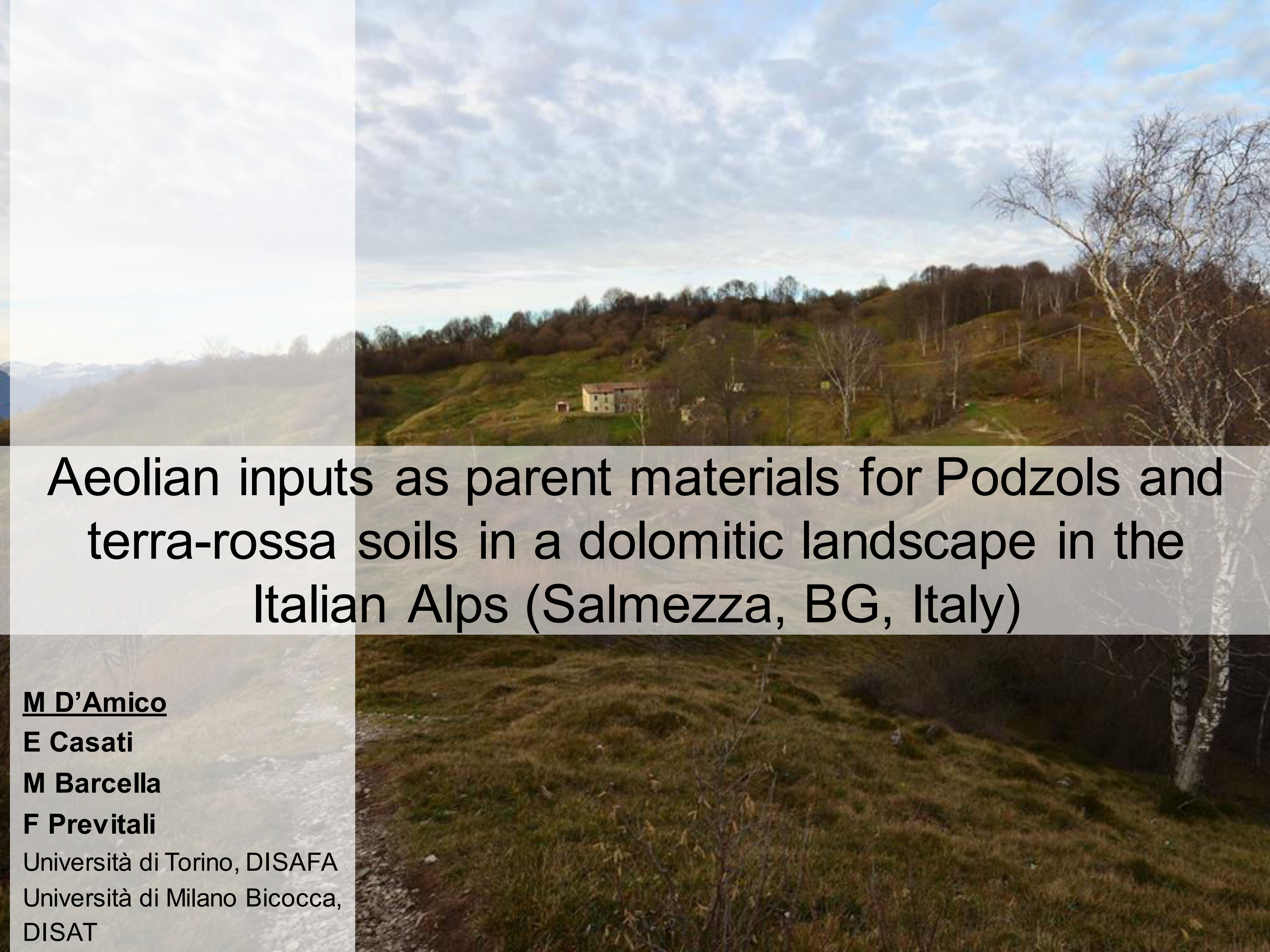

Aeolian inputs as parent materials for Podzols and terra-rossa soils in a dolomitic landscape in the Italian Alps (Salmezza, BG, Italy)

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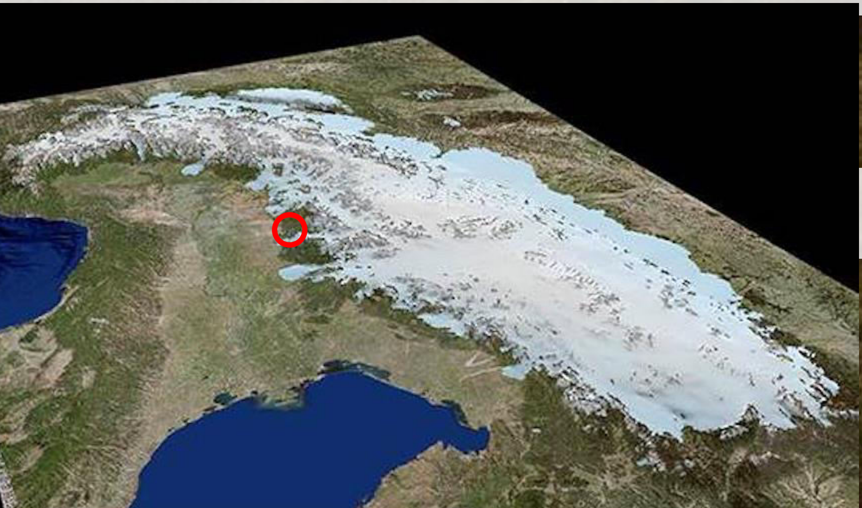
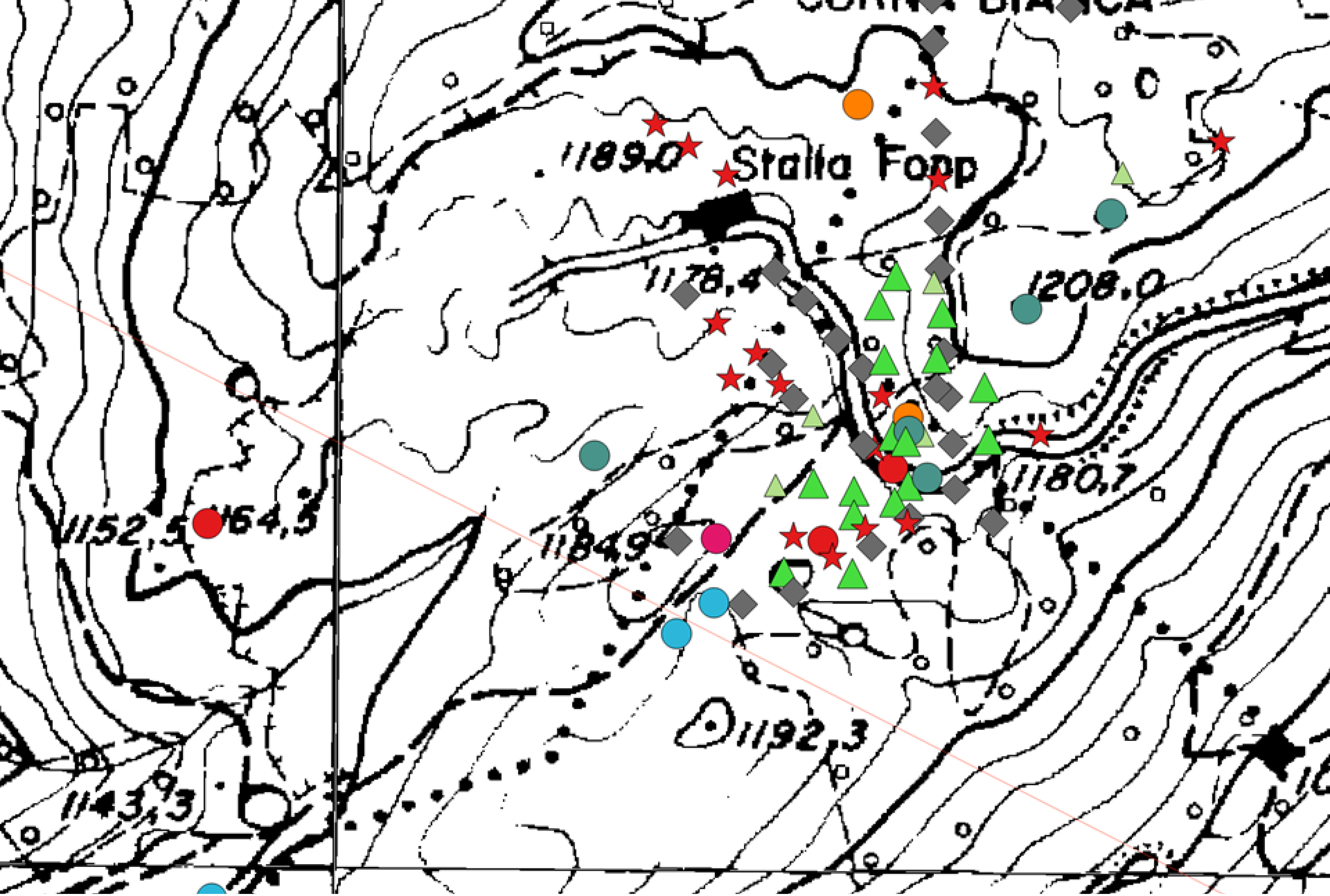
Introduction

Aeolian dust is an important source of elements and minerals in karst soils, although often neglected during soil surveys and studies.

Extremely high pedo-diversity in a karst area in an unglaciated sector of the Lombard Prealps (Salmezza, Nembro municipality, Bergamo), on pure or quartz-rich dolostone.



<u>Where do soil-forming materials come from?</u>



Podzols, Cambisols, Rendzic Leptosols/Phaeozems, buried Terra Rossa (Rhodic Luvisol)/brown “Haplic Luvisol”, Haplic Umbrisol

Site properties

Elevation: 1100-1200 m a.s.l.

MAP: 1600 mm/y

MAT: 7°C

Natural vegetation: beech

dolostone: <1% impurities

Areno-dolostone: 17% sand-sized, well crystallized quartz (after dissolution); dolomite 83%

Main element composition

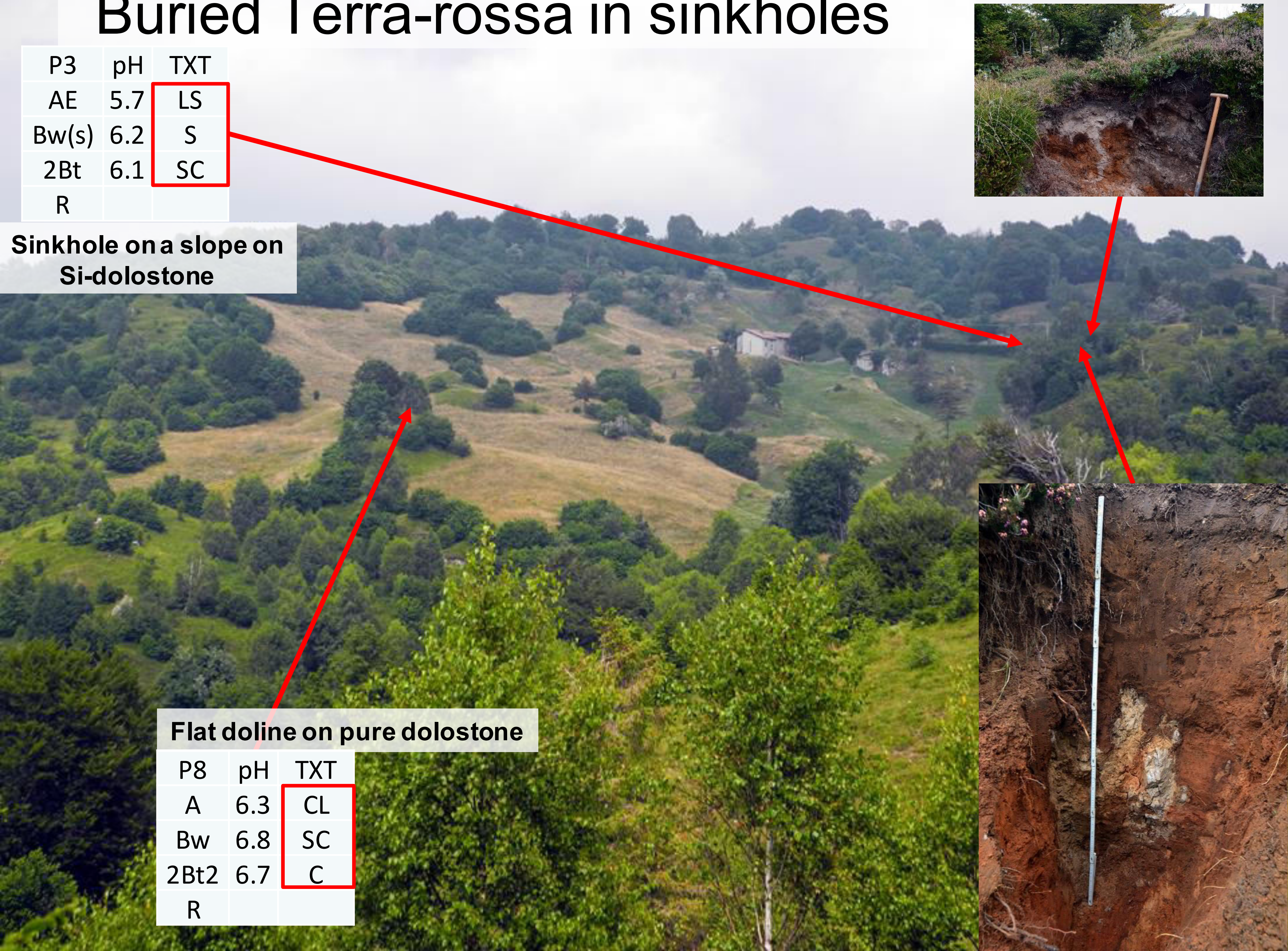
	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %
Dolostone	0.30	0.06	0.04	20.24	29.47
Areno-dolostone	29.76	0.02	0.02	15.12	21.42

Podzols

On Si-dolostone

P2	pH	TXT
E	4.7	S
Bhs1	5.7	S
Bhs2	6.5	S
R		

Buried Terra-rossa in sinkholes



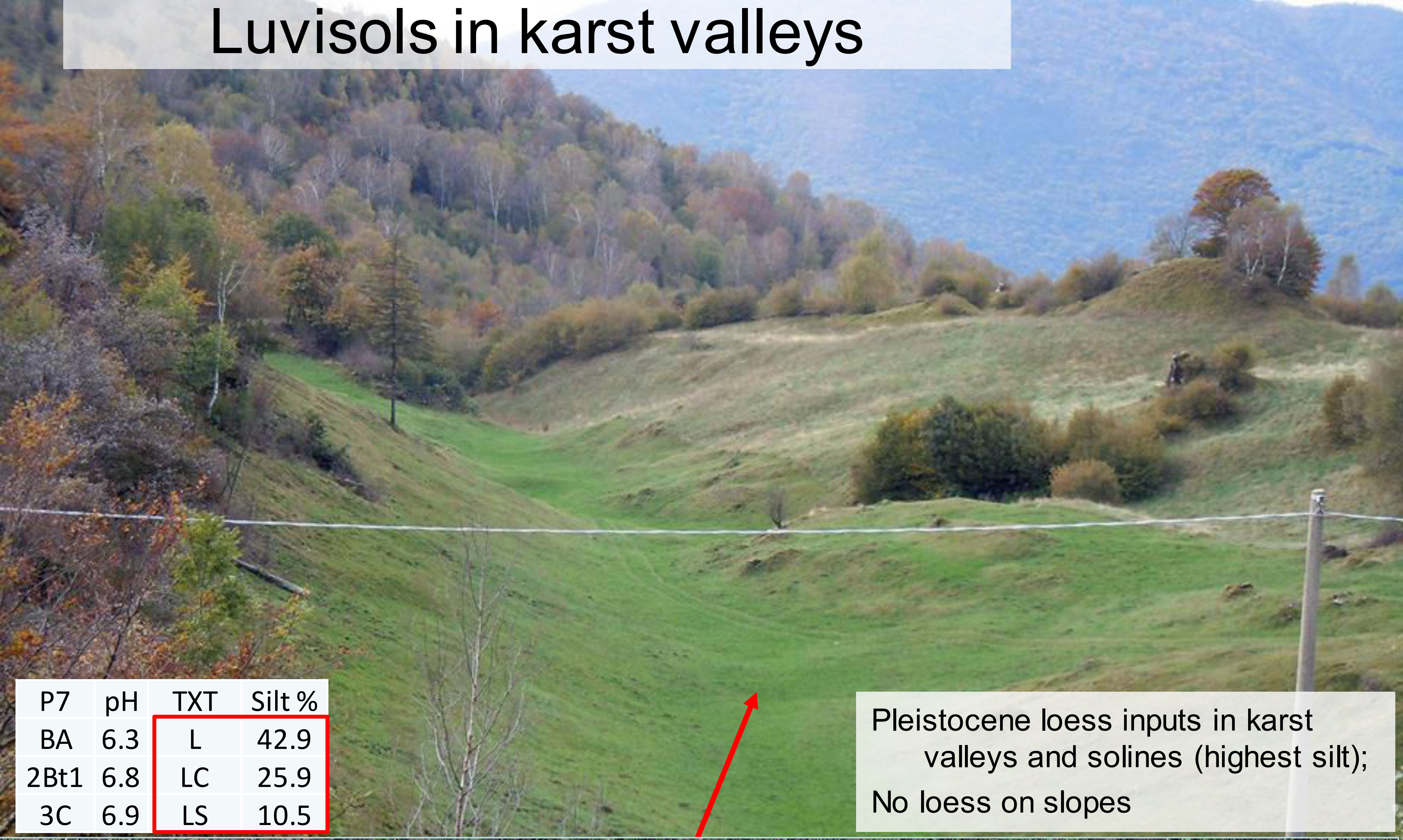
Sinkhole on a slope on Si-dolostone

P3	pH	TXT
AE	5.7	LS
Bw(s)	6.2	S
2Bt	6.1	SC
R		

Flat doline on pure dolostone

P8	pH	TXT
A	6.3	CL
Bw	6.8	SC
2Bt2	6.7	C
R		

Luvisols in karst valleys



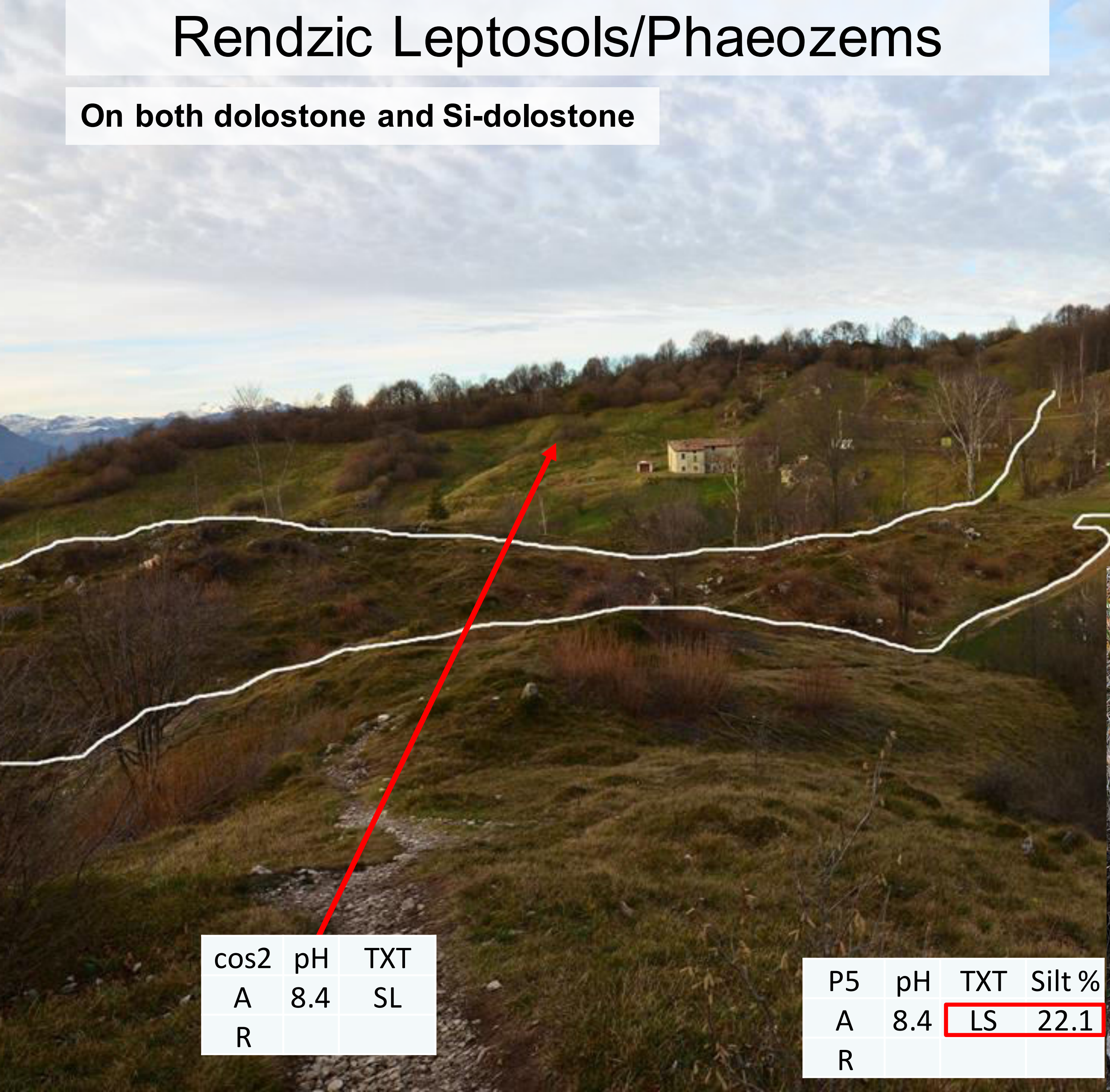
P7	pH	TXT	Silt %
BA	6.3	L	42.9
2Bt1	6.8	LC	25.9
3C	6.9	LS	10.5

Pleistocene loess inputs in karst valleys and solines (highest silt);

No loess on slopes

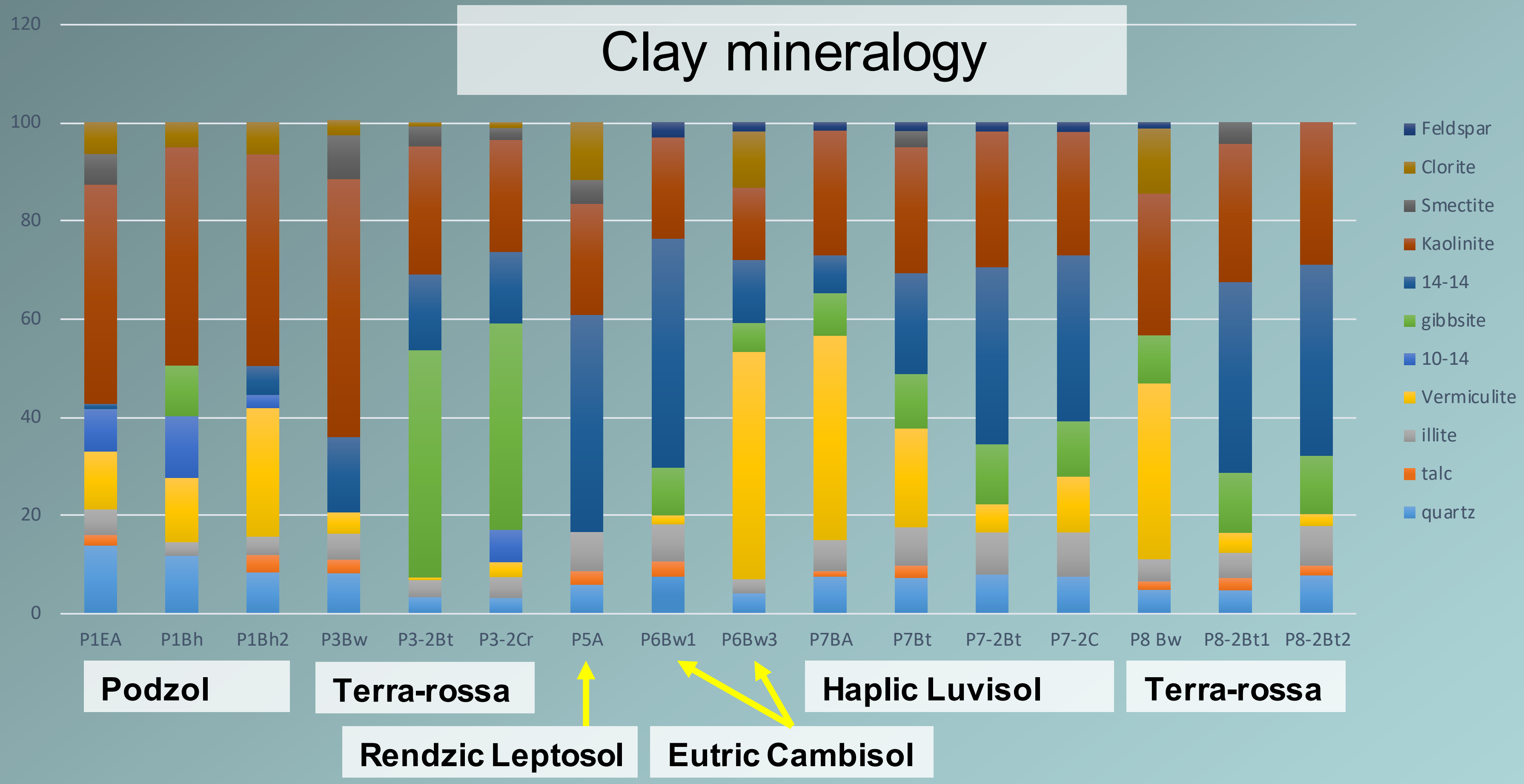
Rendzic Leptosols/Phaeozems

On both dolostone and Si-dolostone



cos2	pH	TXT
A	8.4	SL
R		

P5	pH	TXT	Silt %
A	8.4	LS	22.1
R			



Chlorite abundant in Bw horizons and in surface soils; scarce in buried soils.

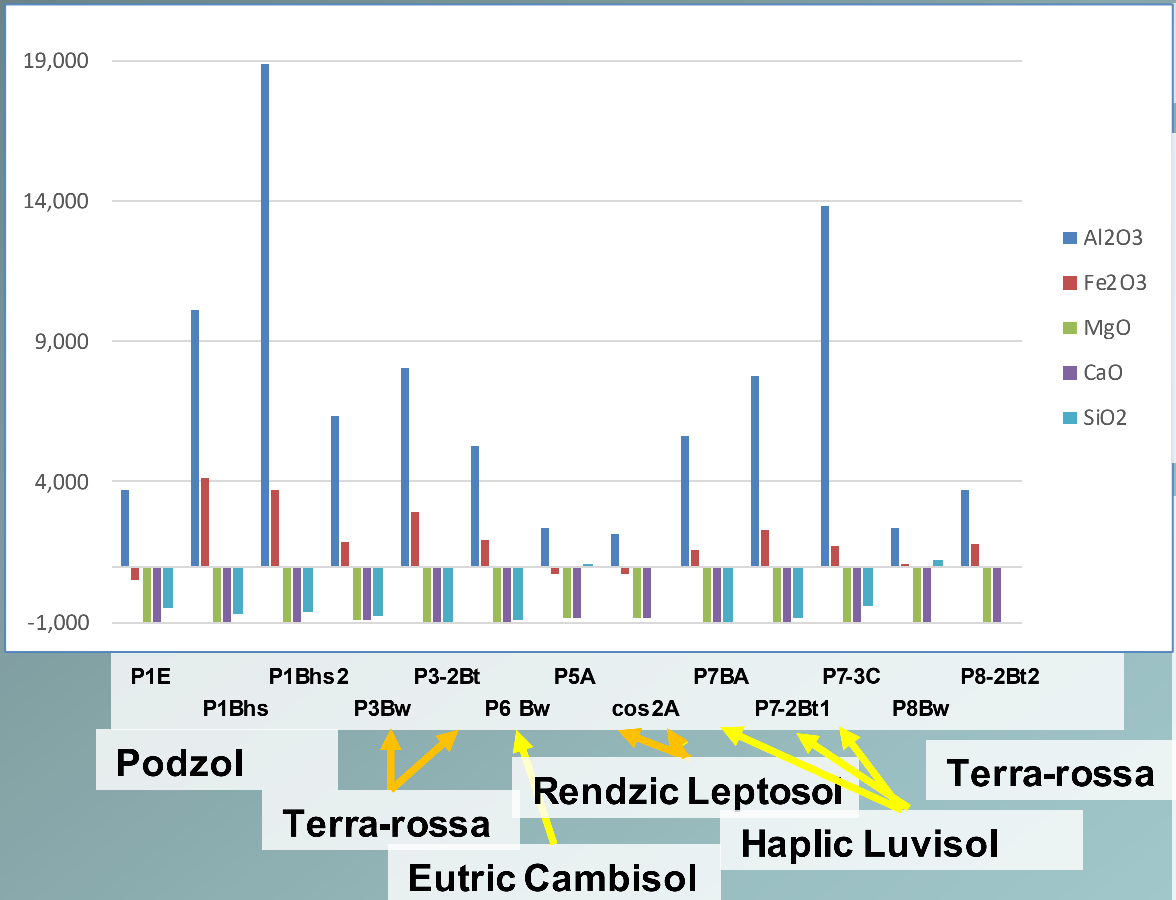
Kaolinite common, particularly in surface soils (Podzols and Bw horizons).

Vermiculite common in surface soils (Podzols and Bw horizons) but not in Rendzic Leptosols

Gibbsite particularly common in buried terra-rossa soils (in agreement with Al2O3 content)

HIS and HIV common in some profiles, not different between surface and buried soils

Mineralogical discontinuites between surface soil horizons and buried ones: different ages



Mass balance (tau)

Based on immobile element TiO_2:

Huge enrichment in Al (up to 1900%) and Fe;
almost complete loss of Ca and Mg;
SiO_2 greatly lost as well.

Trends were related to soil age (assuming Rendzinc Leptosols the youngest, Cambisols and Podzols of Holocene age, buried soils older), except in P8 (terra-rossa soil on pure dolostone); small losses and gains in Rendzic Leptosols, a bit higher in Bw horizons, much higher in Bt and Bhs horizons.

Based on immobile sand-sized quartz in Podzols:

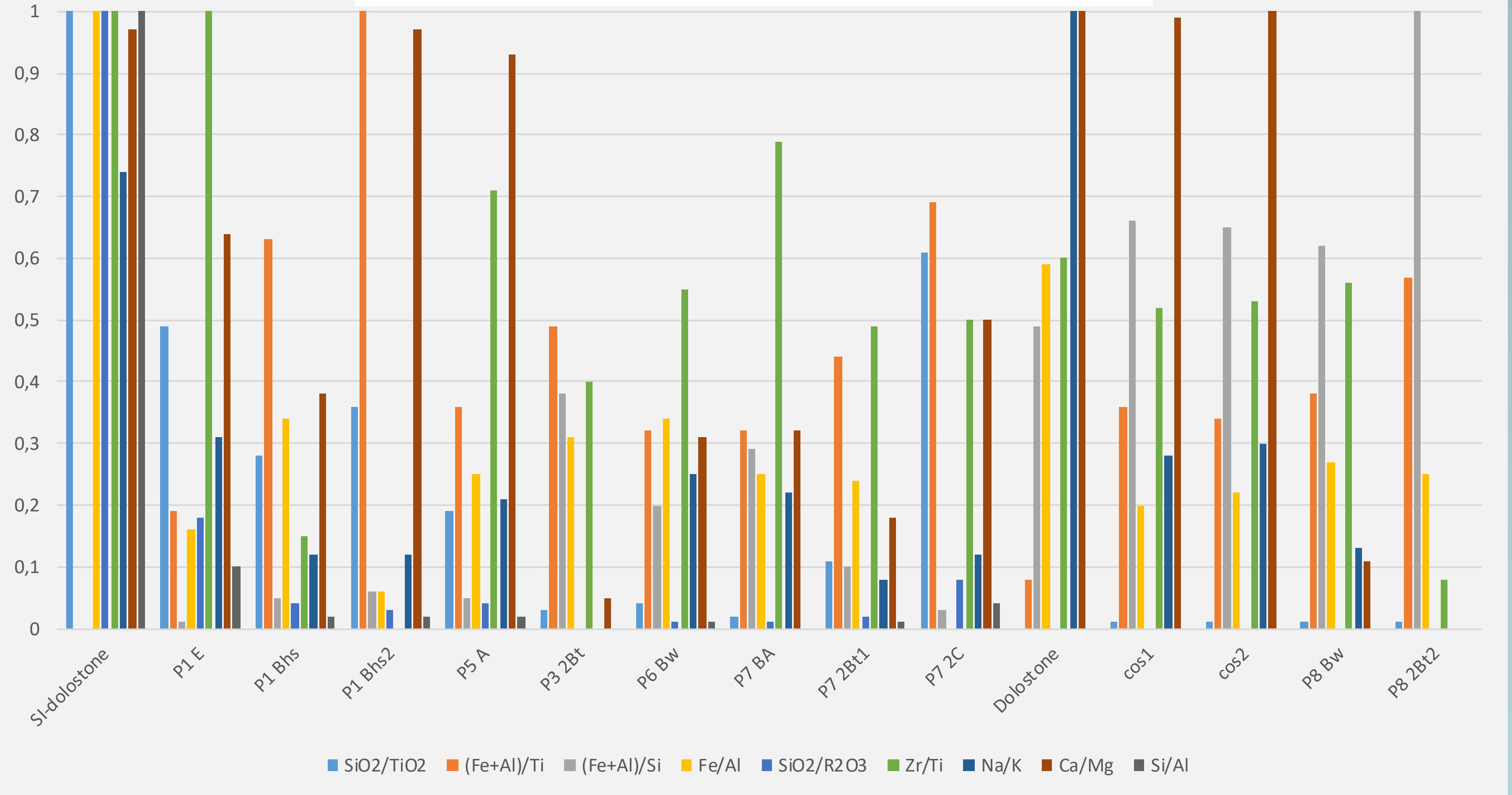
Greater enrichment in Al and Fe;
almost complete loss of Ca and Mg;

	Tau – Al_2O_3	Tau – Fe_2O_3
P1 E	8.59	2.05
P1 Bhs	38.22	17.13
P1 Bhs2	53.34	11.78

<u>The silica loss is not compatible with primary sand-sized, well crystallized quartz in Podzols and in P3:</u>

<u>Post-glacial aeolian inputs in Podzols can explain element enrichment</u>

Normalized «stable» elements ratios



Podzol | **Terra-rossa** | **Rendzic Leptosol** | **Haplic Luvisol** | **Eutric Cambisol**

The variability of the «stable» elements ratios commonly found in the literature is broad between different soil types and even horizons

No univocal aeolian input (loess vs saharan dust vs local dust) is immediately visible.

Discussions and Conclusions

The dissolution of dolostone/areno-dolostone releases few elements to the soils.

Shallow layers of LGM loess can be observed in dolines and karst valleys, mixed with slope materials but quite well characterized mineralogically even if strongly weathered;

On slopes, no loess can be detected, both in surface soils and in buried soils in sinkholes, likely removed by solifluction and erosion, particularly during cold Pleistocene periods

Strong aeolian (Saharan?) inputs are necessary, well visible on arenodolostone.

On arenodolostone, the fast dissolution of dolomite in this temperate-suboceanic climate releases pure quartz sand, in which podzolization takes place.

Aeolian inputs (Saharan dust?) slowly deposits on the soil surface, where the minerals are quickly weathered in the aggressive podzol soil environment; bases are leached, while Fe, Al, Ti etc are concentrated, particularly in spodic horizons.

Different element ratios in different soil types evidences the strong effect of pedogenic processes, also during quite short periods.


Thank you!