEN (TERRESTRIAL INITIAL SOILS)**
Initial stadium of soil formation, characterized by low organic matter accumulation and very low chemical weathering

OO Type: **Syrosem**
with Ai/mC-profile on/of solid carbonate-, sulphate- (gypsum-), siliceous- or silicate rock

OOo Subtypes:
-(Norm-)Syrosem
Ai/mC-profile A thin Ai-horizon overlies solid rock
(*Lithic Leptosol; IA1a, IA2, IB1a*)

OOp -Protosyrosem
mAi/mC-profile with low accumulation of organic matter in porous solid rock

OL Type: **LOCKERSYROSEM**
with Ai/IC-profile of carbonate-, sulphate-(gypsum-), siliceous or silicate unconsolidated rock
OLn
(Norm-)Lockersyrossem
Ai/C-profile
(Haplic Arenosol or Regosol; IA2, a, b, IA3, IB2a)

R
3.1.3 Ah/C-BÖDEN (Ah/C-SOILS) (Ah<40 cm)
Soils of this unit (Ranker, Regosol, Rendzina and Pararendzina) are differentiated
in relation to the parent rock and the properties of the A-horizon

RN
Type: RANKER
with Ah/imC-profile of solid rock with little or no carbonates, <2% carbonates; Ah ≥2
cm, <30cm beneath surface

Subtypes:

RNn
-(Norm-)Ranker (dystric ranker)  base saturation of Ah <50%
Ah/iiC/ in C-profile
<3dm
(special Leptosol or skeletal Umbrisol; IA4a)

RNr
-Euranker (eutric ranker)
Ah/iiC/imC-profile  base saturation in Ah ≥50%
<3dm

Transition Subtypes:

OO-RN
-Syrosem-Ranker: with Aih, always about 2 cm thick on solid rock
BB-RN
-Braunerde-Ranker: under Ah a Bv+Ah or/and Bv-iiCv, Bv+ixCv up to <3dm depth
PP-RN
-Podsol-Ranker: RN with a thin spodic B-horizon. Bh5-iiCv

RQ
Type: REGOSOL
with Ah/iiC-profile with little or no carbonate content (<2 wt.% carbonate)
Unconsolidated siliceous or silicate rock of >3dm thickness; Ah 2 - 40 cm

Subtypes:

RQn
-(Norm)Regosol (dystric Regosol)
Ah/iiC-profile  base saturation of Ah <50%
>3dm
(Special Regosol, Haplic Arenosol or Umbrisol; IA5)

RQr
-Euregosol (Eutric Regosol)
Ah/iiC-profile  base saturation of Ah ≥50%
>3dm

Transition Subtypes:

OL-RQ
-Lockersyrossem-Regosol: with Aih, always about 2cm thick
BB-RQ
-Braunerde-Regosol: in subsoil, Bv-iiCv, Bv+iiC
PP-RQ
-Podsol-Regosol: RQ w. a thin spodic B-horizon, up to <1.5dm depth.
SS-RQ
-Pseudogley-Regosol: S,iiCv-S, from 4-8dm and/or Sw-iiC, then above 4dm, too.
GG-RQ
-Gley-Regosol: Go,iiCv-Go, from 4-8dm

RR
Type: RENDZINA
with Ah/cC-profile of consolidated or unconsolidated carbonate rock (>75%
carbonate) or sulphate-(gypsum-)rock; Ah 2 - 40 cm
Subtypes:

RRn
-(Norm-) Rendzina (Eurendzina)
(e)Ah/eC-profile base saturation ≥50%
(Rendzic Leptosol, Lithic-calcic Chernozem or Calcaric Regosol; IB1b, IB2b)

RRs
-Sauerrendzina
Ah/eC-profile base saturation in Ah <50%

Transition Subtypes:

OO-RR
-Syrosem-Rendzina: with Aih, always about 2 cm thick on solid rock.

OL-RR
-Lockersyrosem-Rendzina: with Aih, always about 2 cm thick overlying unconsolidated rock

BB-RR
-Braunerde-Rendzina: under Ah a Bv+Ah or/and Bv-eCv, Bv+Ccv

CF-RR
-Terra fusca-Rendzina: in subbase saturationoil (Bv-)<T+cCv

GG-RR
-Gley-Rendzina: Go, e,Cv-Go from 4-8dm

RZ
Type: PARARENDZINA
with Ah/eC-profile of unconsolidated or solid siliceous or silicate rock with 2-75% carbonate, Ah 2 - 40 cm

Subtypes:

RZn
-(Norm-) Pararendzina (Eupararendzina)
(e)Ah/eC-profile base saturation ≥50% in Ah
(Calcaric Arenosol or -Regosol; IB1b, IB2b)

RZs
-Saure Pararendzina (dystric RZ)
Ah/eC-profile base saturation <50% in Ah

Transition subtypes

OO-RZ
-Syrosem-Pararendzina: with Aih, always about 2 cm thick overlying hard rock (emC)

OL-RZ
-Lockersyrosem-Pararendzina: with Aih, about 2 cm thick, overlying unconsolidated rock (elC)

BB-RZ
-Braunerde-Pararendzina: under Ah a Bv+Ah or/and Bv-eCv, Bv+ecv

SS-RZ
-Pseudogley-Pararendzina: S, Cv-S from 4 - 8dm or Sw-Ah and/or Sw-eCv, then above 4dm, too

GG-RZ
-Gley-Pararendzina: Go, eCv-Go from 4 - 8dm

T
3.1.4 SCHWARZERDEN (STEPPE SOILS)
This class contains all soils with Axh-horizons of >4dm thickness. The Axh-horizons have Munsell chroma <3.5 and value <4.5 (transition units <5.5).

TT
Type: TSCHERNOSEM (CHERNOZEM)
with Axh/Axh+IC(c)/C(c)-profile Axh>4dm
normally from unconsolidated rock with carbonates. Characteristic is a mixed horizon Axh+IC(c), formed by intensive bioturbation.

Subtypes:

TTn
-(Norm-)Tschernosem
Axh/Axh+IC(c)/C(kc,c)-profile Axh>4dm
(Haplic Phaeozem or -Chernozem; II A1a)

Transition Subtypes:

DD-TT
-Pelosol-Chernozem: with P-Axh

BB-TT
-Braunerde-Tschernosem: with Bv-Axh and/or Bv in subsoil
LL-TT  - Parabraunerde-Tscherneosem: with A(h)-Axhr/B(h)-Axhr
SS-TT  - Pseudogley-Tscherneosem: Axhr-Sw from 4 - 8dm or Sw-Axhr, then above 4 dm, too
GG-TT  - Gley-Tscherneosem: Go and transition horizons from 4 - 8dm

TC  Type: KALKTSCHERNOSEM
    Acxhr/Acxhr+elCc/elCc-profile Acxhr>4dm
As a diagnostic horizon the Acxhr+elCc-horizon is a result of intensive bioturbation.
The solum shows opposite of TT a significant enrichment of secondary carbonate in
form of pseudomyelia.

Subtypes:
TCa  -(Norm-)Kalktschernosem
    profile with Acxhr
    (Calcic Phaeozem or Calcic Chernozem)
DD-TC  Pelosol-Kalktschernosem with P-Acxhr
BB-TC  - Braunerde-Kalktschernosem: with Bv-Acxhr, a little brownish
LL-TC  - Parabraunerde-Kalktschernosem with A(h)-A(c)xhr/B(h)-Acxhr
GG-TC  - Gley-Kalktschernosem: eGco and transition horizons from 4 - 8dm

D  3.1.5 PELOSOLS (CLAY RICH SOILS)
The soils of this class have developed from primarily clay-rich or clayey-marly
parent rock. They are characterized by significant swelling and shrinking mechanisms,
which cause a distinct detachment structure.

DD  Type: PELOSOL
    (P-)Ah/P/C-profile
    P: subsurface horizon w.>45% clay, prismatic to angular blocky
    structure and sometimes >1cm wide cracks in 50 cm depth

Subtypes:
DDn  -(Norm-)Pelosol:
    (P-)Ah/P/i, eC-profile Ah/P>3dm
    (Vertic Cambisol or Vertisol; IA3, IIB1a)
DDh  - Humuspelosol:
    (P-)Ah/Ah-P/(P)/i, eC-profile Ah-P deeper than 4dm, humus like Ah

Transition Subtypes and their diagnostic subsoil horizons:
RN-DD  - Ranker-Pelosol: (iCv-)<P up to 3dm depth overlying solid rock without or <2%
carbonate content
RQ-DD  - Regosol-Pelosol: iCv-P on clay stone debris without or <2% carbonate
RZ-DD  - Pararendzina-Pelosol: elCv-P of cleyey marl
BB-DD  - Braunerde-Pelosol: Bv-P, brownish, without carbonates
SS-DD  - Pseudogley-Pelosol: Sw-P/Sd-P
GG-DD  - Gley-Pelosol: Go, P-Go from 4 - 8dm
3.1.6 BRAUNERDEN (BROWN SOILS)
Soils of this class are characterized by a Bv horizon (resulting from brownification and clay formation)

Type: BRAUNERDE (BROWN EARTH)
with Ah/Bv/C-profile

Subtypes:

BBn
-(Norm-)Braunerde (brown earth):
Ah/Bv/C-profile
(Cambisol, Cambic Umbrisol, -Arensol; IIB2a, IIC1a,b)

BBc
-Kalkbraunerde
A(c)/h/Bcv/Ctc-profile
(Calcagic Cambisol)

BBh
Humusbraunerde
Ah-Bv >4dm, humus content like Ah
Ah/Ah-Bv/(Bv)C-profile
(Umbric or Humic Cambisol)

BBl
-Lockerbraunerde
with Ah/(Ah-)Bvf/C- profile; Bvf: pore volume >60%
(Andosol) A of volcanic ashes or other easy-weatherable rock

Transition Subtypes

RN-BB
-Ranker-BB: Ah+Bv or/and ilCv+Bv up to 1.5dm thick
from or above solid rock, carbonate-free

RQ-BB
-Regosol-BB: Ah+Bv or/and ilCv+Bv up to 1.5dm thick from or above siliceous or silicate substrate without carbonates

RR-BB
-Rendzina-BB: (e)Ah+Bv or/and eCv+Bv up to 1.5dm thick
from and above carbonate- or sulphate rock

RZ-BB
-Pararendzina-BB: (e)Ah+Bv or/and eCv+Bv up to 1.5dm thick
from and above silicious or silicate rock with carbonate content

DD-BB
-Pelosol-BB: from 1.5-3dm P, overlying Bv

LL-BB
-Parabraunerde-BB: with Al-Bv/Btv

PP-BB
-Podsol-BB: spodic horizon up to 1.5dm depth

SS-BB
-Pseudogley-BB: S or transition-S from 4 - 8dm or Sw-Bv, Sd-Bv, then above 4dm, too

GG-BB
-Gley-Braunerde: Go and transition horizons from 4 - 8dm

3.1.7 LESSERTIVES
The soils of this class are characterized by vertical clay migration and by ± strong texture differentiation in its profiles.

Type: PARABRAUNERDE
with Ah/Al/Bv/C-profile
difference in clay content between Al- and Bt-horizon (in mass%): ≥3% at <17% clay and <50% silt; ≥5% at <17% clay and >50% silt as well as at 17-45% clay; ≥8% at >45% clay

Subtypes:

LLn
-(Norm-)Parabraunerde
Ah/Al/Bv/C-profile
(Haplic Luvisol or -Alisol, IIB3a)
LLd
-Bänderparabraunerde
Ah/A/Bv+Bbt/(ilCv+Bbt)/C-profile
clay-enriched bands in Bv, ilCv<5cm respectively, mostly >1cm thick
(Luvic Arenosol or Haplic Luvisol)

LLh
Humusparabraunerde
Ah/Alh/(Ah)-Bt/(B(t)v)/C-profile; horizons with Ah >4dm depth, with humus content
like Ah
(Haplic Luvisol)

Transition Subtypes:

TT-LL
-Tscheronosem-LL: with Axb-Al/Axb-Bht up to 4dm depth

BB-LL
-Braunerde-LL: with Bv-Al/Bvt or with B(v)t/Bv

PP-LL
-Podsol-LL: spodic horizon up to 1.5 dm depth

TT-LL
-Terra fusca-LL: Bt-T from 3-7dm depth

SS-LL
-Pseudogley-LL: S or transition-S from 4-8dm or Sw-Al,Sd-Bt, then above 4dm, too

GG-LL
-Gley-LL: Go and transition horizons from 4-8dm

LF
Type: FAHLERDE
with Ah/Ael/Ael+Bt/Bt/C-profile
Vertical clay migration and texture differentiation stronger than in LL. Difference of
clay content between Ael- and Bt-horizon: ≥9% at <17% clay and <50% silt; ≥12% at
<17% clay and >50% silt as well as at >17% clay
The Ael-horizon is mostly pale grey (moist: >6/chroma <4 or value 5-6/chroma <3;
dry: value >7/chroma <3 or value 4-5/chroma <2.5). The transition to Bt is sharp
and/or tonguing.
(Glossisol; ILB3c, ILB3g)

Subtypes:

LFn
-(Norm-)Fahlerde:
Ah/Ael/Ael+Bt/Bt/C-profile

LFd
-Bänderfahlerde
Ah/Ael/Ael+Bt/Bv+Bbt/(ilCv-Bbt)/C-profile. Clay bands <5cm, mostly, however,
>1cm thick

Transition Subtypes:

BB-LF
-Braunerde-LF: with Bv-Ael or with Bt/Bv in subsoil

PP-LF
-Podsol-Fahlerde: spodic horizon up to <1.5 dm depth

SS-LF
-Pseudogley-Fahlerde: S or transition-S from 4-8dm, or Sw-Ael, Sd-Bt, then above
4dm, too

GG-LF
Gley-Fahlerde: Go and transition horizons from 4-8dm

P 3.1.8 PODSOLE
The soils of this class have mostly developed from quartz-rich sands, sandstones,
quartzites and siliceous shists. They are characterized by podzolization. In the topsoil
they are extremely impoverished.

PP
Type: PODSOL
with Ahe/Ae/B(s)h/B(h)s/C-profile
Subtypes:

**PPn**
-(Norm-)-Podsol (Eisenhumuspodsol)

\[(Ahe/)-Ae/B(s)/h/B(h)\text{a/s/C-profile ratio}\] [Cp:Fep\(^1\)] in Bsh and Bhs \(3-10\)

(Haplic Podzol; II(2))

**PPh**
-Eisenpodsol

\[(Ahe)/Ae/Bs/C-profile ratio}\] [Cp:Fep\(^1\)] in Bs \(<3\)

(Duric or Haplic Podzol; II(2))

**PPh**
-Humuspodsol

\[(Ahe)/Ae/Bh/C-profile ratio}\] [Cp:Fep in Bh \(>10\)]

(Humic Podzol)

Transition Subtypes:

**BB-PP**
-Braunerde-Podsol: B(s)v under 1.5-7dm thick Podzol

**LL-PP**
-Parabraunerde-Podsol: (Al)/Bt under 1.5-7dm thick Podzol

**SS-PP**
-Pseudogley-Podsol: S or transition-S from 4-8dm or Sw-Ae, Sw-Bh, Sw-Base
saturation, then above 4dm, too.

**SG-PP**
-Stagnogley-Podsol (Ortsteinaupodsol): Sd-B(h)ms under Srw-Ae

**YK-PP**
-Kolluvisol-Podsol: M-horizon under 1.5-7dm thick Podsol

**YE-PP**
-Plaggenesch-Podsol: E-horizon under 1.5-7 dm thick Podsol

**GG-PP**
-Gley-Podsol: Go and transition horizons from 4-8dm

**PS**

Type: Staupodsol
with (Sw-)Ahe, Sw-Aa/Sw-Ae/Sw-Bh/Sm/C-profile

Subtypes:

**PSh**
-Bändchenstaupodsol

\[(Ahe)/Ae/Bh/Bbms/(Base saturation)/C-profile Bbms with thin iron-pans\]

**PSn**
-(Norm)-Staupodsol

\[(Sw-)/Ahe/Sw-Ae/Sd-B(h)ms/C-profile\]

**Psd**
-Bändchenstaupodsol

\[(Ahe)/Ae/Bh/Bbms/(Base saturation)/C-profile Bbms with thin iron pans\]

**C**

3.1.9 TERRAE CALCIS

very clay-rich, bright yellow-brown to brown-red coloured soils, developed from solution residues of carbonate rocks.

**CF**

Type: TERRA FUSCA
with Ah/T/cC-profile
T-horizon \(>65\) mass% clay, high water permeability because of a distinct angular blocky structure and karst drainage

Subtypes:

**CFn**
-(Norm-)Terra fusca
Ah/T/cC-profile

(Verti-ferratic (or chromic) Cambisol or Luvisol)

**CFc**
-Kalk-Terra fusca
A(c)h/Tc/cC-profile with secondary carbonate enrichment

\(^1\)(p pyrophosphate extr.)
Transition Subtypes:

- **BB-CF**
  - Braunender-Terra fusca: with Bv-T; less clay content than in Norm-Terra fusca, e.g. by loess mixing

- **LL-CF**
  - Parabraunerde-Terra fusca: with Bt-T up to the area above 3dm

- **SS-CF**
  - Pseudogley-Terra fusca: with Sd-T; with surface water stagnation because of reduced karst drainage

**CR**

Type: **TERRA ROSSA**

with Ah/Tu/cC-profile

from carbonate rock, mostly low humus content, bright brown-red coloured by hematite; normally translocated; rubification under warmer climates; in Germany fossil or relictic.

(*verti-ferralic* or *chromic*) *Cambisol or Luvisol*

**V**

### 3.1.10 FERSIALLITIC and FERRALITIC PALEOSOLS

Residues of tropical-subtropical weathering, formed during the Tertiary and in even earlier periods, occur on old land surfaces. Today these formations are found as relic or fossil residues, often translocated by solifluction. Complete profiles are not known in Germany. At the very best, there are residues of subsoil to be found. They are always covered by younger stratum.

**VV**

Type: **Fersiallit**

with .../IIb jitter/Cj/Cv-profile

Bj mostly kaolinized, plastic, often grey, but also yellow-brown, red-brown to red coloured.

(*Lixisol or Acrisol residues*)

**VW**

Type: **Ferralit**

with .../IIBw/Cj/Cv-profile

Bu with stable earthy aggregates, intensively red or yellow coloured

(*Ferralsol residues*)

**S**

### 3.1.11 STAUWASSERBÖDEN (Soils with stagnic properties)

The soils of this class show stagnic properties, caused by surface water stagnation. Significant is a change between wetness and reduction, followed by drought and migration of iron and manganese (bleaching, formation of concretions and mottles).

**SS**

Type: **PSEUDOGLZEY**

with Ah/S(e)w/(II)Sd-profile

often two-layer-profile. The redoximorphic horizons begin <4dm deep (mottling and concretions above)

**Subtypes:**

- **SSn**
  - (Norm-)Pseudogley

- **SSc**
  - Kalkpseudogley

- **SSg**
  - Hangpseudogley

- **SSH**
  - Humuspseudogley

(*Humi-mollis* or *histic*) *Stagnosol*
Ah/Ah-Sw/Sd-profile, Ah/Ah-Sw>4dm, humus content like Ah

SSIn
-Anmoorpsudogley
Sw-Aa/Sew/(II)Sd-profile Sw-Aa >1dm thick

Transition Subtypes:

TT-SS
-Tschernosem-Pseudogley: Axh-Sw above 4dm or Bv-Sw above and under 4dm
BB-SS
-Braunerde-Pseudogley: Bv or Sw-Bv<4dm deep, above S
LL-SS
-Parabraunerde-Pseudogley: Al or Sw-Al<4dm deep; above Bt-Sw or Bt-Sd S or transition-S above and under 4dm
LF-SS
-Fahlerde-Pseudogley: Ael or Sw-Al<4dm deep, above Bt-S or transition-S above and under 4dm
PP-SS
-Podsol-Pseudogley: spodic horizon; Sw or transition-Sw beginning above 4 dm
DD-SS
-Pelosol-Pseudogley: with P-Sd
TT-SS
-Terra fusca-Pseudogley: with T-Sd
YK-SS
-Kolluvisol-Pseudogley: with M-Sw, beginning above 4dm
YE-SS
-Plaggenesch-Pseudogley: with E-Sw, beginning above 4dm
GG-SS
-Gley-Pseudogley (Amphigley): Go and transition horizons from 4-8dm

SH
Type: HAFTPSEUDOGLY
with Ah/Sg-profile, silt-rich, no differences in texture between top- and subsoil

SHa
-(Norm-)Haftpsudogley
Ah/Sg/(II)C-profile in Sg<17% clay at >50% silt and fine sand, clayey variety (>35% clay)

SHh
-Humshaftpsudogley
Ah/Ab-Sg/Sg-profile Ah/Ab-Sg >4dm, humus content like Ah

Transition Subtypes:

BB-SH
-Braunerde-Haftpseudogley: Bv or transition-Bv<4dm deep above Sg or Bv-Sg above and under 4dm
GG-SH
-Gley-Haftnässepseudogley: Go and transition horizons from 4-8dm

SG
Type: STAGNOGLEY
with Sw-Ah/S(e)rw/IISrd-profile
with strong redoximorphic properties because of long wetness (mottling and reduction bleaching)

SGn
-(Norm-)Stagnogley
Sw-Ah/S(e)rw/IISrd-profile; mostly low pH
(Albic Stagnosol or Plamosol; IIIC1b)

SGd
-Bändchenstagnogley
(Sw-)Ahe/S(e)rw/Bbms-Srd,Srd-Bbms/C-profile Fe-oxide cemented horizon with 2-8mm thickness and perched watertable

SGm
-Annmoorstagnogley
Sw-Aa/S(e)rw/IISrd-profile Sw-Aa >1dm thick

SGb
-Moorstagnogley
H/(Ah-S(e)rw)/S(e)rw/IISrd-profile H <3dm thick
(Histic Planosol or Histi-albic Stagnosol)
Transition Subtype:
GG-SG
-Gley-Stagnogley: G(r) from 4-8dm, groundwater influence within 8 dm

X
3.1.12 REDUKTOSOLS
Reduktosols are soils formed by reducing or oxygen deficiency causing gases like methane, hydrogen sulphide and/or carbon dioxide with a Y-horizon as a diagnostic horizon. The gases evolve from postvolcanic mofettes, leaks of gaspipes, or are formed from easily decomposable organic matter under very reducing conditions by microorganisms in garbage, sludge or harbour mud.

XX
Type: REDUKTOSOL
with Ah/Yr-profile

Subtypes:
XXn
-(Norm-)Reduktosol
Ah/Yo/Yr-profile
Yo <4dm depth

XXt
-Rohreduktosol
(Y)-Ai/(Yo)/Yr-profile

XXx
-Ockerreduktosol
Ah/Yo/Yr-profile
Yo up to >4dm depth

XXu
Fahlreduktosol
Ah/Yr-profile
only Yr, Yo is missing

Y
3.1.13 TERRESTRISCHE KULTOSOLE (Anthropogenic terrestrial soils)
Soils of anthropogenic accumulations are classified as natural soils due to their horizotnation. In the class of the Kultosols those soils are included which have been altered so strongly by direct human action that the original sequence of soil horizons has been mostly destroyed. However, this class does not include those soils which got an Ap-horizon by ploughing, under which a natural horizon sequence remained. A soil systematical unit of transferred column material into the following units is necessary, as long as no new soil formation has completely transformed this material in its complete thickness.

YK
Type: KOLLUVISOL
with Ah/M/II...-profile, Ah/M >4dm thickness, from translocated top soil material (solum sediment, humus content fits in the definition of the Ah-horizon), which is either washed off by water from slopes and deposited at the slope foot, in sinks and small valleys or eroded and accumulated by wind or by cultivation, respectively by anthropogenic transport.

Subtypes:
YKn
-(Norm-)Kolluvisol
Ah/M/II...-profile
Ah/M >4dm thickness
(Cumulic Anthrosol; Vba)

Transition Subtypes:
PP-YK
-Podsol-Kolluvisol: Podsol <1.5dm above M up to >4dm depth
SS-YK
-Pseudogley-Kolluvisol: S or transition-S from 4-8dm, Sw-M above 4dm, too.
GG-YK
-Gley-Kolluvisol: Go and transition horizons from 4-8dm
YE Type: **PLAGGENESCH**
with Ah/E/II...-profile; Ah/E >4dm thick, E-horizon from accumulated plaggen material (sods)

**Subtypes:**
- (Norm-)Plaggenesch
- Ap/EII-profile **Ap/E >4dm thickness**
  *(Cumulic Anthrosol)*

**Transition Subtypes:**
- PP-YE: Podsol-Plaggenesch: Podzol <1.5 above E up to >4dm depth
- SS-YE: Pseudogley-Plaggenesch: S or transition-S from 4-8dm, Sw-E above 4dm, too.
- GG-YE: Gley-Plaggenesch: Go and transition horizons from 4-8dm

YO Type: **HORTISOL**
with Ap/Ex/(Ex-)...-C-profile **Ap/Ex >4dm thickness**
Ex formed by long lasting intensive horticulture (frequent addition of organic matter, intensive cultivation, deep digging, additional water supply, shading) and intensive bioturbation.
*(Hortic Anthrosol; VIIA1)*

YY Type: **RIGOSOL** *(e.g. Vineyard Soil)*
with R-Ap/(Ah-)...R/C-profile
The R-horizon was caused by recurrent 4 up to 10dm deep trench-ploughing („Rigolen“), mostly in vineyards. R-Ap= regularly cultivated upper part of R
*(Cumulic (or Hortic) Anthrosol; VIIA2)*

YU Type: **TREPOSOL** *(deeply disturbed by subsoiling)*
with R-Ap/R+/.../-profile
normally caused by a single deep ploughing or a single deep trench-ploughing. In connection with R+ the soil horizons of the ploughed soil are listed (i.e. Bt, Ae,Bhs).
*(Cumulic Anthrosol)*

### 3.2 SEMI-TERRESTRISCHE BÖDEN
Semi-terrestrial soils are influenced by groundwater less than 4 dm beneath soil surface

#### A

**3.2.1 AUENBÖDEN (FLOODPLAIN SOILS)**
In this class soils from sediments or alluvial sediments in river and creek valleys are combined, which
- are flooded periodically (recently, if not dammed)
- normally have a fluctuating groundwater table, which generally is connected to the river water level.
The upper border of the aG-horizon (apart from the transitions to Gley) is >8dm; often it is deeper than 20dm below soil surface.

AO Type: **RAMBLA (AUENLOCKERSYROSEM)**
with aA/aC/aG-profile
from recent fluvial deposits, aG deeper than 8dm
*(Fluvisol; VALa)*
AQ
Type: **PATERNA** (AUENREGOSOL)
with aAh/aI/C/aG-profile
from recent fluvial deposits without or with <2% carbonates; aG deeper than 8dm
(*Haplic or Umbric Fluvisol; VA1c*)

Subtypes:
AQt
-(Norm-)Paternia
aAh/aI/C/aG-profile aAh/aI/C >8dm thickness

Transition Subtype:
GG-AQ
-Gley-Paternia: aGo and transition horizons from 4-8dm

AZ
Type: **KALKPATERNIA** (AUENPARARENDZINA)
with aAh/aI/C/aG-profile
from recent fluvial deposits with carbonate content >2% or even high carbonate content;
aG deeper than 8dm

Subtypes:
AZt
-(Norm-)Kalkpaternia
aAh/aI/C/aG-profile aAh/aI/C >8dm thickness
(*Skeleti-calcaric Fluvisol; VA1b*)

Transition Subtype:
GG-AZ
-Gley-Kalkpaternia: aGo and transition horizons from 4-8dm

AT
Type: **TSCHERNITZA** (CHERNOZEM-LIKE FLOODPLAIN SOIL)
with aA\((/aM)\)/aC/aG-profile; aA\(>4\)dm thickness, aG deeper than 8dm
(*Gleytic Phaeozem or Mollic Fluvisol; VA1b*)

AB
Type: **VEGA** (BROWN FLOODPLAIN SOIL)
with aAh/aM/(aI/C)/aG-profile
aAh/aM >4dm thickness, aG deeper than 8dm

Subtypes:
ABt
-(Norm-)Vega
aAh/aM/(IIaI/C)/(II)aG-profile, aAh >4dm, aG deeper than 8dm
(*Fluvic Cambisol; VA1c*)

Transition Subtype:
GG-AB
-Gley-Vega: aGo and transition horizons from 4-8dm

G
3.2.2 **GLEYE** (GROUNDWATER AFFECTED SOILS)
This class are groundwater influenced soils with redoximorphic features, at least in parts of the upper 40 cm.

GG
Type: **GLEY**
with Ah/Go/Gr-profile
GGn
- (Norm-) Gley
Ah/Go/Gr-profile Go upper border above 4dm, Gr normally deeper than 4-8dm (special Gleysol)

GGx
- Oxygley
Ah/Go-profile only Go, no Gr, because of O₂-saturated groundwater

GGe
- Brauneisengley (bog iron gley soil)
Ah/(Go)Gso/(Gr)-profile with strong cementation of brown iron oxides, often
with iron pans (petro ferric) (Plinthic Gleysol)

GGi
- Bleichgley without ironoxides and oximorphic features
Ah/Gw/Gr-profile

GGw
- Wechselfley (Gley with a strongly fluctuating groundwater table)
Ah/Go/Gor/(Gr)-profile Ah/Go >8dm; with strongly fluctuating groundwater,
outside floodplains

GGc
- Kalkgley
A(c)/h/Geo/G(c)-profile with secondary carbonate (Calcic Gleysol)

GGh
- Humusgley
Ah/Ah-Go/(Go)/(Ah-Gr)Gr-profile Ah/Ah-G >4dm, humus content like Ah
(Humi-Umbri Gleysol; IIIB1bf, IIIIC2b)

GGa
- Auengley
aAh/(aIC,aM/)aGo/aGr-profile gley with floodplain dynamics in the whole
profile (Fluvic Gleysol)

GGg
- Hänggley
Ah/sGo/(sGr)-profile on slopes with >9% inclination (Gleysol)

GGq
- Quellengley
Ah/qGo/qG(o)-profile formed by spring water

Transition Subtypes:
RR-GG
- Rendzina-Gley: Ah/cC<4dm depth
RQ-GG
- Regosol-Gley: Ah/fIC<4dm depth
TT-GG
- Tscherneßem-Gley: Ah<4dm depth overlying Go-Axh or Axh-Go up to 4dm depth
DD-GG
- Pelosol-Gley: Ah/P<4dm depth overlying P-Go
BB-GG
- Braunerdegley: Ah/Bv<4dm depth
LL-GG
- Parabraunerde-Gley: Ah/AI/(Bt)<4dm depth
LE-GG
- Fahlerde-Gley: Ah/AeI/(Bt)<4dm depth
PP-GG
- Podsol-Gley: Ae/(Bhs)<4dm depth
SS-GG
- Pseudogley-Gley: Ah/Sw<4dm depth
YK-GG
- Kolluvisol Gley: Ah/M<4dm depth above Go-M or M-Go>4dm
YE-GG
- Plaggenesch-Gley: Ap(E)<4dm depth above Go-E or E-Go>4dm
AB-GG
- Vega-Gley: aAh/aM<4dm depth above aGo-aM or aM-aGo>4dm

GN
Type: NASSGLEY
with Go-Ah/Gr-profile Go-Ah<4dm depth, long lasting groundwater saturation
close to soil surface
GNa
Subtypes:
- (Norm-)Naßgley
Go-Ah/Gr-profile Go-Ah<4dm depth (Gleysol)

GNc
-Kalknaßgley
Go-Ach/Gc-profile Go-Ach<4dm depth

GNh
-Humusnaßgley
Go-Ah/Ah-Gr/Gr-profile Ah-Gr deeper than 4 dm, humus like Ah

GNg
-Hangnaßgley
Sgo-Ah/sGr-profile SGo-Ah<4dm depth, slope water with >9% inclination

GNq
-Quellennaßgley
qGo-Ah/qGr-profile qGo-Ah<4dm depth, influenced by spring water

GM
Type: ANMOORGLEY
with Go-Aa/Gr-profile
Go-Aa 1-4dm thickness, long-lasting groundwater near soil surface

Subtypes:
GMa
(Norm-)Anmoorgley (Half-bog gley)
Go-Aa/Gr-profile Go-Aa 1-4dm thickness (Humic Gleysol; IIIc2b, IIIc2d)

GMc
-Kakanmoorgley
Geo-Aa/G(c)-profile Geo-Aa 1-4dm thickness (Calcari-humic Gleysol; IIIb1f)

GMg
-Hanganmoorgley
sGo-Aa/sGr-profile sGo-Aa 1-4dm thickness, slope water with >9% inclination

GMq
-Quellenanmoorgley
qGo-Aa/qGr-profile qGo-Aa 1-4dm thickness, influenced by sink water

GH
Type: MOORLEY (GROUNDWATER SOILS WITH PEATY TOPSOIL)
with H/II-Gr-profile, H-horizon <3dm thickness (Umbric Gleysol; IIIc2c,d)

Subtypes:
HN-GH
-Niedermoorgley
nH/Gr-profile nH<3dm thickness

HH-GH
-Hochmoorgley
hH/Gr-profile hH<3dm thickness, moss peats

GHg
-Hangmoorgley
H/sGr-profile H<3dm thickness, slope water with 9% inclination

GMq
-Quellenanmoorgley
H/qGr-profile H<3dm thickness, influenced by spring water

M
3.2.3 MARSCHEN (MARSH SOILS)
Soils of sediments deposited in tidal areas, under natural conditions with high daily fluctuating groundwater table.

MR
Type: ROHMARSCH
with (e)Go-Ah/((e)Go)/(e)Gr-profile from mostly tidal sediments with carbonate content, often high contents of sulphides (Thionic Fluvisol or Salic Fluvisol; VA2)
Subtypes:
division in (Norm-)Rohmarsch (formerly Salzmarsch), Brackrohmarsch and Flußrohmarsch in dependence from sedimentation in sea-, brackish oder riverwater regions.

MC  Type: **KALKMARSCH**
with (e)Ah/eGo/(z)eGr-profile from unconsolidated tidal sediments with carbonates, at least in the first 3dm
*(Calcari-thionic Fluvisol; VA2)*

Subtypes:
identical to Rohmarsch

MN  Type: **KLEIMARSCH**
with Ah/Go/(z)eGr-profile from mostly unconsolidated tidal sediments, decalcified deeper than 4 dm.
*(Fluvi-molllic Gleysol; VA2)*

Subtypes:
identical to Rohmarsch

MD  Type: **DWOGMARSCH**
with Ah/Go-Sw/fAhSd/fGoSd/Go/Gr-profile from tidal sediments (upper boundary below 7dm; layered profile, often with humus- and/or irondwog (fossilite Ah- or Go-horizon), compacted, (Sd).

MK  Type: **KNICKMARSCH**
with Ah/Sw/Sq/Gr-profile from tidal sediments (upper boundary of carbonate below 7dm) with strong compaction (Knick), beginning above 4dm below soil surface and >2dm thick.
*(Verti (or stagni)-fluvic Gleysol; VA2)*

MO  Type: **ORGANOMARSCH**
with oAh/oGo/oGr-profile from tidal sediment of humic clay; often interlayers of peats and muds, strongly acid, often Maibolt (mineral: Jarosite).
*(Fluvi-umbrlic Gleysol, Fluvi-Thianic Gleysol; VA2)*

**3.3 SEMISUBHYDRISCHE UND SUBHYDRISCHE BÖDEN**
(SEMI-SUBHYDRIC AND SUBHYDRIC SOILS)

**I**

**3.3.1 SEMISUBHYDRISCHE BÖDEN (SEMI-SUBHYDRIC SOILS)**
Soils under marine tidal influence and in the lower basins of rivers between mean low water and mean high water tide levels; with a F-horizon. Mostly unvegetated

**IW**

Type: **WATT (TIDAL-FLAT SOILS)**
with (z)(e)Fo/(z)(e)Fr-profile from marine tidal sediments with mostly rich fauna and mixture with organic matter, partly above fossilite or relictic marsh soil or peat, daily flooded.
3.3.2 SUBHYDRISCHE BÖDEN (SUBHYDRIC SOILS)
Horizontation and subdivision of subhydric soils are still discussed.

Type: PROTOPEDON (IMMATURE SUBHYDRIC SOIL)
Subhydric soil of different sediments without macroscopic visible organic matter, but inhabited by organisms (with Fi-horizon).

Type: GYTTIA
Subhydric soil of organic or/and mineral, mostly limnic sediments, usually muds; nutrient-rich, well aerated (with Fo-horizon).

Type: SAPROPEL
Subhydric soil of mostly organic, limnic sediments (sapropel), often with sulphides; nutrient-rich, badly aerated (mostly with black Fr-horizon).

Type: DY
Subhydric soil, mainly of dark brown, humic acids (brown mud); deficient in nutrients, badly aerated.

3.4 MOORE (PEAT SOILS)
Soils of peats (>30wt.% organic matter), >3dm thickness.

3.4.1 NATÜRLICHE UND VERERDETE MOORE
(NATURAL AND EARTHY PEAT SOILS)
Natural peats still have their original profiles. Generally peat forming as a pedogenic process continues. However, in many cases water-, structure- and nutrient dynamics have been altered by drainage and land use procedures, which has lead to more or less strong mineralization (Hv-horizon) and humification (Hm-horizon) of the upper soil and partially specific stucture of the subsoil by shrinking, swelling and aerobic humification (coarse- to fine subangular blocky structure (Ha-horizon), coarse-prismatic peat-shrinking structure (Ht-horizon) as a result of drainage).

Type: NIEDERMOOR (Fen)
Niedermoor develop under the influence of continuously at or over land surface standing ground- or flooding water.

Subtypes of natural peat soil:
-(Norm-)Niedermoor; base-rich
nHw/nHr/(F/II)(f) - profile
(Fibric or haplic Histosol; IV 2a)

Kalkniedermoor (Calcareous fen)
((e)nHcw/) (e)nHcr/(nHr)/(F/II)(f) - profile
(Calcari-haplic Histosol)

Übergangs(nieder)moor (transition mire)
(uHw/uHr/(nHr)/(F/II)(f) - profile
(Fibric or Haplic Histosol; IV 2c)

Subtypes Niedermoor (of earthy peat soils)
-Erdniedermoor, base-rich
nHv/(nHt/nHw/nHr/(F/II)(f) - profile
-Erdkalk(nieder)moor
(e)nHcv/((e)nHct/(e)nHcw/(e)nHcr/(F/II(f)...-profile
-Erdübergangsmoor
uHv/(uHr/uHw/uHr/(nHr/(F/II(f)...-profile

earthly and segregated:
-Mulnmiedermoor, base-rich
nHm/nHa/nHt/nHw/nHr/(F/II(f)...-profile
-Mulmkalk(nieder)moor
(e)nHcm/(e)nHca/(e)nHct/(e)nHcw/(e)nHcr/(F/II(f)...-profile

HH Type: HOCHMOOR (RAISED BOG FROM MOSS PEAT)
Raised-Bog Soils develop independently from groundwater (ombrogenic moors), but mainly under climatic conditions, i.e. from a positive climatic water balance with impeded soil drainage only from precipitation. Such conditions lead to very acid soils containing few nutrients.

Subtype of natural peat soils
(Norm-)Hochmoor
(hHw)/(hHr/(uHr)/(nHr)/(F/II(f)...-profile
(Fibric or Haplic Histosol; IV2c)
Subtype of earthy peat soils
Erdhochmoor
hHv/hHw/hHr/(uHr)/(nHr)/(F/II(f)...-profile

3.4.2 MOORKULTOSOLE

Cultivated bog soils have lost their original soil profile and their significant bog soil-characteristics by human land use. This, however, does not mean the formation of strongly humified soils by drainage, but strong changes by cultivation like deep ploughing (sand mixing tillage), covering with a sand layer (cultivation by sand cover) or mixture of the mineral soil with well decomposed peats (German: „Fehnkultur“).
Soils are only characterized as Cultivated Bog Soils, if there is a peat layer (>30% organic matter) of at least 3dm thickness left at the soil surface, which may only be overlain by 2dm mineral soil cover. If bog soils are altered by anthropogenetic operations so heavily that they do not fit in the mentioned conditions, only a classification as a mineral terrestrial or semiterrestrial soil type should be considered.
4. CRITERIA FOR THE FORMATION OF VARIETIES UND THEIR DIAGNOSTIC HORIZONS

These separations are used as adjectives or prefixes of the subtype name.

<table>
<thead>
<tr>
<th>Criteria, nomenclature of varieties</th>
<th>Diagnostic horizons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.1 Humus form</strong></td>
<td></td>
</tr>
<tr>
<td>Mull (similar to mollic) Mull-Normbraunerde</td>
<td>Axh&gt;1dm, base saturation ≥50%, crumb structure, bioturbation; diagnostic horizons of Chernozems eAh/cC, mostly &gt;15 mass% organic matter, mixed with skeleton- and carbonate-rich mineral material, hardly clay-bound</td>
</tr>
<tr>
<td>Mullartig (Mullartige Normrendzina)</td>
<td>L/Of/Oh/Ahe,Aeh,Ahe/...; indistinct transitions between the horizons</td>
</tr>
<tr>
<td>Moder (similar to folic; e.g. Moder-Normbraunerde)</td>
<td>L/Of/Oh/Ahe/...; very distinct to distinct transitions between the horizons</td>
</tr>
<tr>
<td>Rohhmsus (raw humus) (e.g. Rohhmsus-Podsol-Braunerde)</td>
<td>L/Of/Oh/Ovh/...</td>
</tr>
<tr>
<td>Tangel (e.g. Tangel-Norm-Rendzina)</td>
<td>Ah 1-2dm thickness, &gt;8-15wt.% organic matter</td>
</tr>
<tr>
<td>Feuchtquoll (moist)</td>
<td>dystric, Oh greasy</td>
</tr>
<tr>
<td>Feuchtmoder (moist)</td>
<td>dystric, Oh greasy</td>
</tr>
<tr>
<td>Feuchtrohumus (moist)</td>
<td></td>
</tr>
</tbody>
</table>

| **4.2 Humus-rich Ah- or Ap-horizon** | in Ah>8-15 mass% organic matter up to >1dm depth |

| **4.3 Lithogenic carbonate content in** | Solumn (Calcaceous residue) |
| Calcaceous (e.g. Calcaceous Pelosol)   | is still discussed |

| **4.4 Precipitations** | is still discussed |
| e.g. Jarosite, iron sulphide, bog iron |                     |

| **4.5 Base saturation** |                     |
| P, Bv, Al, Ael, T, Sw, Sg, Srw , Y, M, E, aM, G in 2-5 dm depth; for A/C-soils in Ah. basenreich, eutric | base saturation ≥50% |
| mittelbasisch, medium   | base saturation 20-50% |
| basenarm, dystric       | base saturation <20% |
| e.g. Eutrofe Normbraunerde, Mesotrofe Humuspseudogley |                     |

| **4.6 Podsoligkeit** | O/Aeh/Ahe,Ahe+Ae/+... |
| initial podzolization, not yet well differentiated in albic and spodic horizons |                     |
| podsolig subdivision on subvariety level |                     |
| slightly podsolig | O/Aeh/+... |
| moderate podsolig | O/Ahe/+... |
| strong podsolig | O/Ahe+Ae/+... |

| **4.7 Pseudovergleung (stagnic)** |                     |
| pseudogleyed | upper boundary Sw or transition-Sw 8-13dm u. GOF or with only faint pseudogleyung above 8dm upper boundary Sw or transition-Sw deeper than 13 dm u. GOF |
| deep pseudogleyed |                     |

| **4.8 Gleying** | upper boundary Go or transition-Go 8-13dm u. GOF |
| gleyed |                     |
| deepgleyed | upper boundary Go or transition-Go deeper than 13 |
4.9 Floodplain groundwater dynamics in terrestic subsoils
Auenpelosol
Auenparabraunerde
Auenpodsol
Auenpseudogley
Pelosol
Parabraunerde
Podsol
Pseudogley
each with aG deeper than 8dm u. GOF

drainage (lowering of groundwater level) in semi-terrestrial soils with the result of a changing horizon sequence (drained Pseudogleys as varieties are being discussed) drained rG

4.11 Aufstau (raised ground water table)
By drowned soils the actual groundwater dynamics and their resulting characteristics are decisive factors for classification, e.g. Gley, developed from Podsol; classification as variety

4.12 Colour
Plaggensch: grey, brown, grey-brown
Auenrendzina: grey, brown

gE, bE, gbE gaAh, baAh

4.13 Ackernutzung (arable land use)
Acker...(arable...)
(e.g. Ackerbraunerde)

Ap (including „kultotroph“)

4.14 Other agricultural use
Base- and nutrient soil conditions changed by fertilizing
kultotroph (anthric, man made)
suggestion:

4.15 Transition forms Varieties occur
- at transition forms within a type (e.g. Hangoxigley = Oxigley in slope position
- in case of combination of a transition subtype with a 3rd type (e.g. Podsolierter Braunerde-Gley = spodi-cambic Gleysol, 3rd type adjectival)
- in case of combination of a deviation subtype with a norm-subtype or 2 deviation subtypes (each of different types, e.g. Kalkbraunerde-Gley = Cambi-calcic Cambisol-Gleysol-Gley)
- at combination with a variety or of varieties

5. LITERATURE


Herrn Karl Stahr, Hohenheim, wird für die kritische Durchsicht des Manuskriptes gedankt.