



Deriving WRB soil types using National German Soil Survey Guidelines

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Interpreting the German inventory for international use

- German “soil systematics” is based on morphogenetic horization
→ no diagnostics independent of horization described
- international context → WRB
→ derive diagnostics from soil database data
- automated tool

First approach – German pedogenetic system to WRB

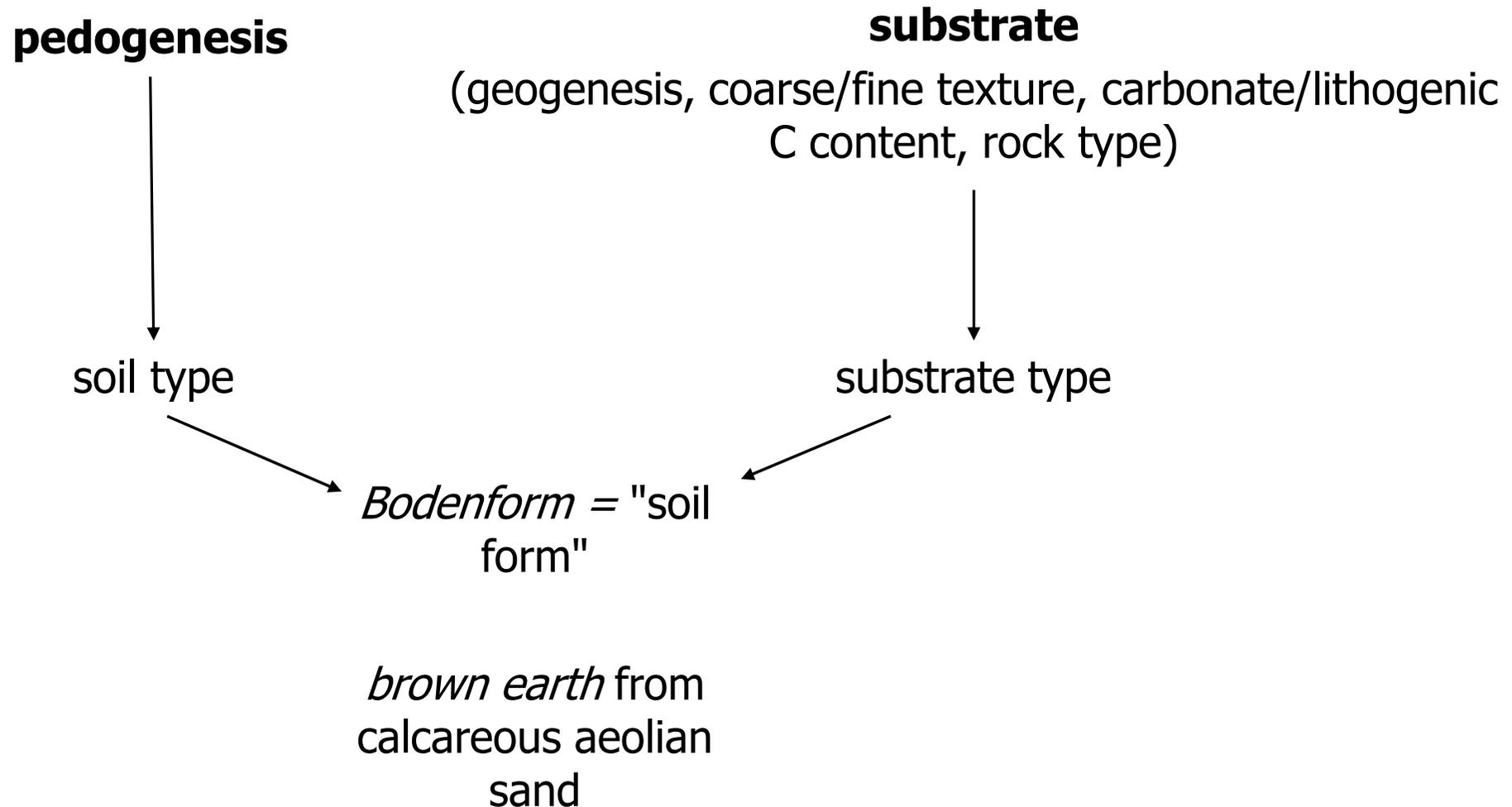
	Terrestrial soils	Semi-terrestrial soils	(Semi-)Submersed soils	Fens and Bogs	
divisions					4
classes	13	4			21
types	29		6	5	57
subtypes		70	3	12	223

BUT: translation possible for 50 % of all systematical units only

(25 core classes, 30 deviating, 83 transitional)
 (16 core classes, 30 deviating, 24 transitional)

2794 varieties + 22 criteria for sub-varieties

German pedogenetic system + substrate



Data – German Soil Mapping Guideline 5th ed.

Germany: Data obtained and coded according to German soil survey guideline, 5th ed.

- 40 site and profile parameters
- 87 horizon-related parameters
many multiple-entry
incl. data on distribution, share, size, intensity



49 different kinds of distribution of phenomena, e.g. lenses, on aggregates, in pockets, etc.

9 classes [%]
f1 <1
f2 1-<2
...
f8 70-<90
f9 ≥90

	micro	medium	macro
1	<0.5	<2 [mm]	<50
2	..<1	..<5	..<100
3	..<2	..<20	..<200
4	..<5	..<50	..<500
5	≥5	≥50	≥500

5 classes
g1 very weak
g2 weak
g3 medium
g4 strong
g5 very strong

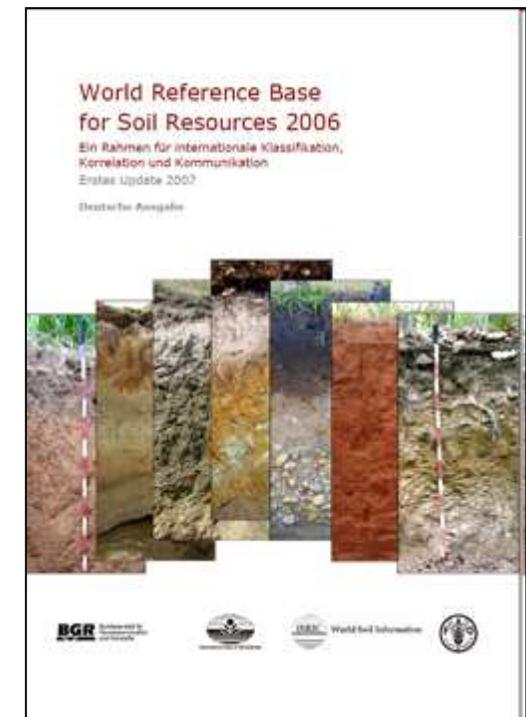
- additionally using lab data if available

WRB

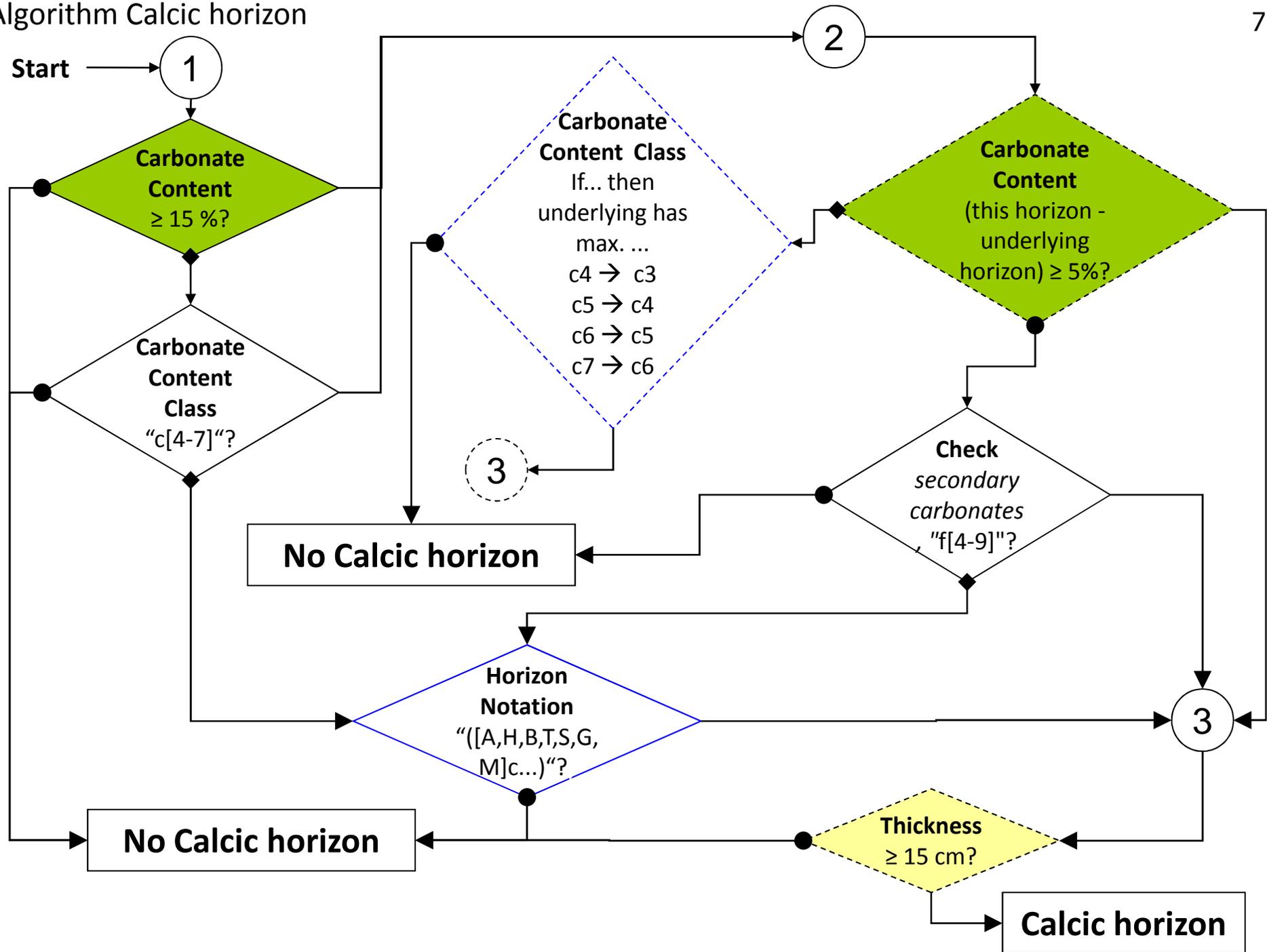
- 32 Reference Soil Groups (RSG)
- 171 Qualifier, incl. pseudo-specified qualifiers (plus 46 explicitly defined combinations with specifiers)
 - 70 encode presence of a diagnostic within a certain depth range
 - 31 add further criteria to a diagnostic
 - 67 encode non-diagnostics-related information
 - 2 encode absence of diagnostics
 - 1 encodes absence of relevant diagnostics

based on

- 39 diagnostic horizons
 - 14 diagnostic properties
 - 12 diagnostic materials
- } 65 diagnostics



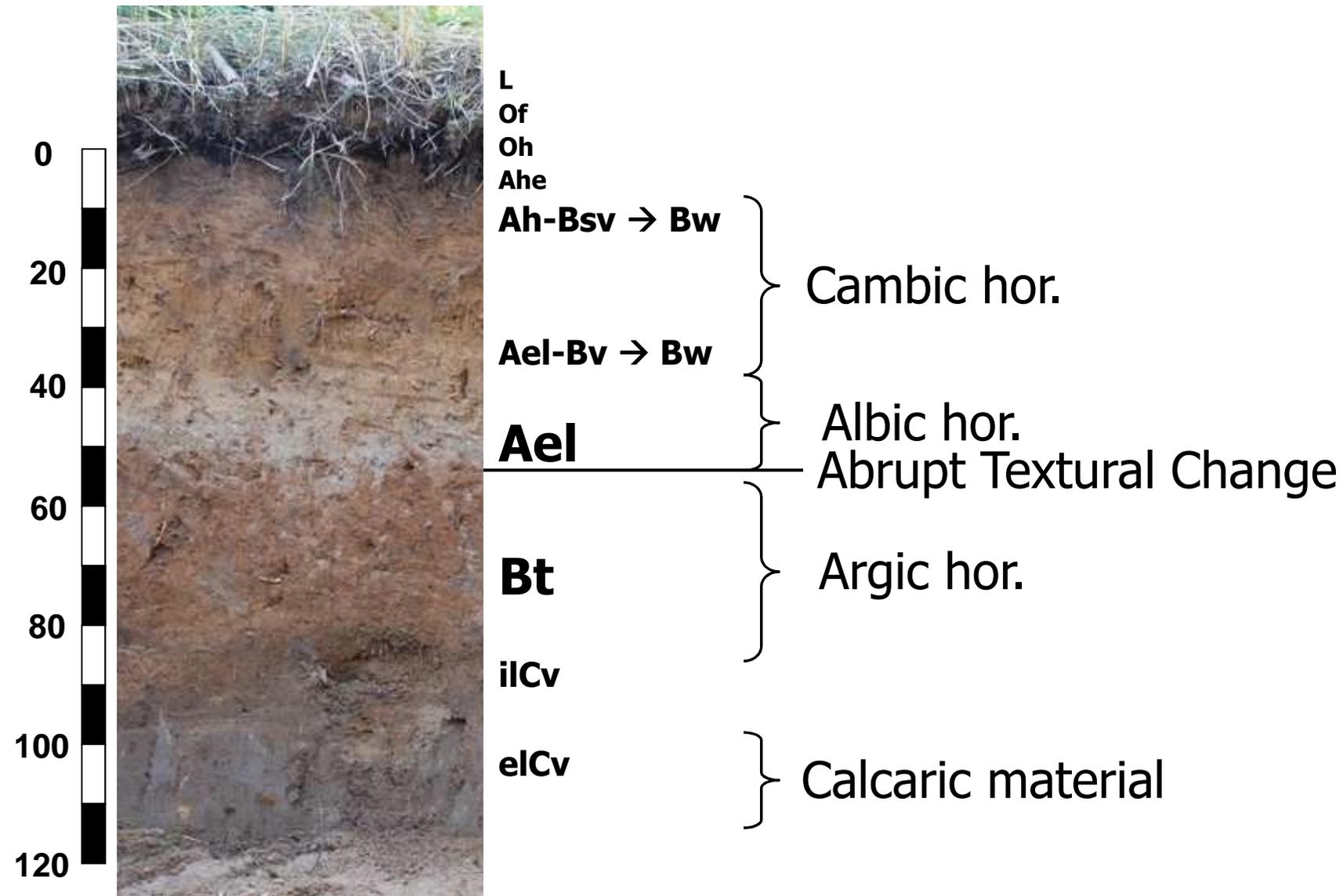
Algorithm Calcic horizon



Challenges identified

- Morpho-genetic horizonation may hide diagnostics
- How depth information is stored in databases and affects identification of diagnostics
- Determination of start and end depth of diagnostics
- Definition of classes of descriptive parameters – e.g. textural classes

Classification in the field vs. with database data



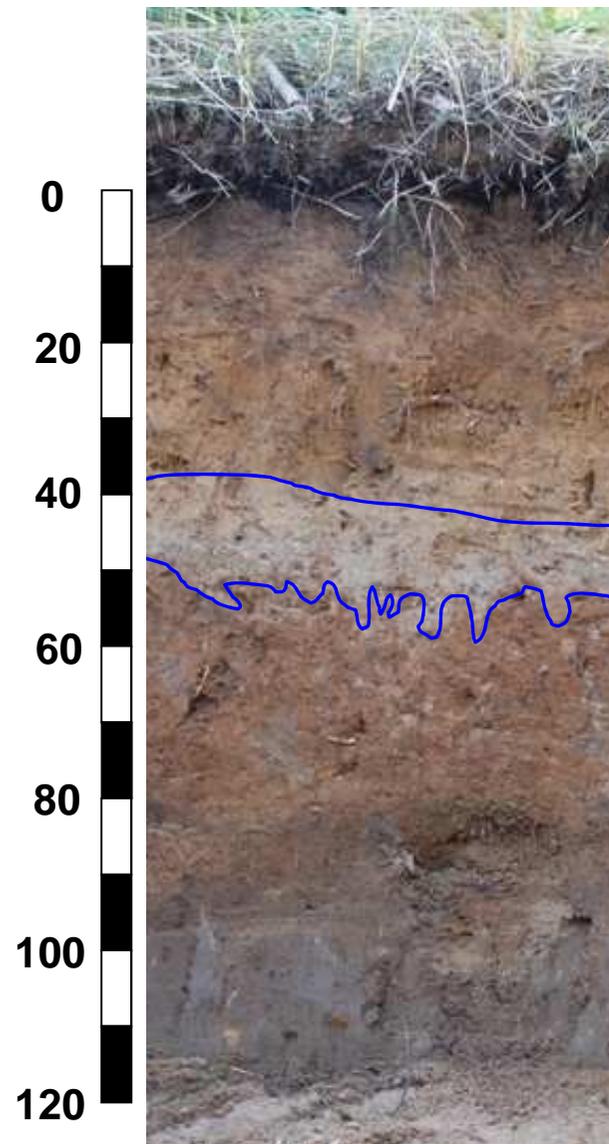
Horizonation, horizon notations, horizon description affect detection of Albeluvic tonguing

Defintion:

Albeluvic tongues

1. colour of an albic horizon; and
2. greater depth than width, ...
3. occupy 10 percent or more of the volume in the first 10 cm of the argic horizon ... ; and
4. have a particle-size distribution matching that of the coarser textured horizon overlying the argic horizon.

Albeluvic tonguing and shape of lower horizon boundary ¹¹



L
Of
Oh
Ahe [E]
Ah-Bsv [BwsAh]

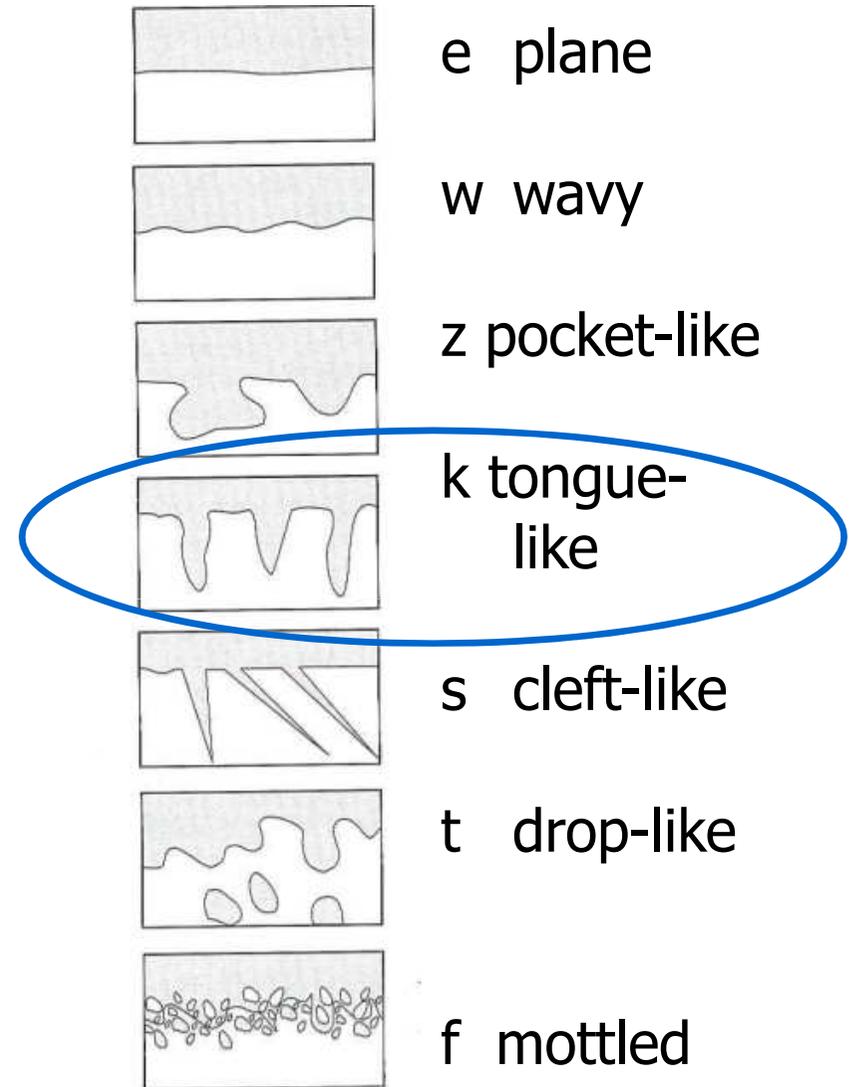
Ael-Bv [BwE]

Ael [E]

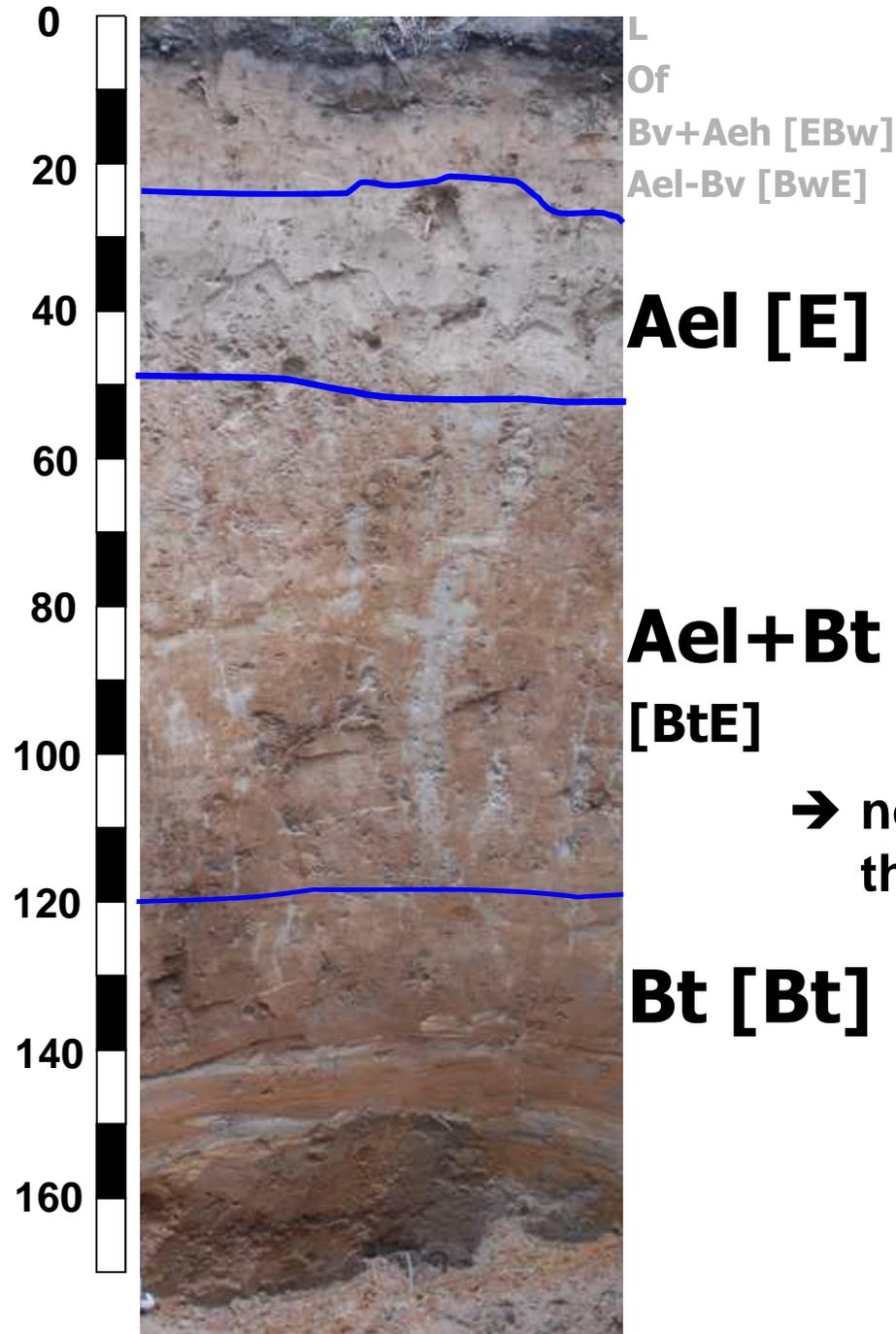
Bt

ilCv

elCv



Albeluvic tonguing and "combination horizons"



Ael [E]

Ael+Bt [BtE]

Bt [Bt]

← "combination horizon"

→ no information on shape and share of the pale domain...

Data recording affects identification of diagnostics

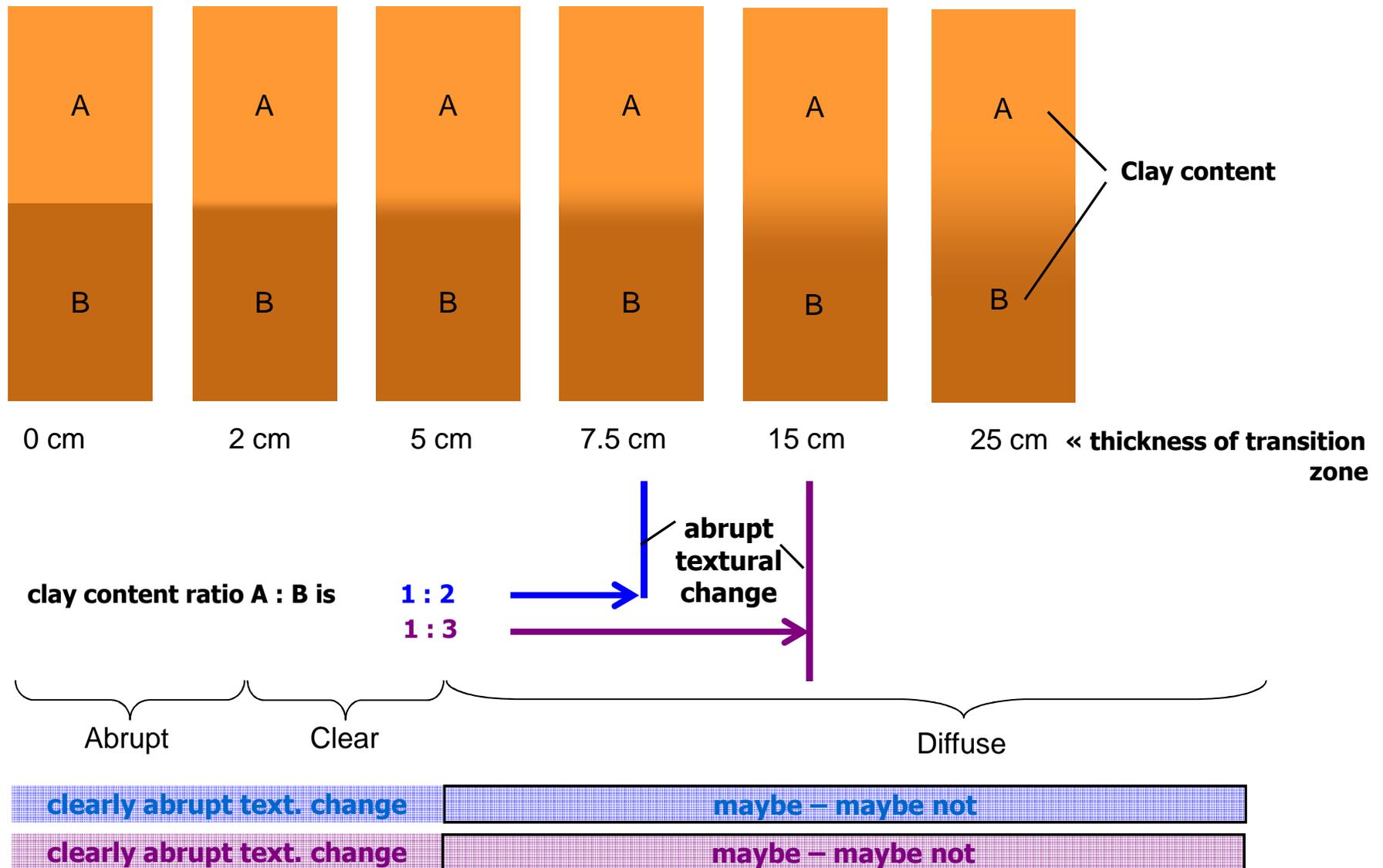
Example: Abrupt textural change

Definition:

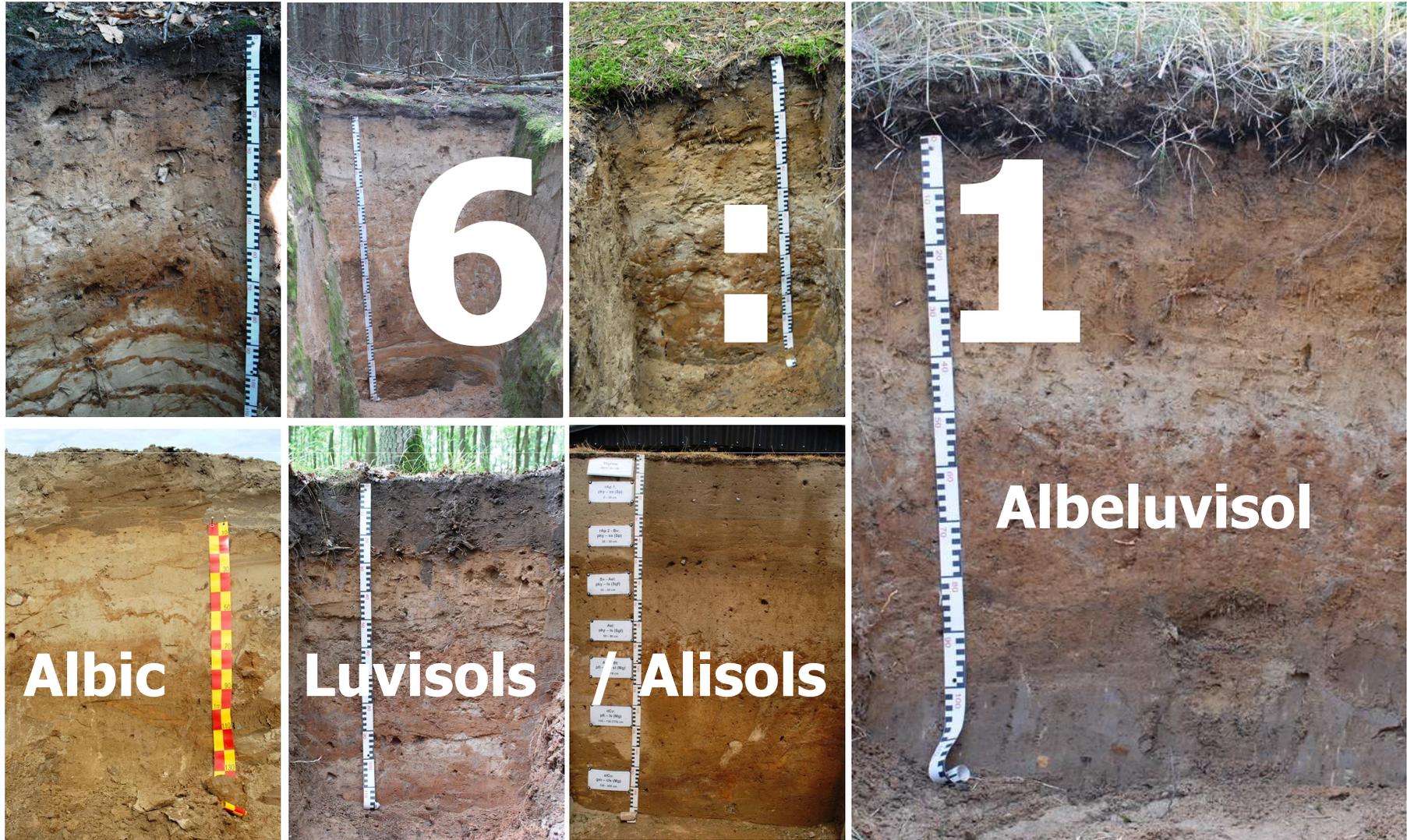
“8 percent or more clay in the underlying layer and:

1. doubling of the clay content **within 7.5 cm** if the overlying layer has less than 20 percent clay; or
2. 20 percent (absolute) increase in clay content **within 7.5 cm** if the overlying layer has 20 percent or more clay.”

Abrupt textural change – sharpness of horizon boundary



Performance – are *Fahlerden* Albeluvisols?



because of no tongues, tongues lithologically determined, mottles instead of tongues, ...

Performance of algorithms

Albic Cutanic Lamellic Luvisol (Ruptic, Arenic)



Albic Cutanic Alisol (Ruptic, Alomic, Greyic, Arenic → Epiarenic)



Albic Cutanic Luvisol (Abruptic, Ruptic, Arenic → Epiarenic)



Albic Cutanic Luvisol (~~Anthric~~ → not enough org. C, Abruptic, Ruptic, Epidystric, Greyic, Epiarenic → Arenic)



Albic Cutanic Luvisol (Abruptic, Ruptic, Arenic)



→ Albic Cutanic Albeluvisol → Luvisol (Abruptic, Ruptic, Dystric → Epidystric, Greyic, Epiarenic)



correct not correct correct (with no-data assumption)
 correct with horizon symbol interpretation → change

Challenges for database data evaluation - Determination of start and end depth

A **Salic horizon** has:

1. **averaged over its depth** ... an electrical conductivity ... (ECe) of $15 \text{ dS}\cdot\text{m}^{-1}$ or more ... or an ECe of $8 \text{ dS}\cdot\text{m}^{-1}$ or more ... if the pH (H_2O) of the saturation extract is 8.5 or more; and
 2. **averaged over its depth** ... a product of thickness (in centimetres) and ECe (in $\text{dS}\cdot\text{m}^{-1}$) of 450 or more; and
 3. a thickness of 15 cm or more.
- no hard criterion for upper and lower depth given – which (parts of) morphogenetic horizons should be included?

Further challenges

- some criteria difficult
(e.g. micromorphological findings in **operational form**)
- “minor” parameters are often helpful (e.g. “further pedogenic properties” – bleached sand grains, etc.), but might often contain **no data**
- horizon notation as integrating parameter often used, but **quality hardly to estimate**

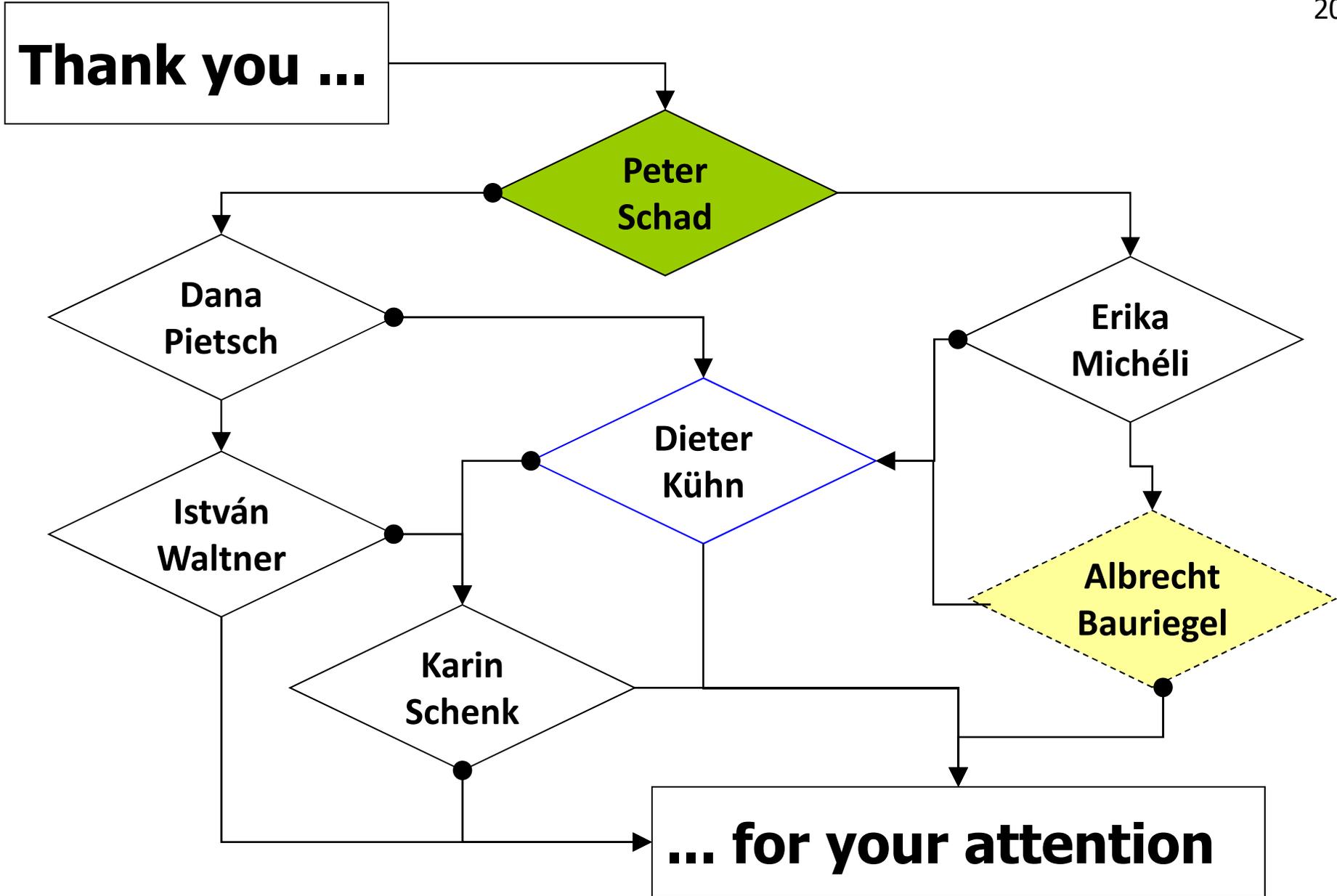
Conclusions

... do we have to improve the data?

- more detailed description of horizons does not necessarily result in better evaluable data
- improve profile description:
e.g. when to distinguish a further horizon?
- always note "best guess" instead of scientifically correct understatement (e.g. boundary depths)

... or the classification?

- Definition of diagnostics should always include an absolute criterion
- Robustness of classification against data and data storage artefacts (e.g. Albeluvisol detection needs a soil pit
→ size importance down from RSG to qualifier level?
→ Glossalbic Luvisol/Alisol/etc.?)



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