

Lessons from the last million years old climatic record preserved in the loess-paleosol sequences in the Vojvodina region, Serbia



Global climate changes
Regional environmental responses

This is the Danube loess multidisciplinary story Written by many researchers from many countries



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**Pal Sumegi,
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**Bjoern Machalett,
Humboldt University,
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**Mark Bokhorst &
Jef Vandenberghe,
Free University, Amsterdam**

**Pierre Antoine and Denis-Didier
Rousseau, CNRS, France**



Loessfest09 89 participants from 26 countries
Novi Sad, 31.08.-03.09. 2009

INQUA Loess research focus group



What Loess community can tell us?

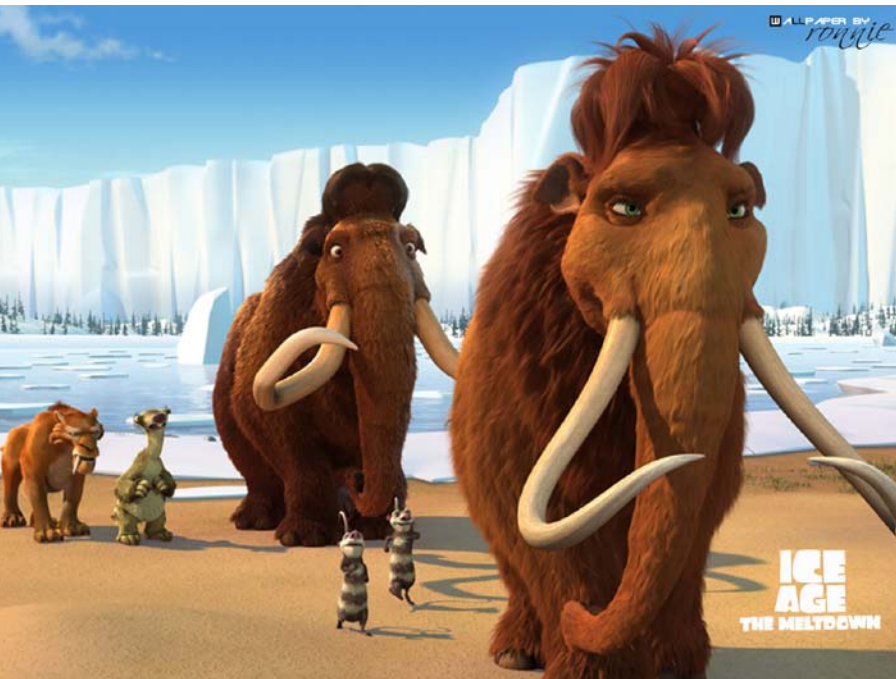


How does look like our future from the past perspective?



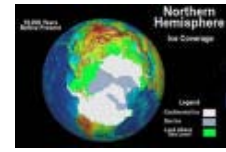


Back to the ICE AGE, back to our roots





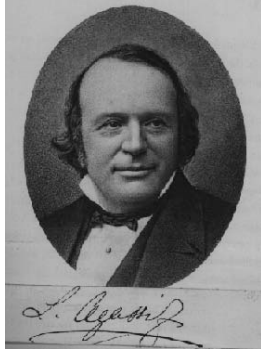
Ice Age Discovery



Backland



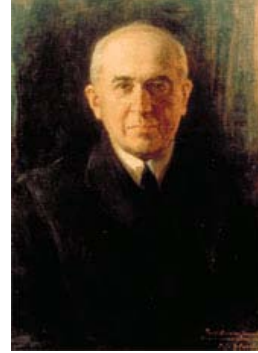
Layel



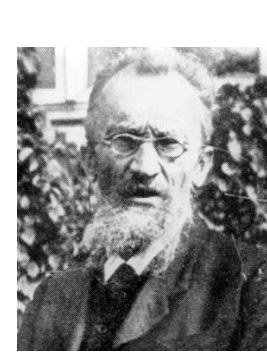
Agassiz



Kroll



Milankovitch



Koeppen



Wegener



Emiliani



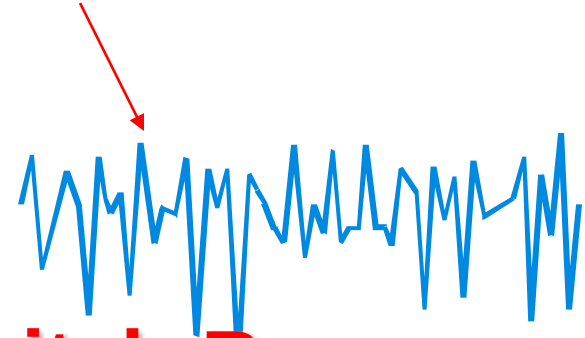
Berger



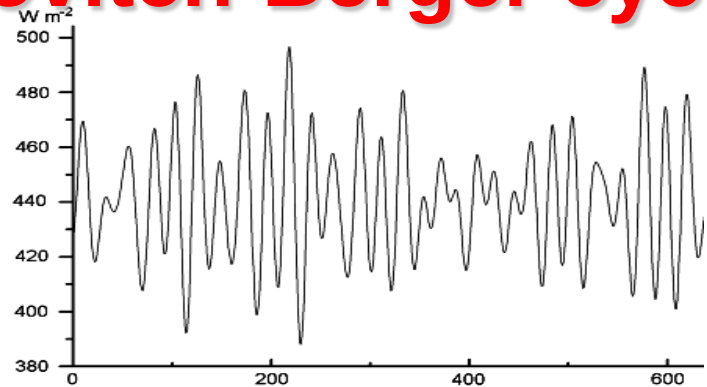
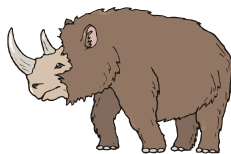
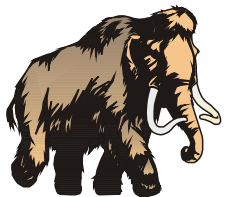
Shackleton



Backland

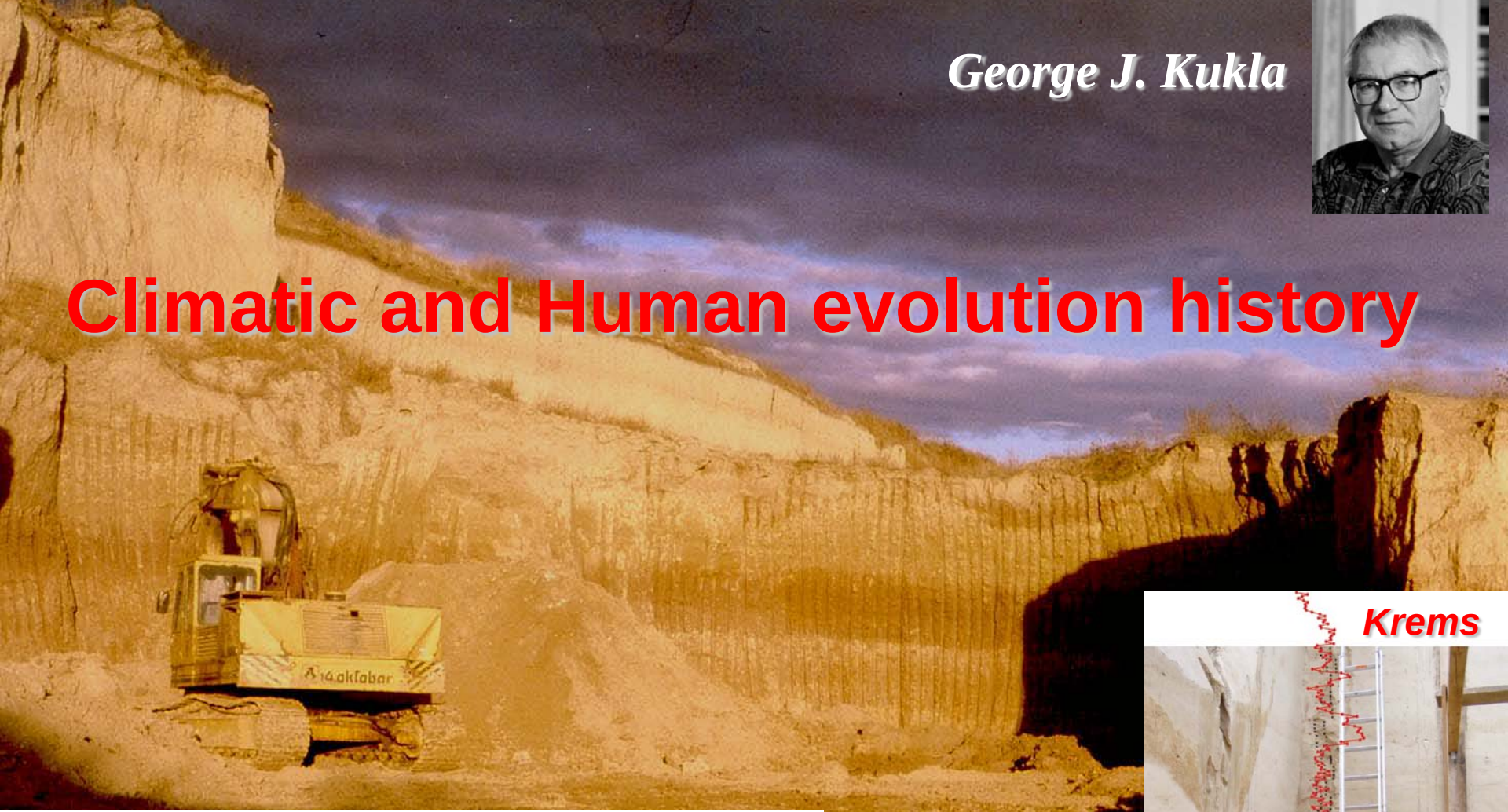


Milankovitch-Berger cycles

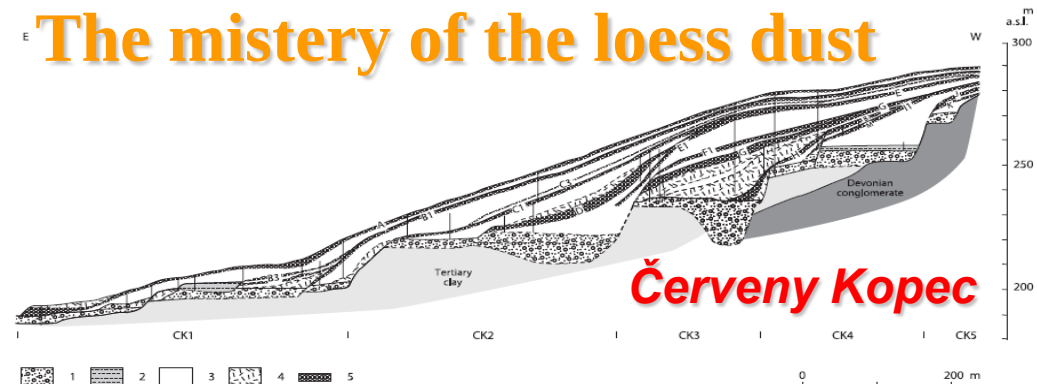


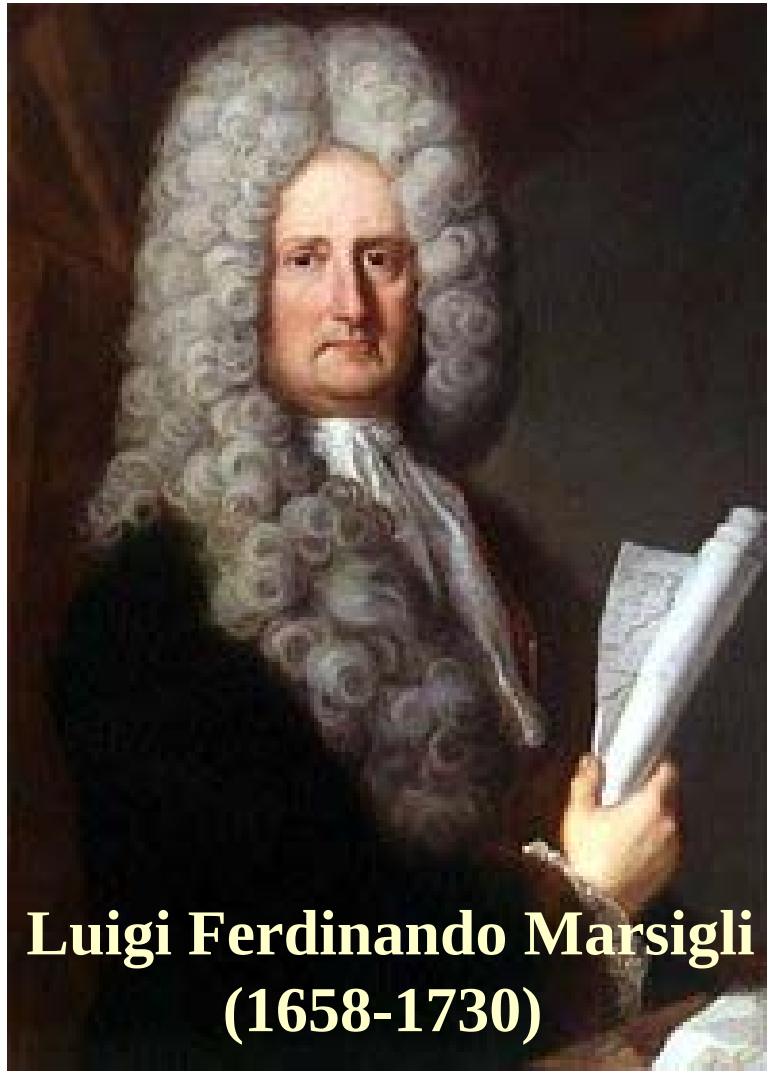


Climatic and Human evolution history



Krems





**Luigi Ferdinando Marsigli
(1658-1730)**

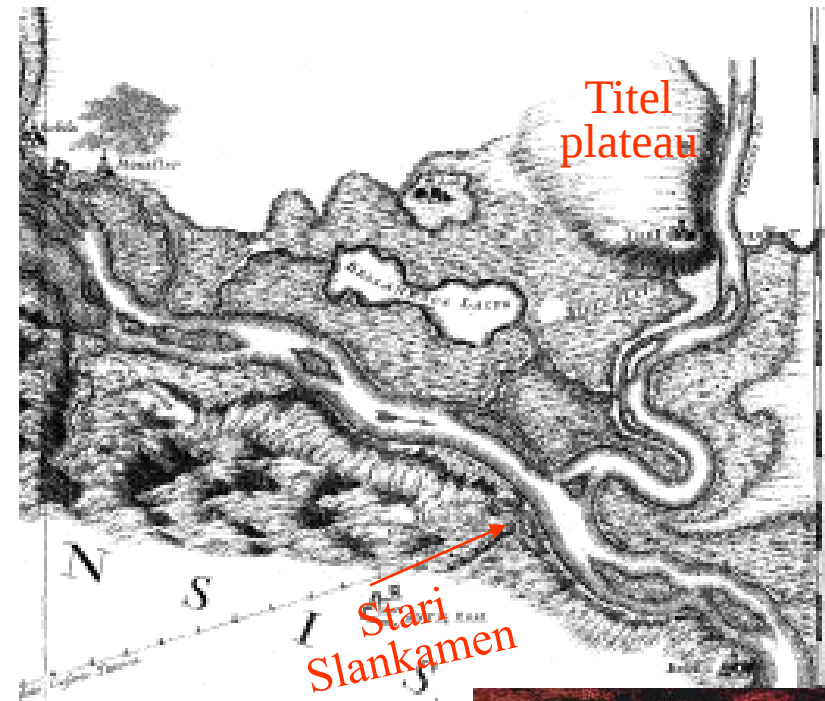
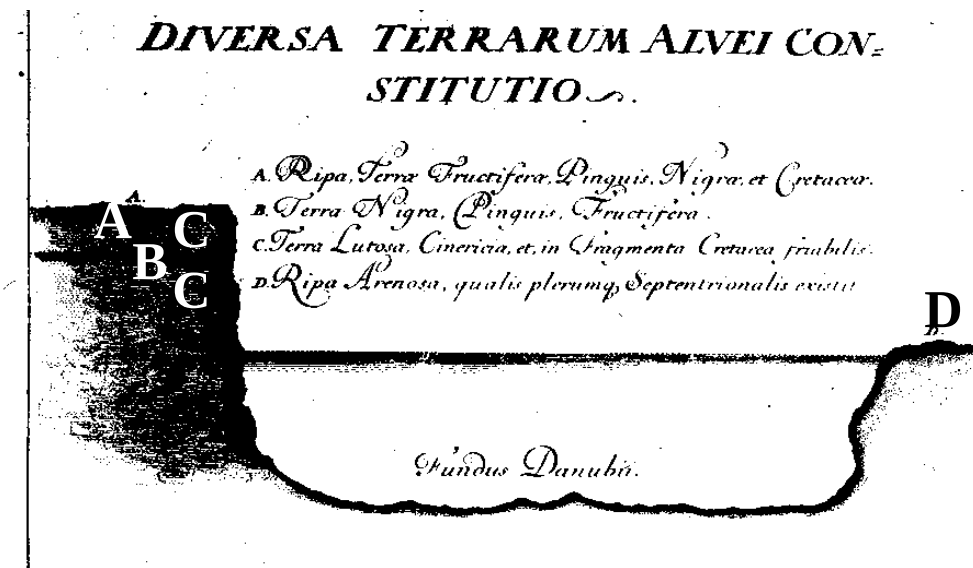
European Loess Research Started in 1726



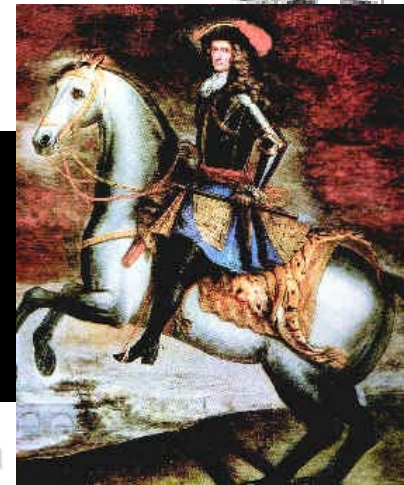
Marsigli, L.F., 1726, *Danubius Pannonico Mysicus; Observationibus Geographicis, Astronomicis, Hydrographicis, Physicis; perlustratus*: The Hague and Amsterdam, Grosse, P., Alberts, Chr., de Hoodt P., Herm. Uytwert and Franc Changuion.

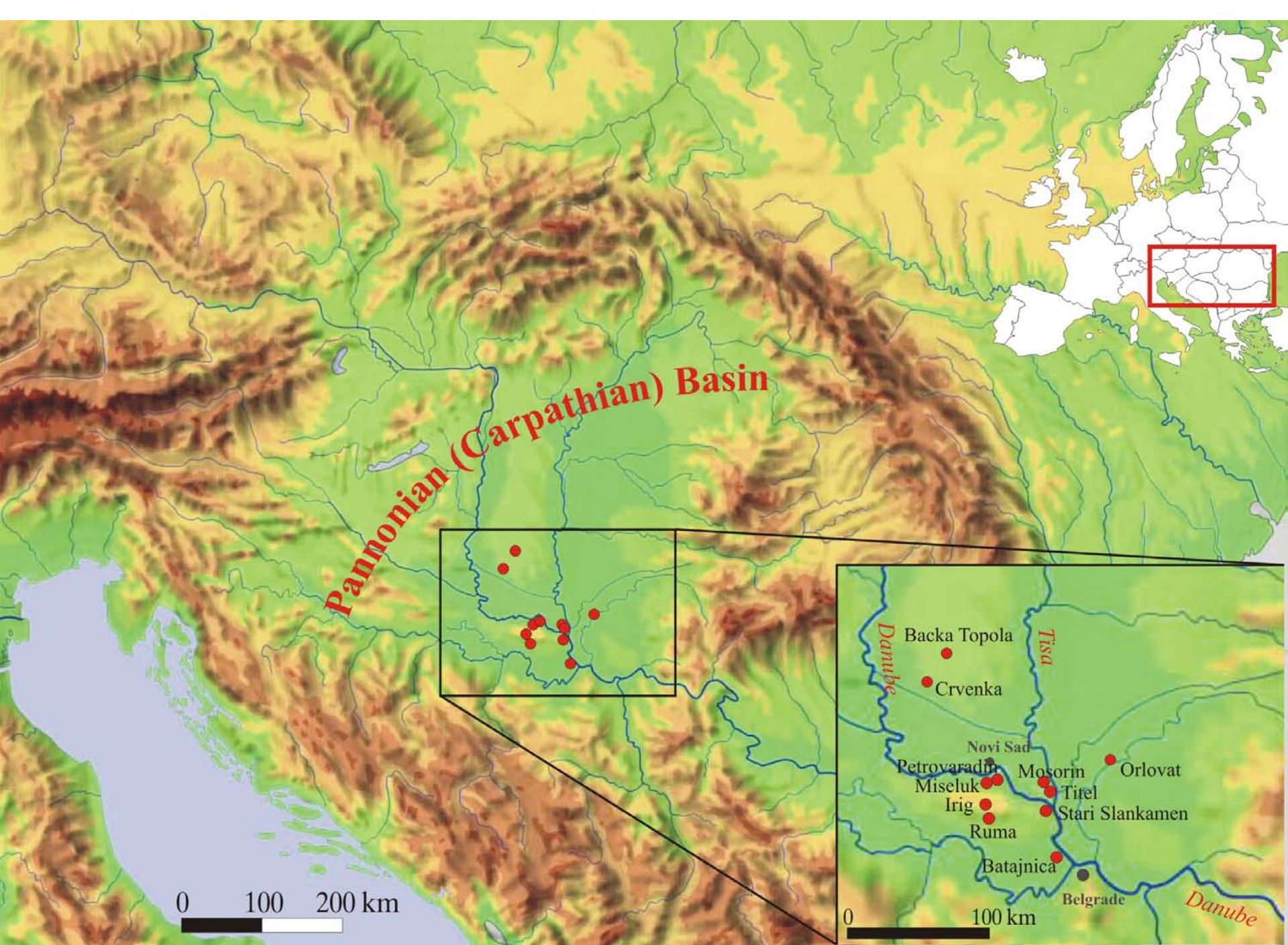
The first description of European loess-paleosol sequences (F.L. Marsigli, 1726)

Cont Marsigli described lithology of loess bank of Danube river, respectively:



- A) *Terra fructifera pinguis nigra et creatacea* (black fertile soil – recent),
- B) *Terra nigra fructifera pinguis* (black fertile soil - paleosol)
- C) *Terra lutosa cinerive et in fragmento creatacea priabilis* (pale-yellow sediment with carbonate fragments – loess)





Loess in the Vojvodina region, Serbia

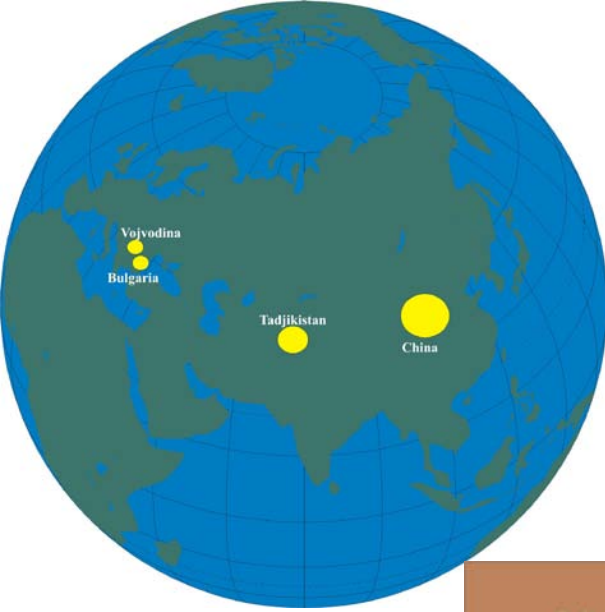
60% of the Vojvodina region is covered by Loess and loess like sediments

Maximal thickness ~ 55 m

An unique European
Middle and Late Pleistocene paleoclimatic
Archive

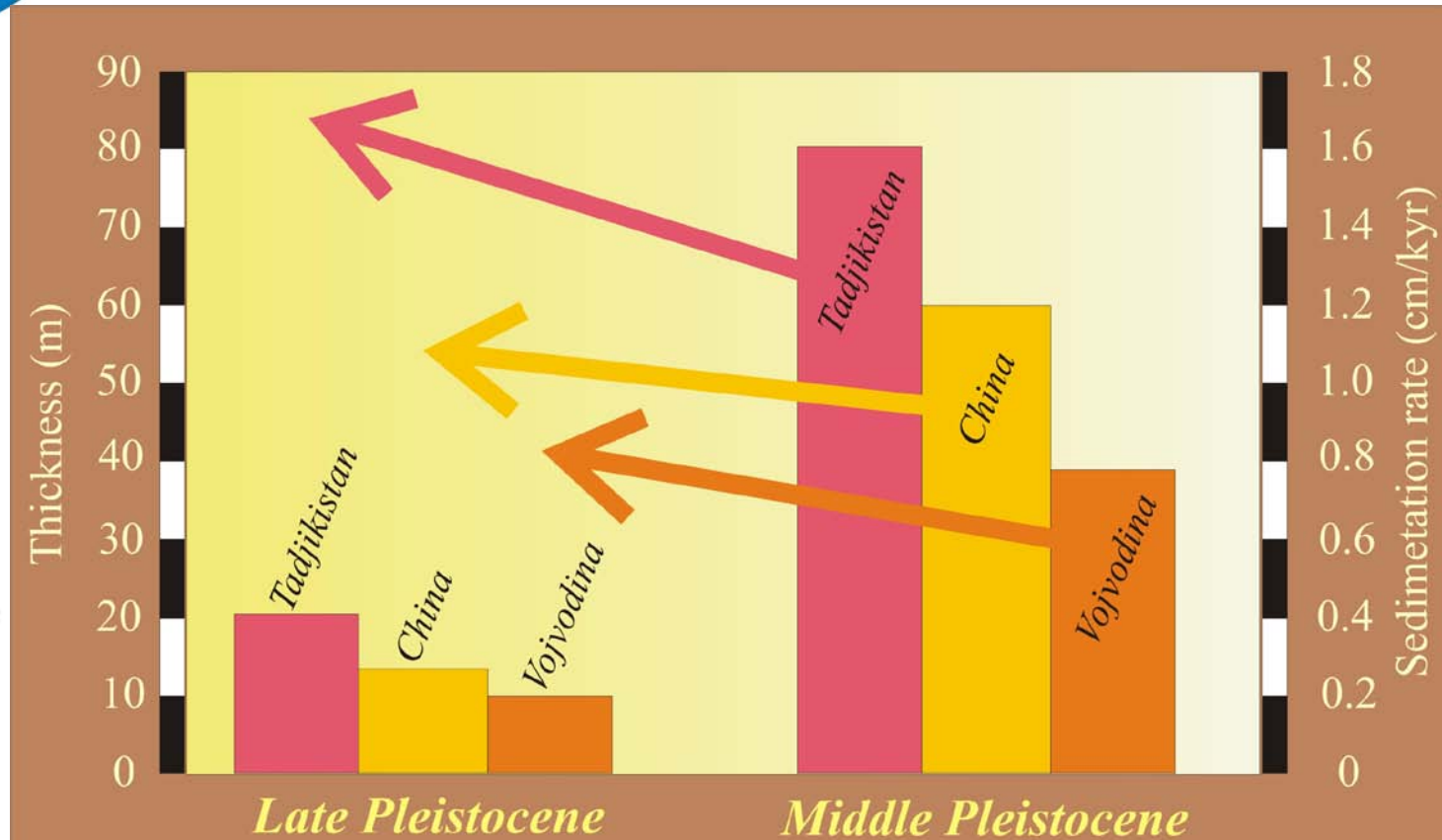


55m



Relation with other main Eurasian Pleistocene loess records

Despite of lower sedimentation rates than observed in Asian loess, **Serbian loess** provides **the most complete paleoclimate record at European continent during the Middle Pleistocene**



New methodological approach

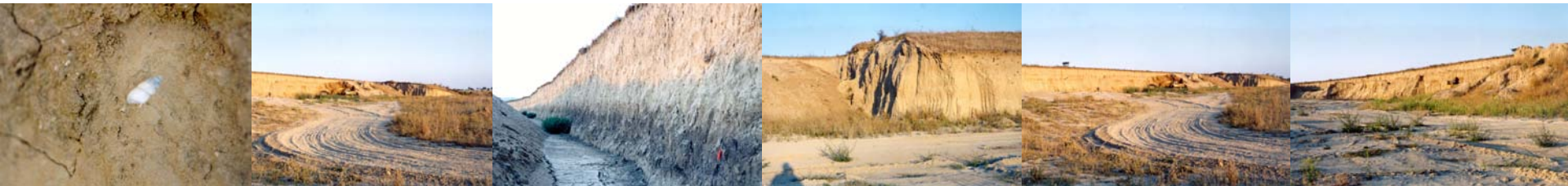
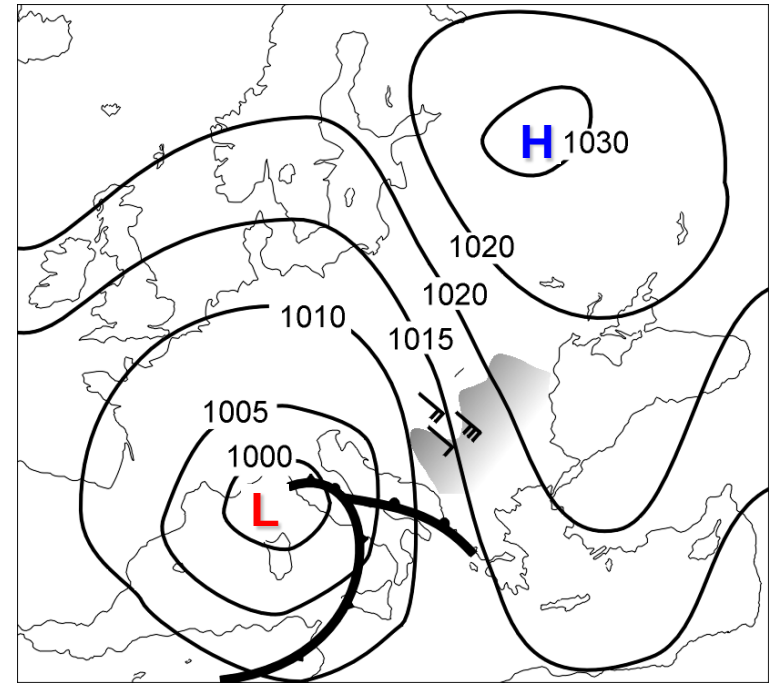
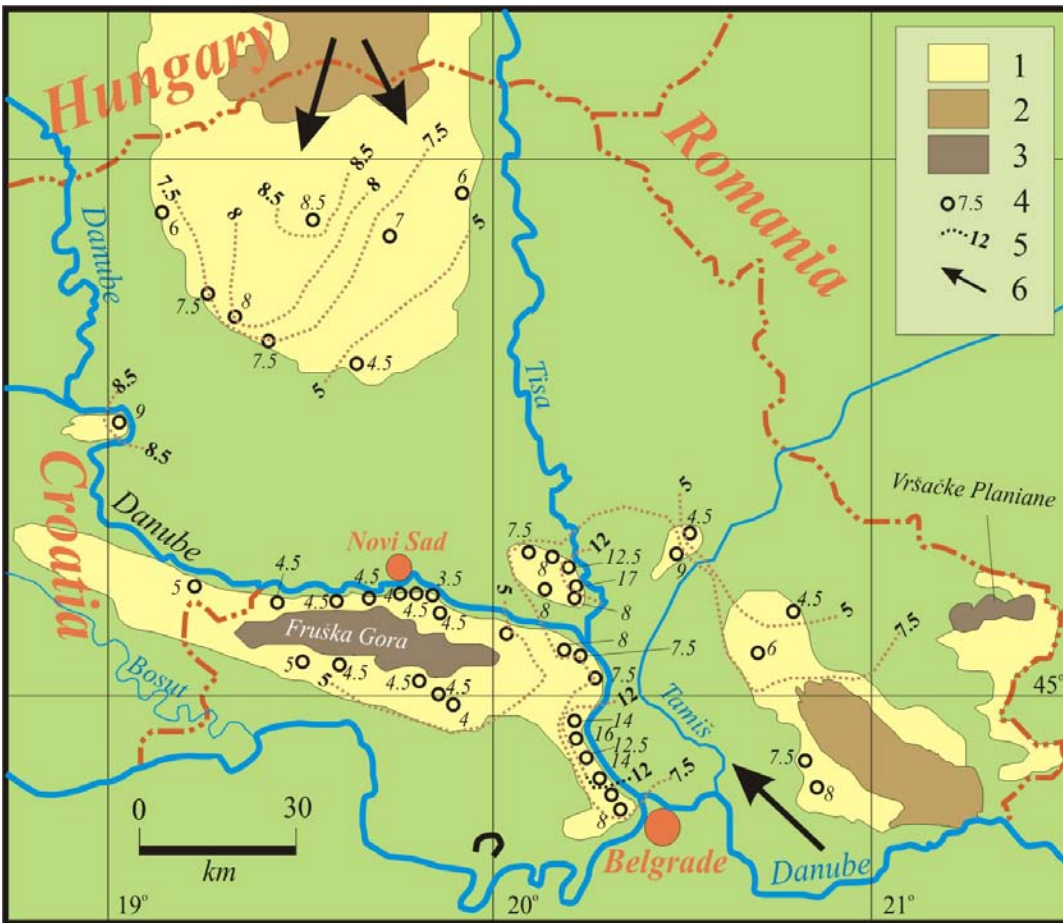


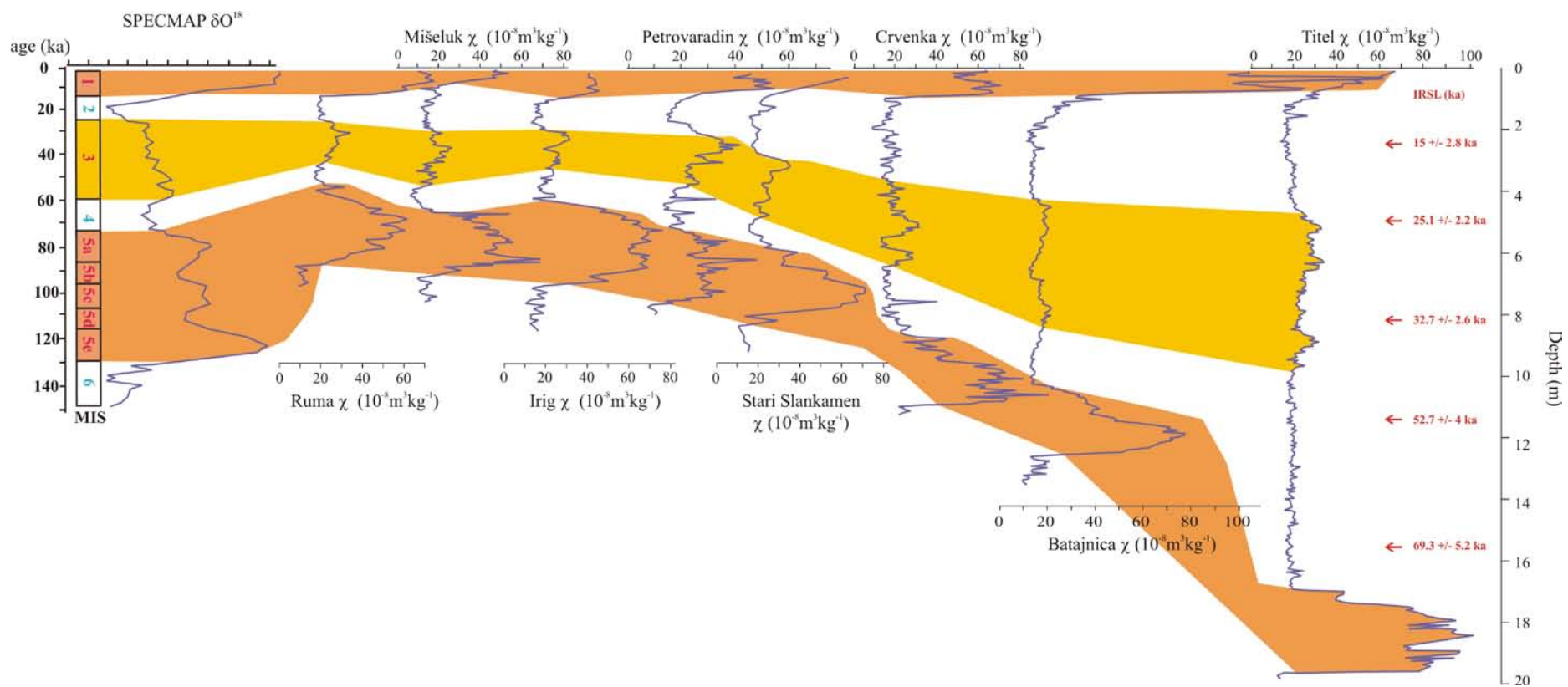
*Magnetic &
paleomagnetic research
Grain size
Geochemistry
AAR geochronology
Luminescence dating
Malacological studies*



Titel loess plateau

The thickness of the last glacial loess sediments

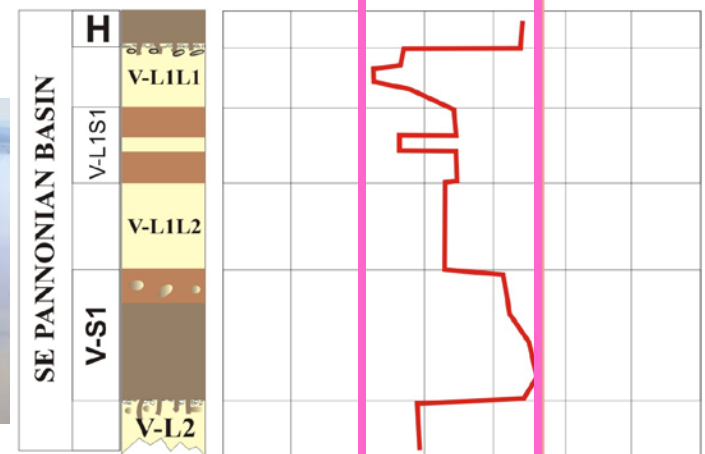
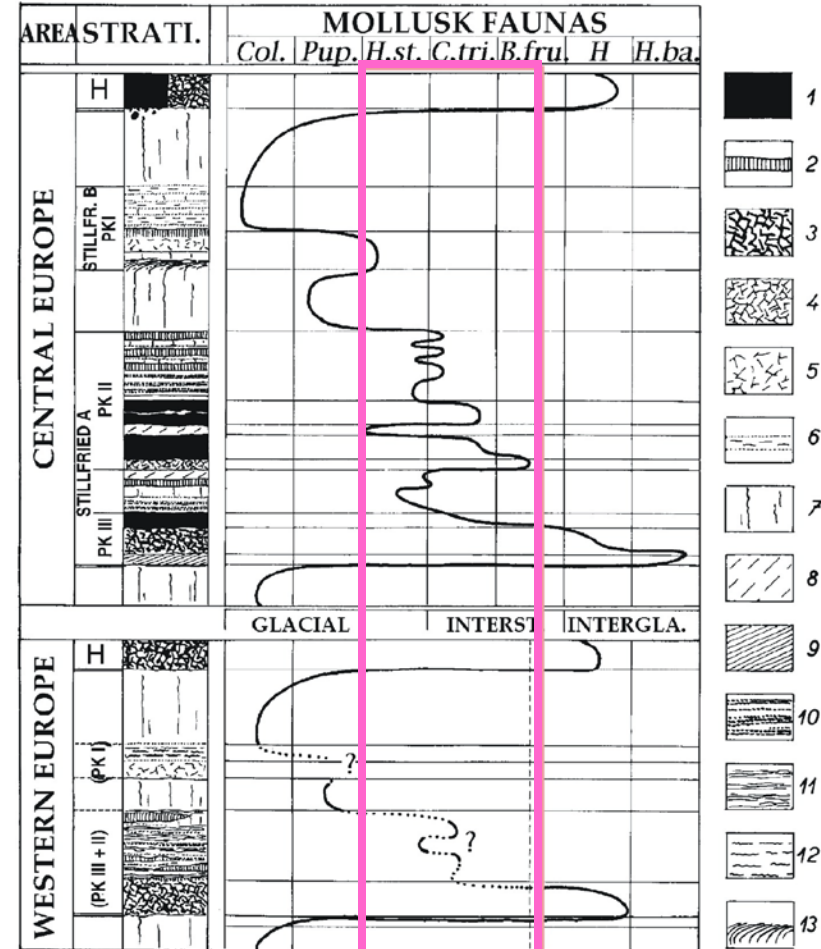


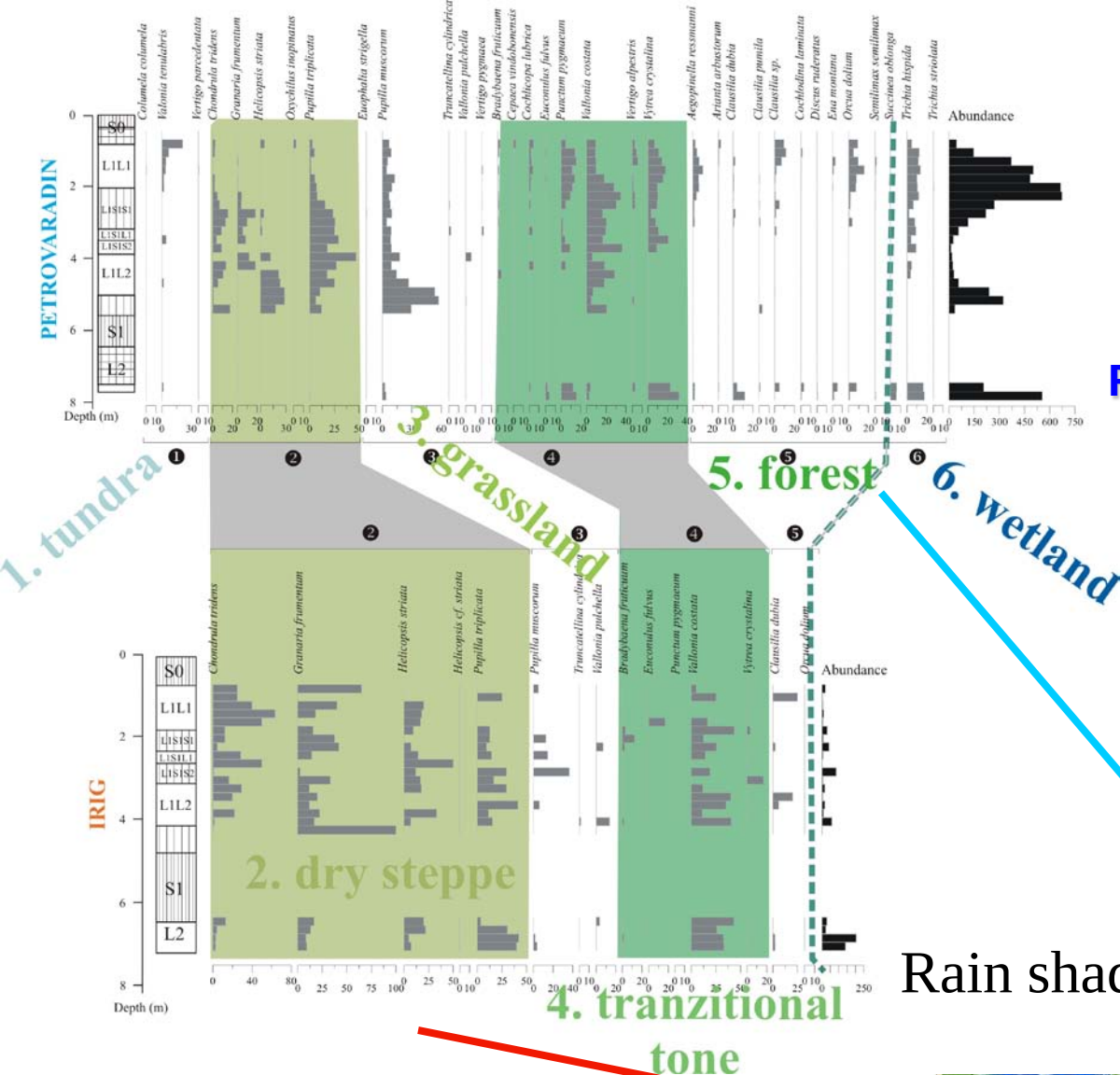


Marković et al., JQS, 2008



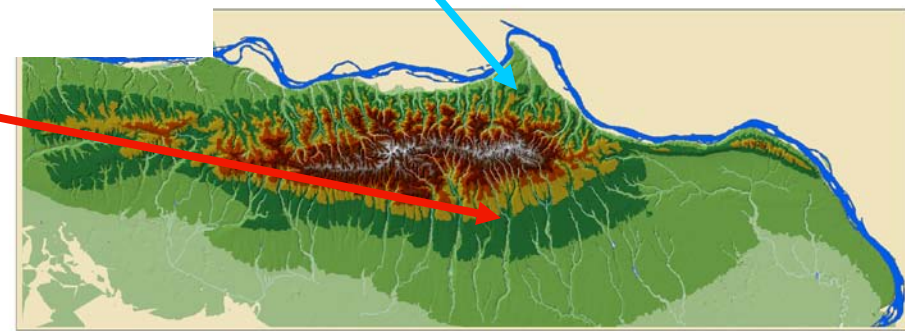
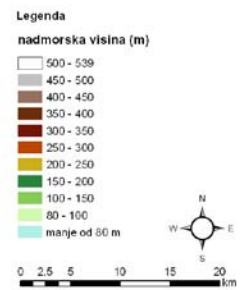
Absence of any criogenic features, identified land snail fauna and pedogenetic evidence observed at loess-paleosol sequences in the Vojvodina region indicate **dry the Late Pleistocene climatic conditions** and **reduced environmental diversity**





Refugium Palaeollirian fauna

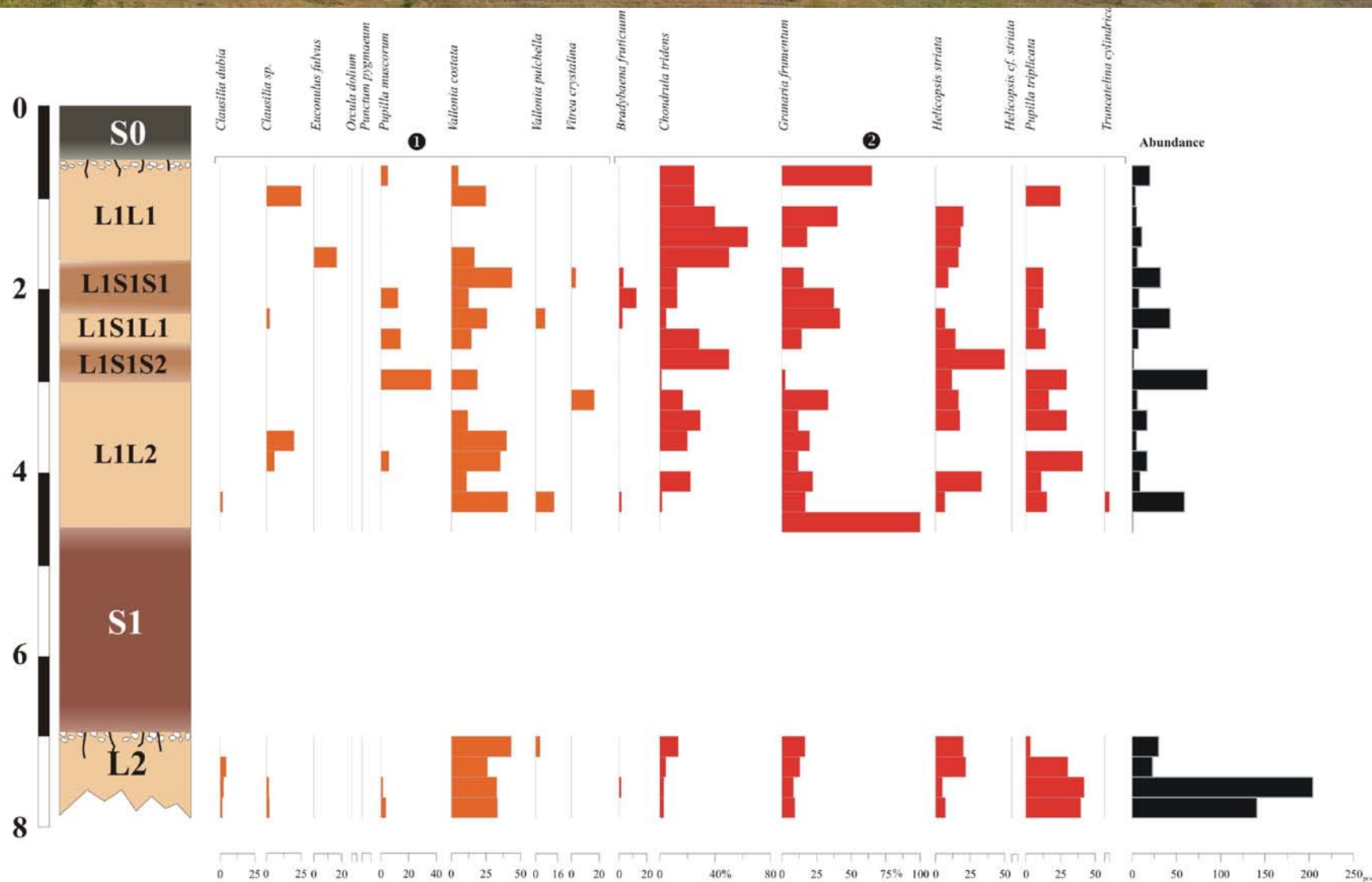
Rain shadow



Refugium *H. striata* и *C. tridens* fauna

„Warm“ glacial loess climate

Irig brickyard



Marković et al., 2007, G³

Tepmerate

Termophilous

Serbian Loess Antiquity

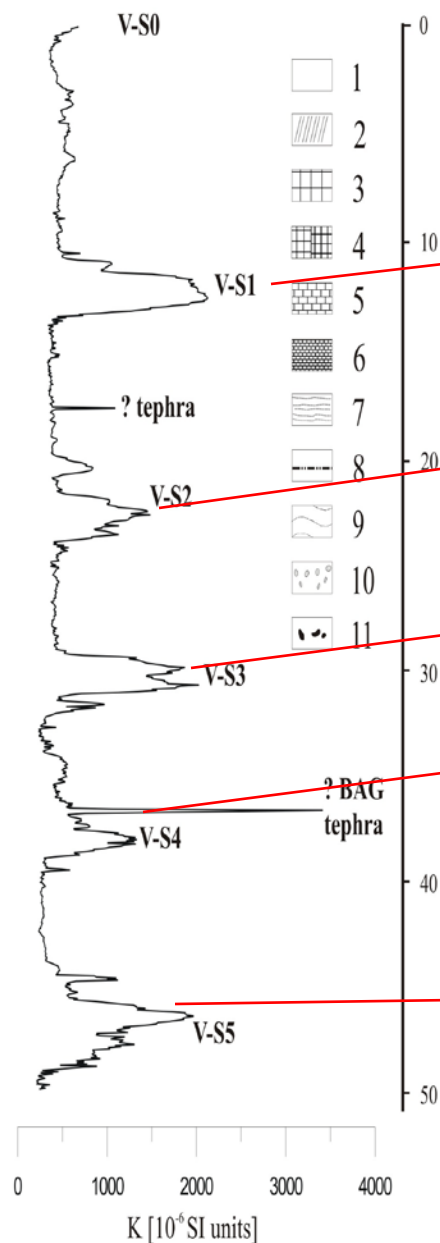
High resolution the most complete continental the European Middle Pleistocene record





Titel loess plateau synthetic profile

depth (m)



Stratigraphy

New and Revised

VS1

VS2

VS3

VS4

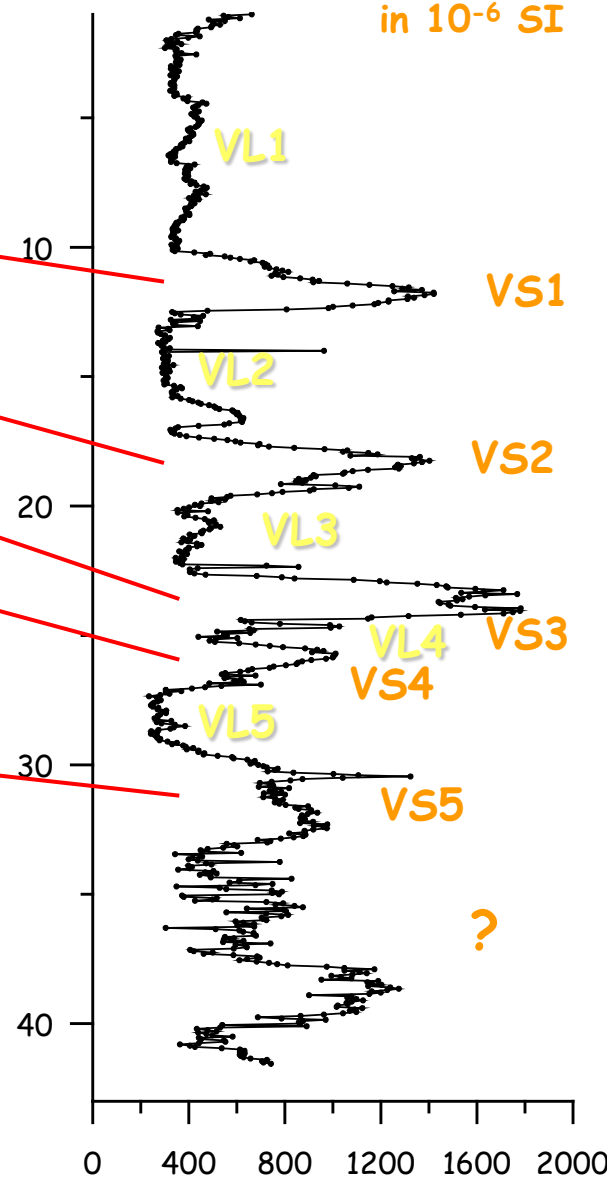
VS5

Marković et al. (2008) designated the units by names following the Chinese loess stratigraphic system (e.g. Liu et al., 1985; Kukla, 1987) but inserted the prefix “V” referring to the Vojvodina region.

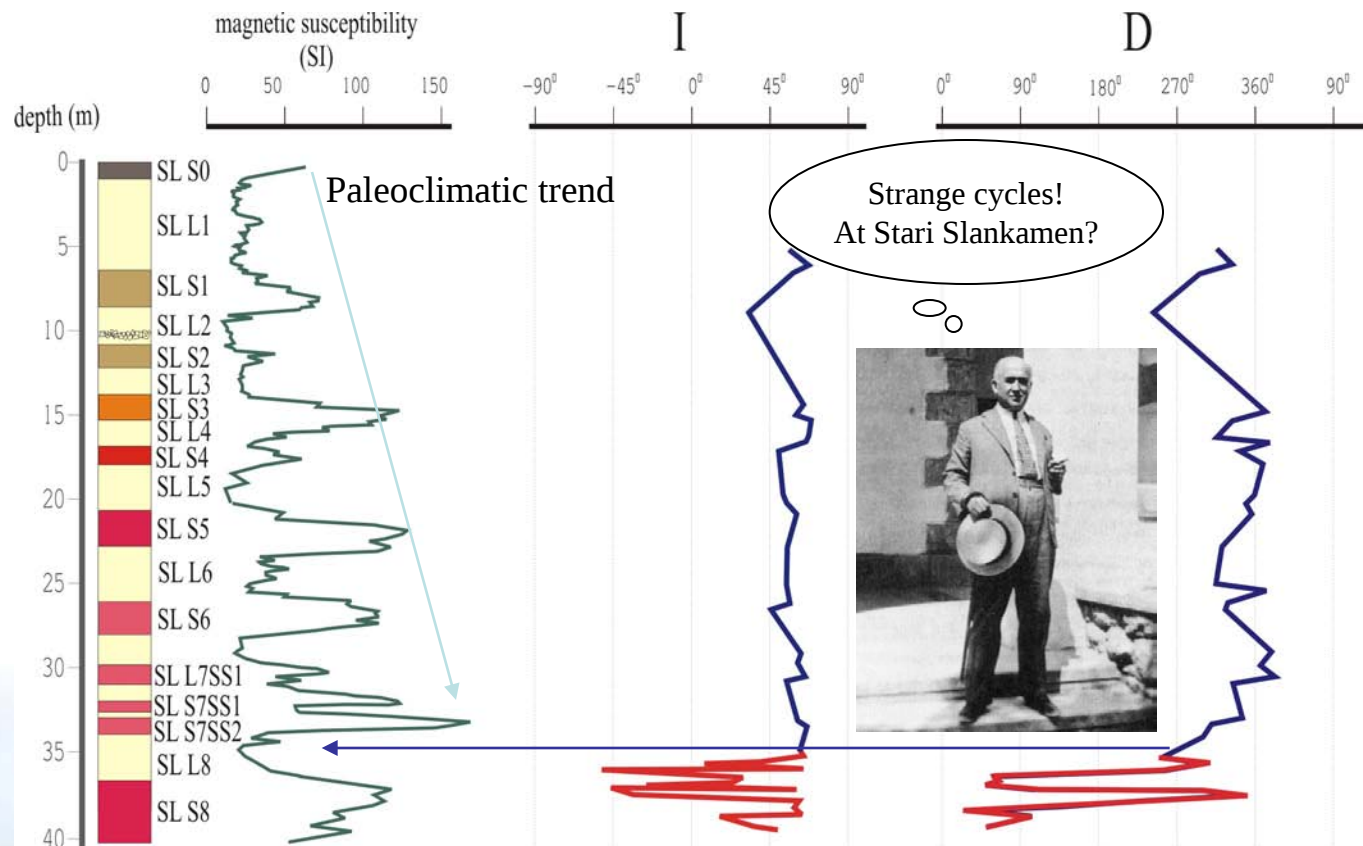
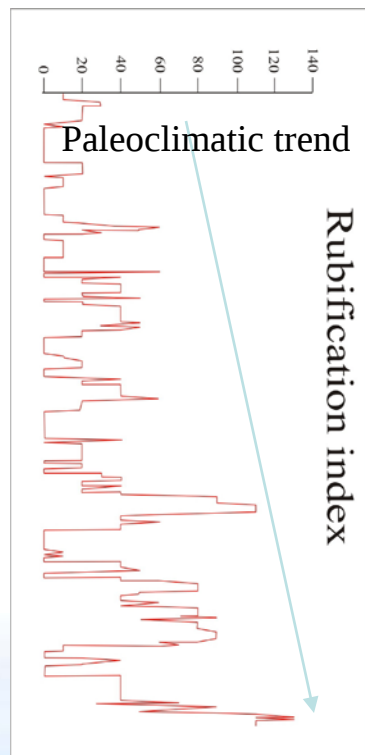
MAGNETOSTRATIGRAPHY

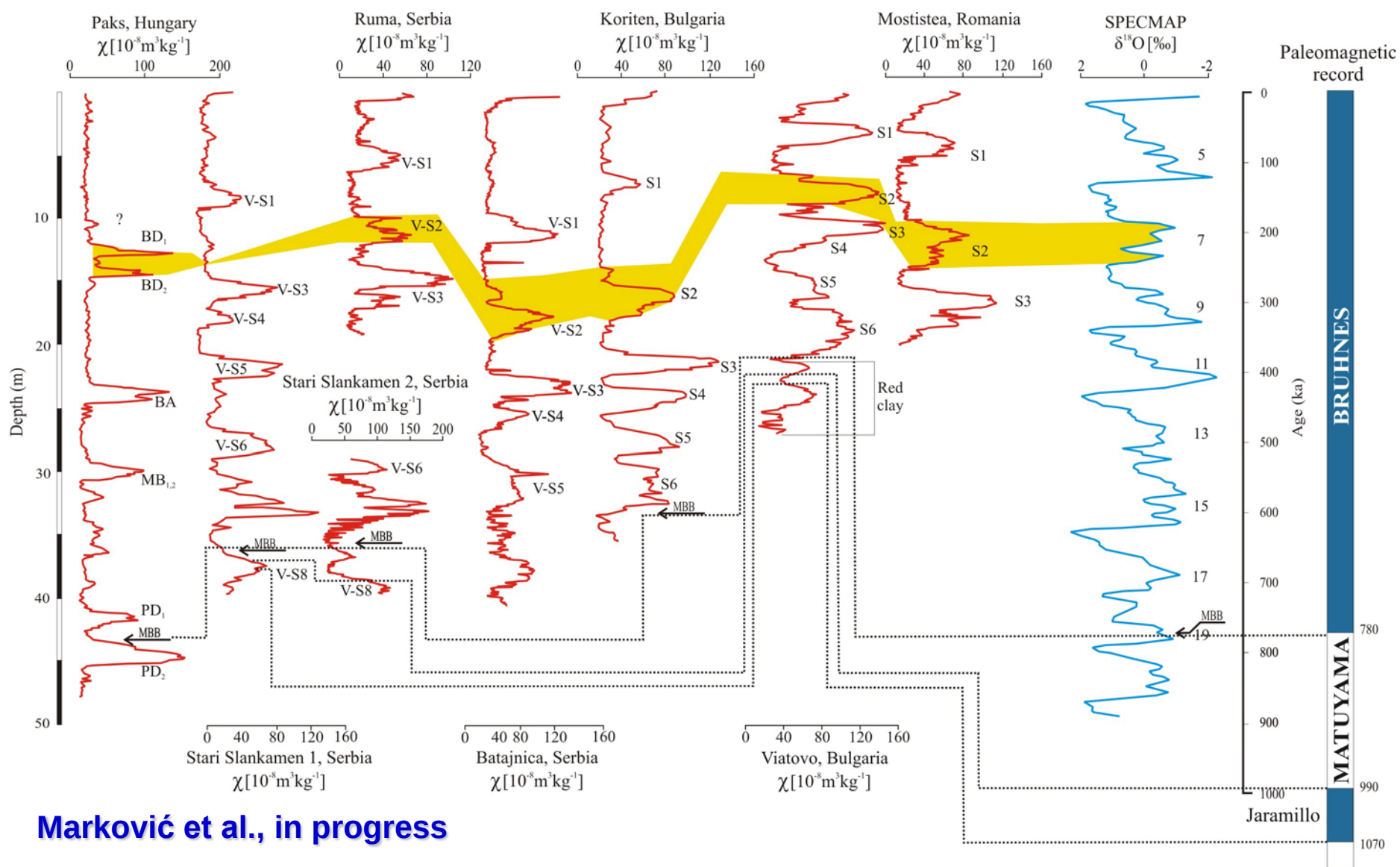


Magnetic Volumesusceptibility
in 10^{-6} SI



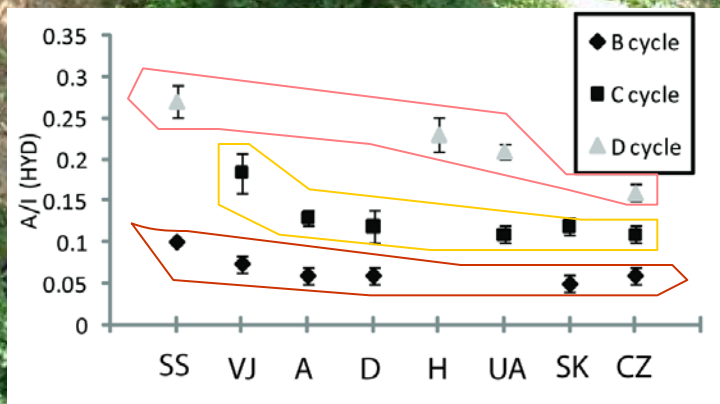
Stari Slankamen – key section





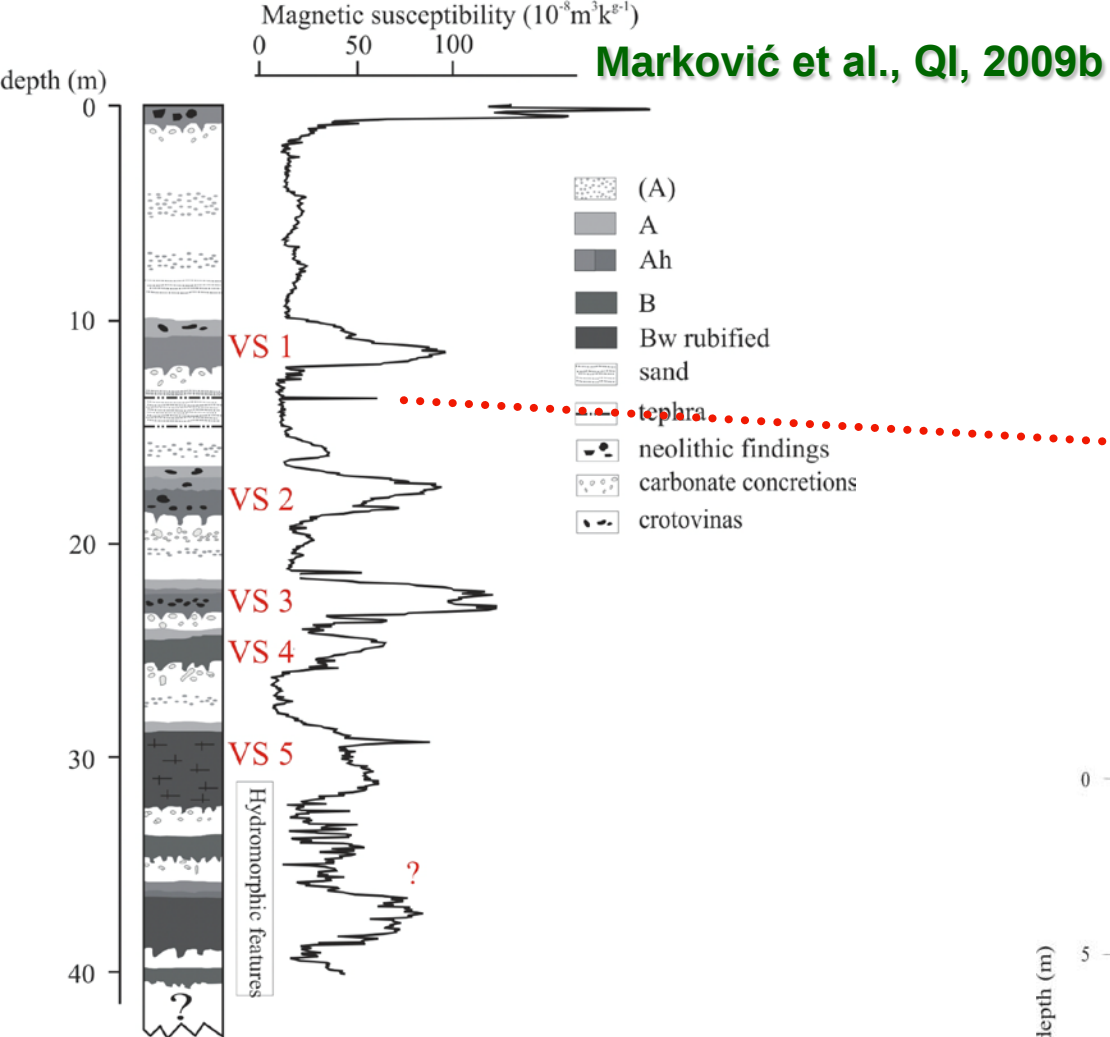
Stari Slankamen

VS3
VS4
VS5
VS6
VL7S1
VS7
VS8

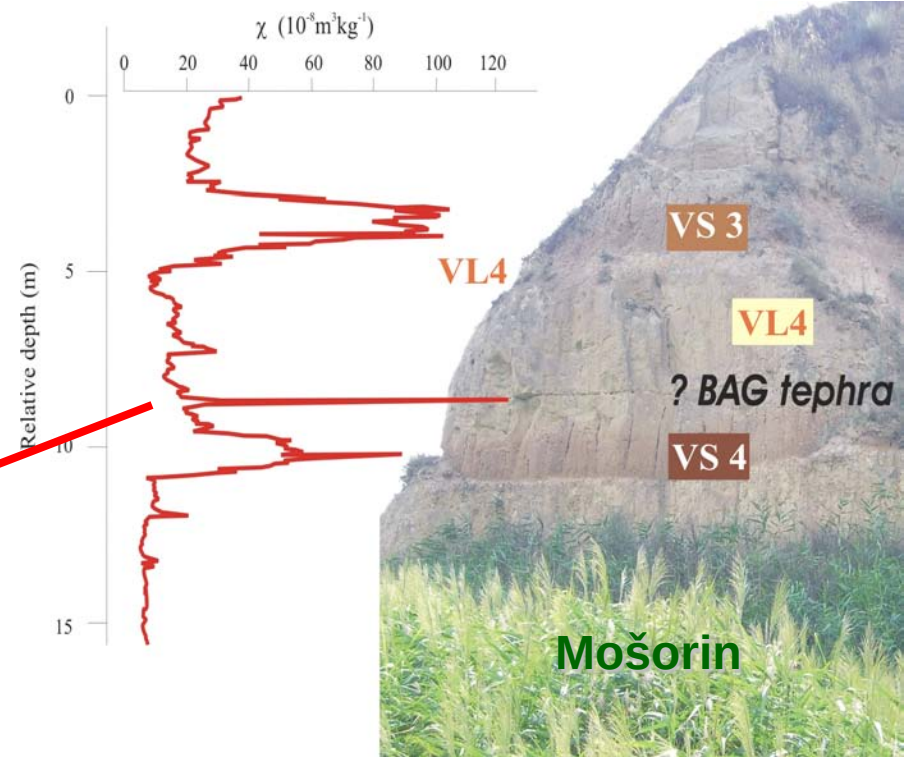
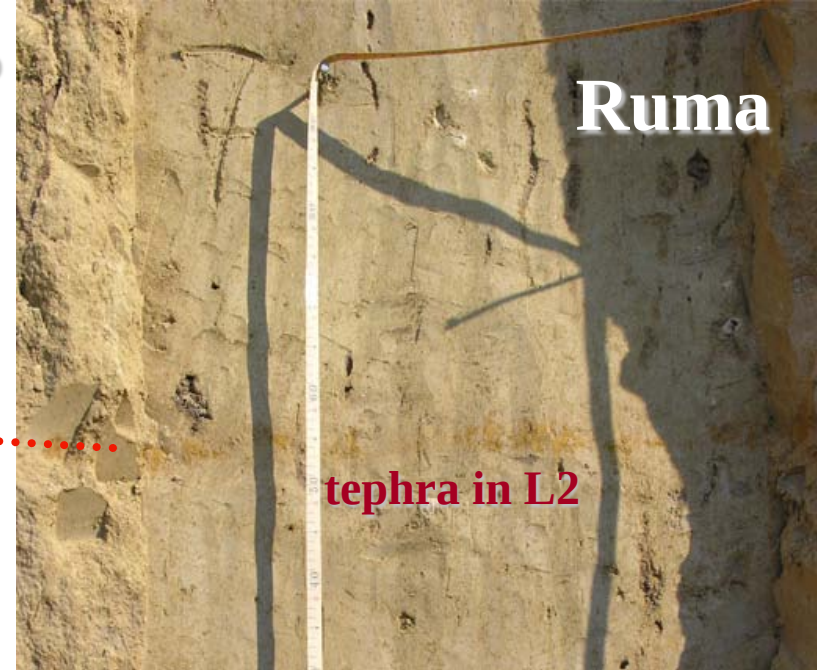


Stari Slankamen	
<i>Pupilla</i> , HYD	
Unit	D/L Glutamic acid
L1	0.19 (1)
L3	0.39 ± 0.04 (5)
L4	0.43 ± 0.002 (2)
L5	0.49 ± 0.01 (5)
L6	0.57 ± 0.02 (4)
L7	0.60 ± 0.02 (3)

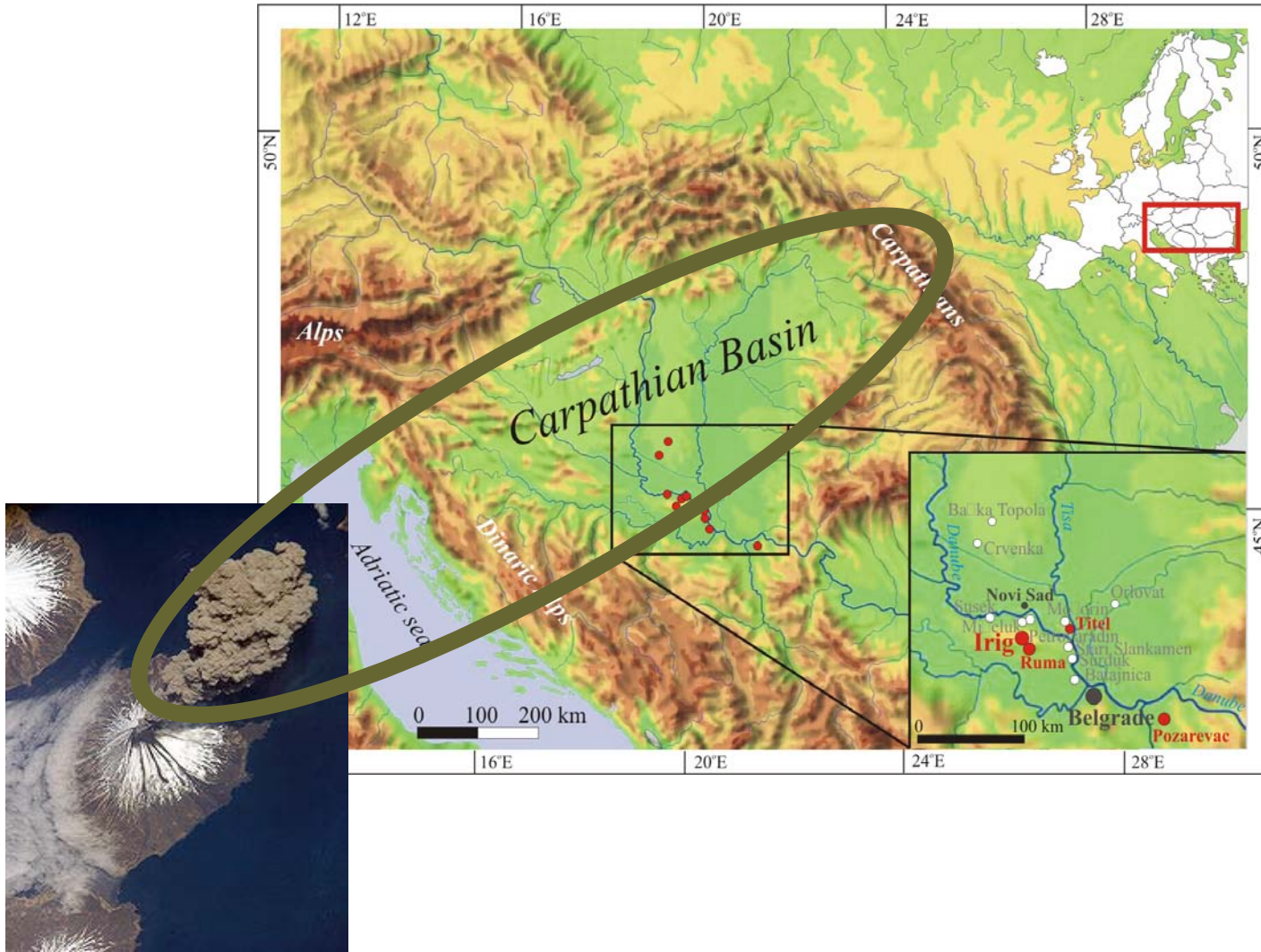
AAR
Geochronology

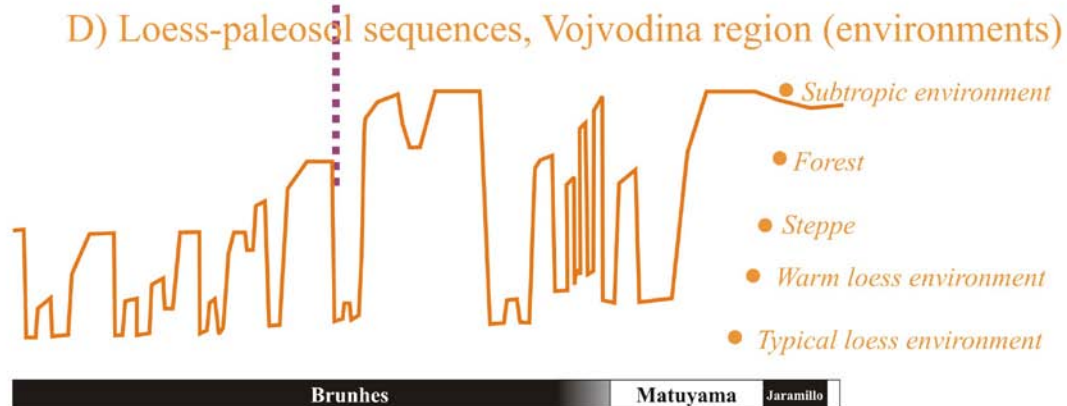
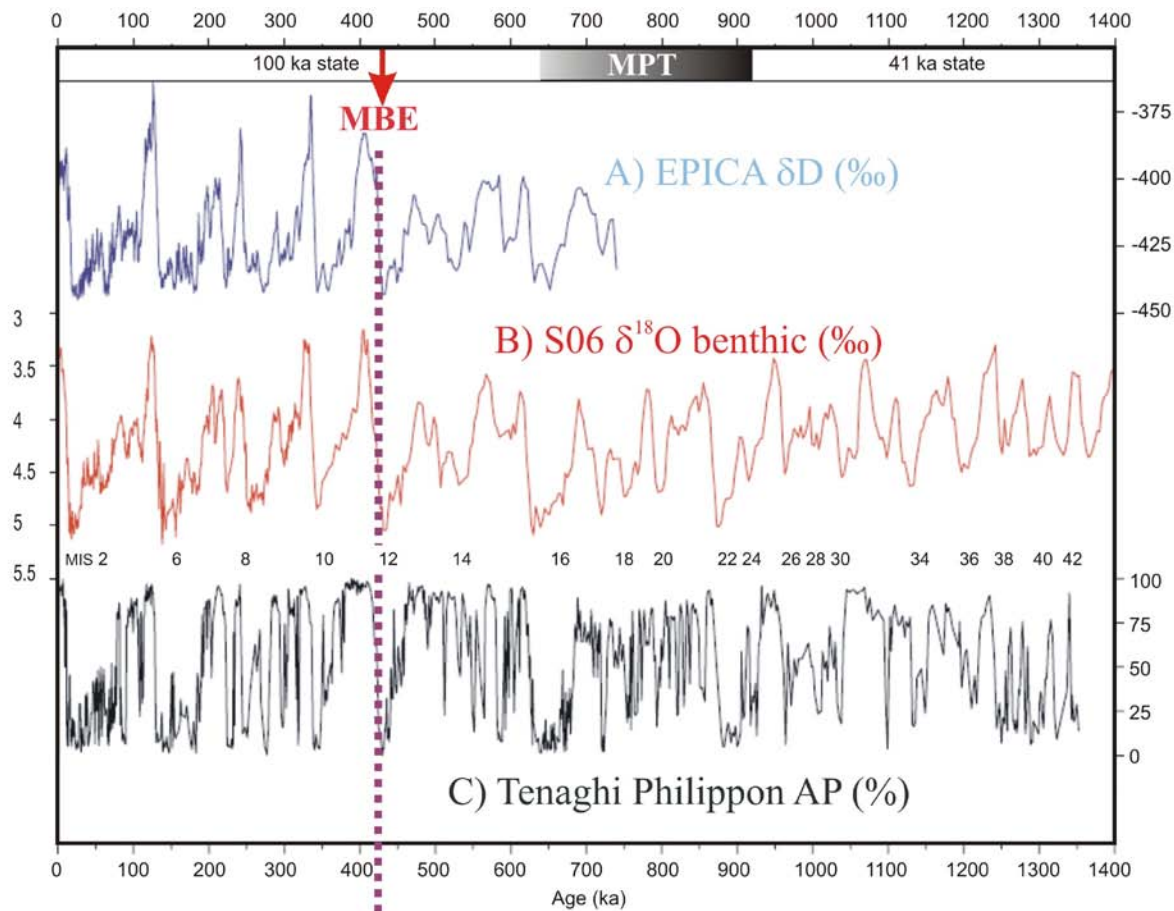


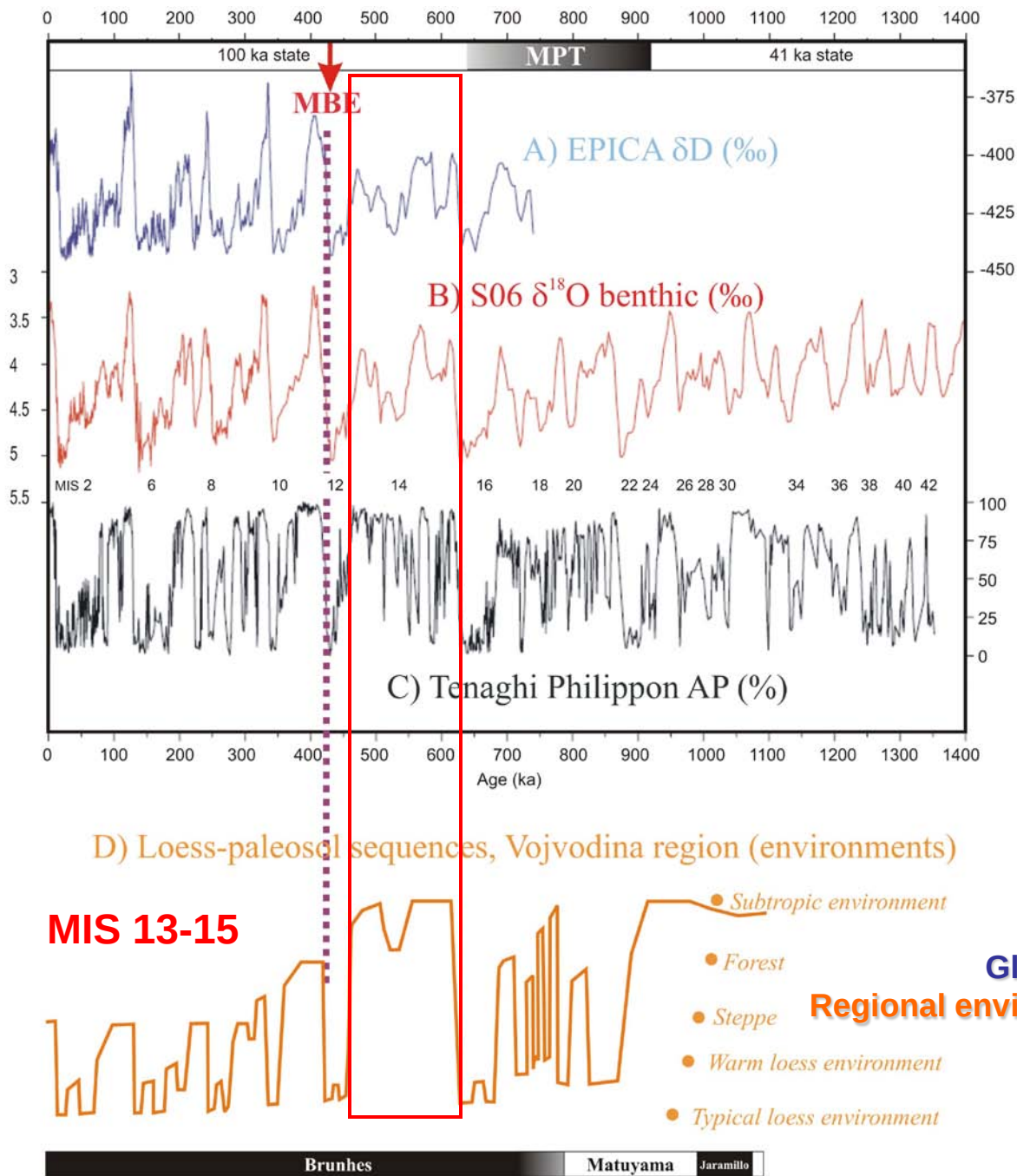
Batajnica



Distribution of the BAG tephra about 350.000 ago







Magnetostratigraphy

Global climate changes
Regional environmental responses

Interglacial climate succession

Vojvodina



China

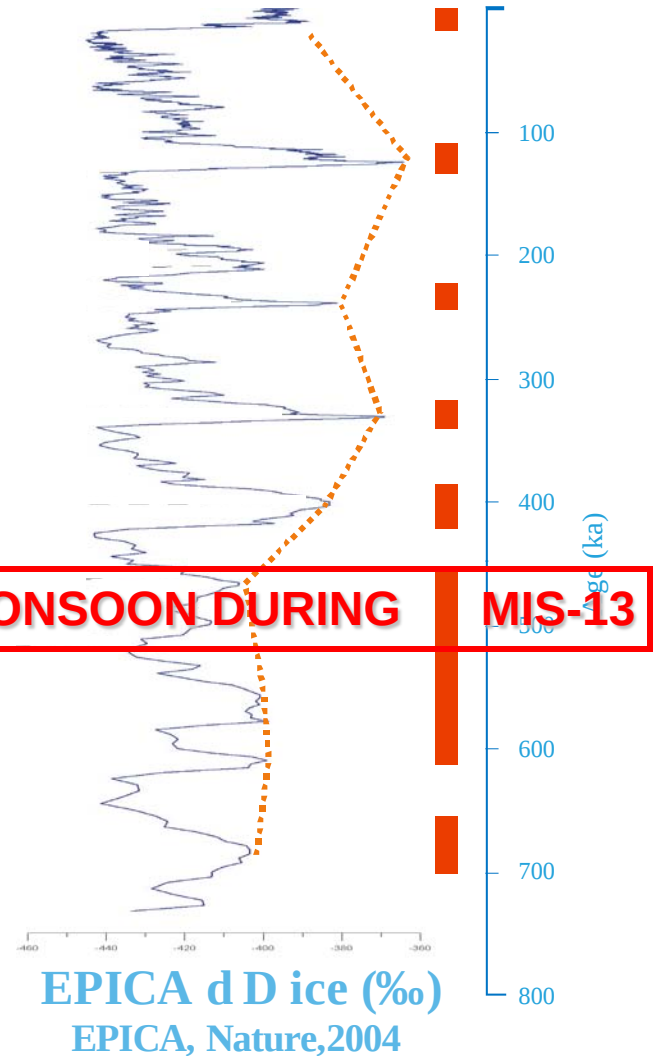


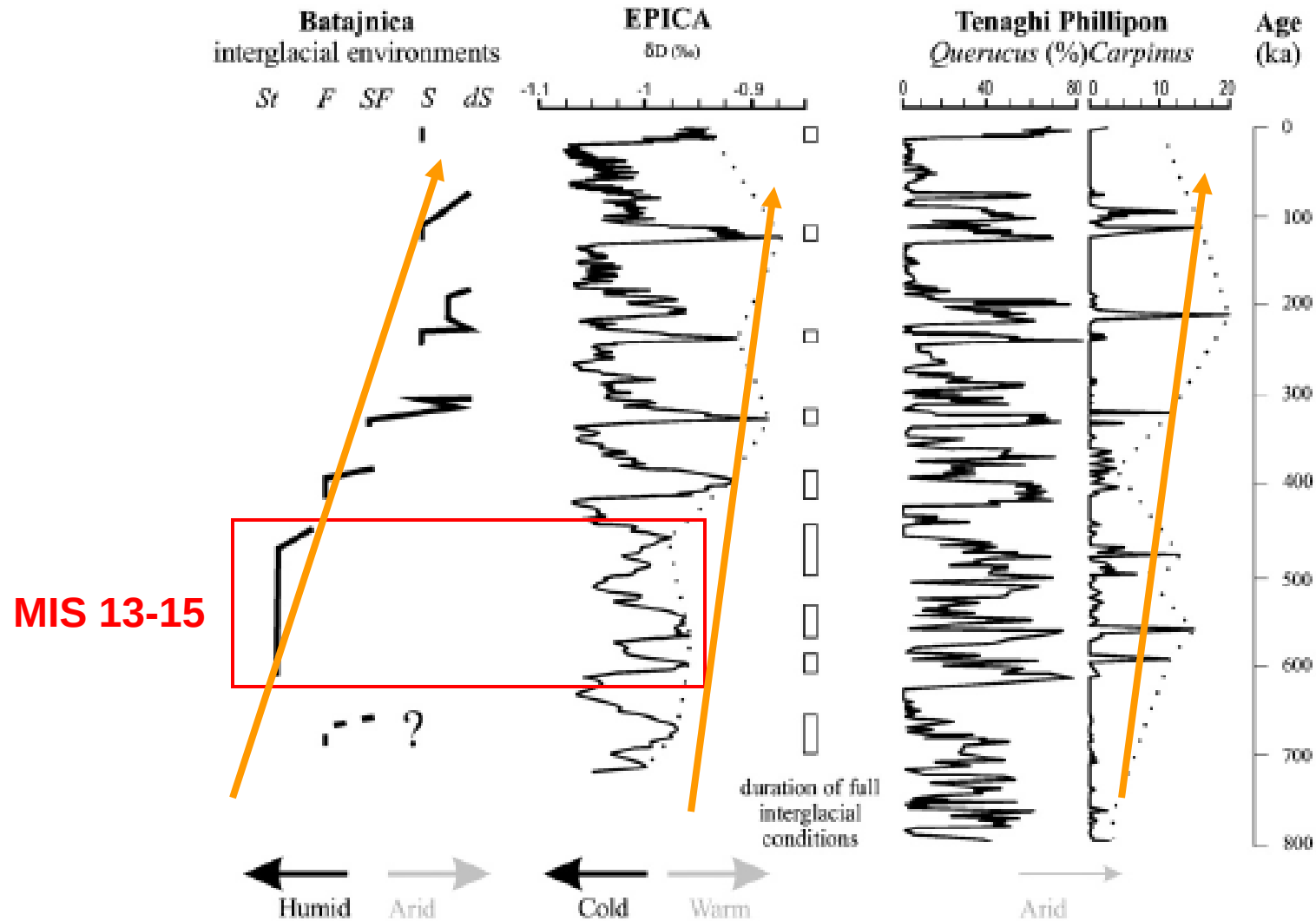
Other Eurasian loess-paleosol records indicate similar paleoclimatic trend during the Middle Pleistocene, but environmental indices of progressive aridization

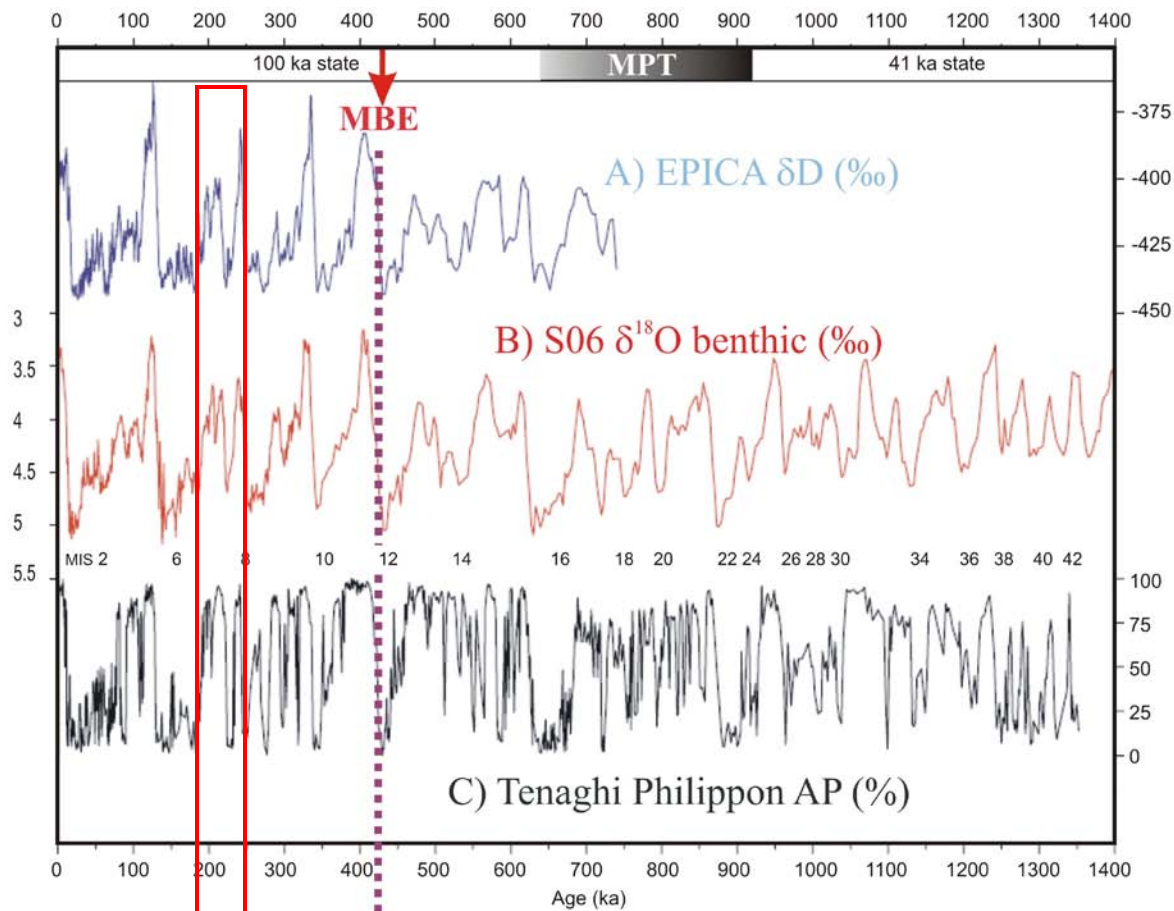
AN EXTREMELY STRONG EAST ASIAN SUMMER MONSOON DURING MIS-13

especially during the interglacials are even sharper expressed at Serbian loess exposures.

Aridity







D) Loess-paleosol sequences, Vojvodina region (environments)



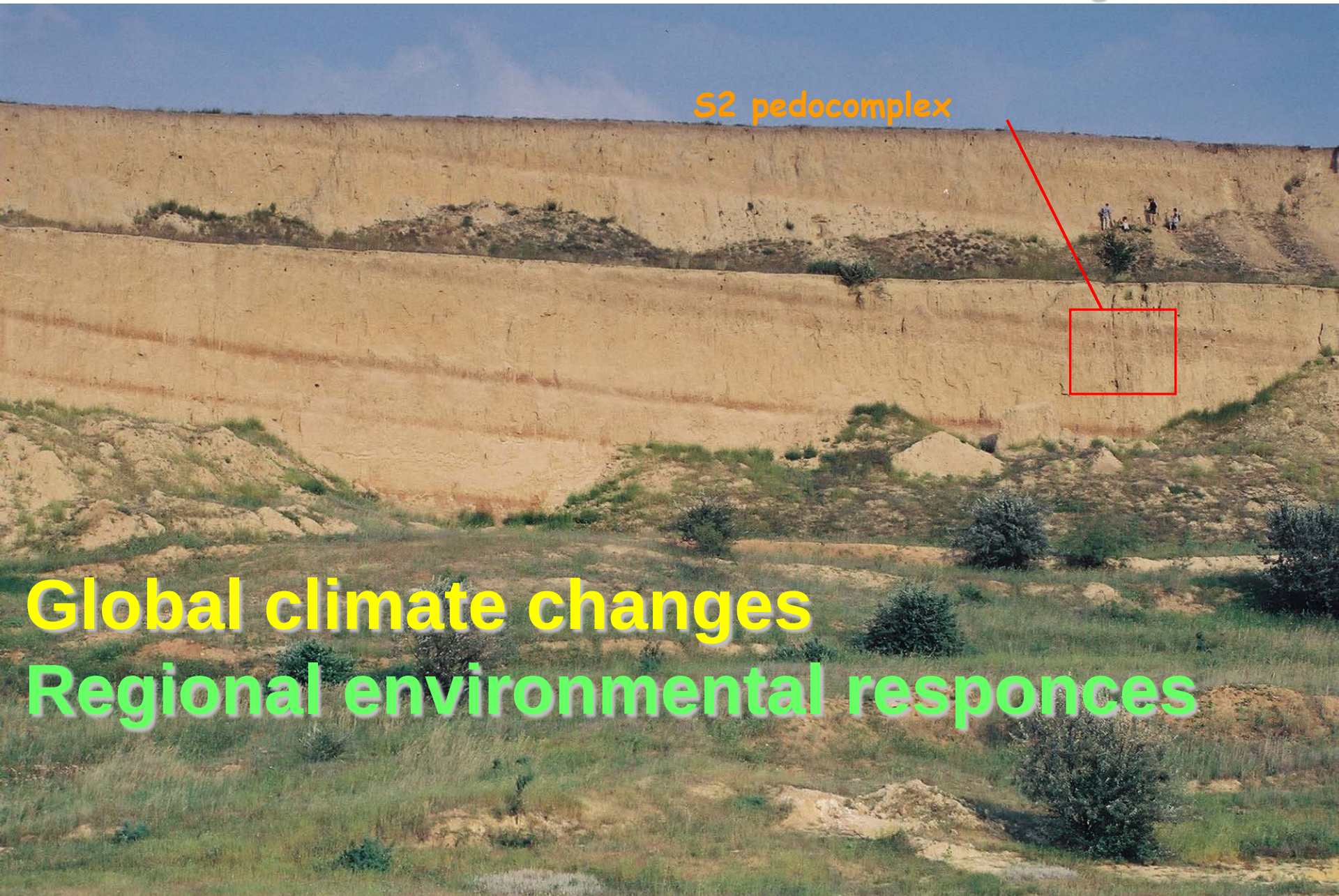
Global climate changes
Regional environmental responses

Brunhes Matuyama Jaramillo

Magnetostratigraphy

MIS 7 pedocomplex S2

Mircea Voda, Dobrogea, Romania

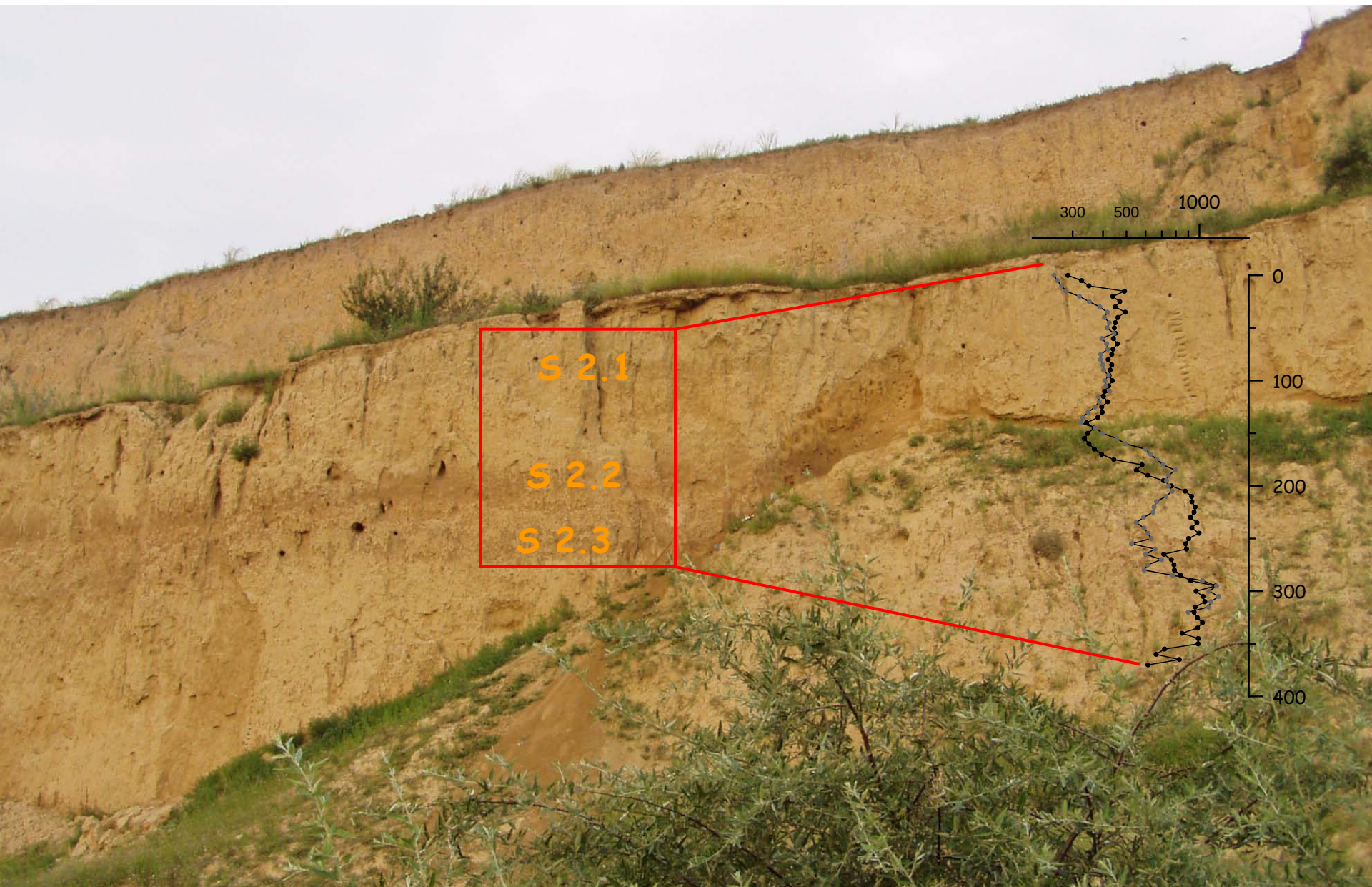


S2 pedocomplex

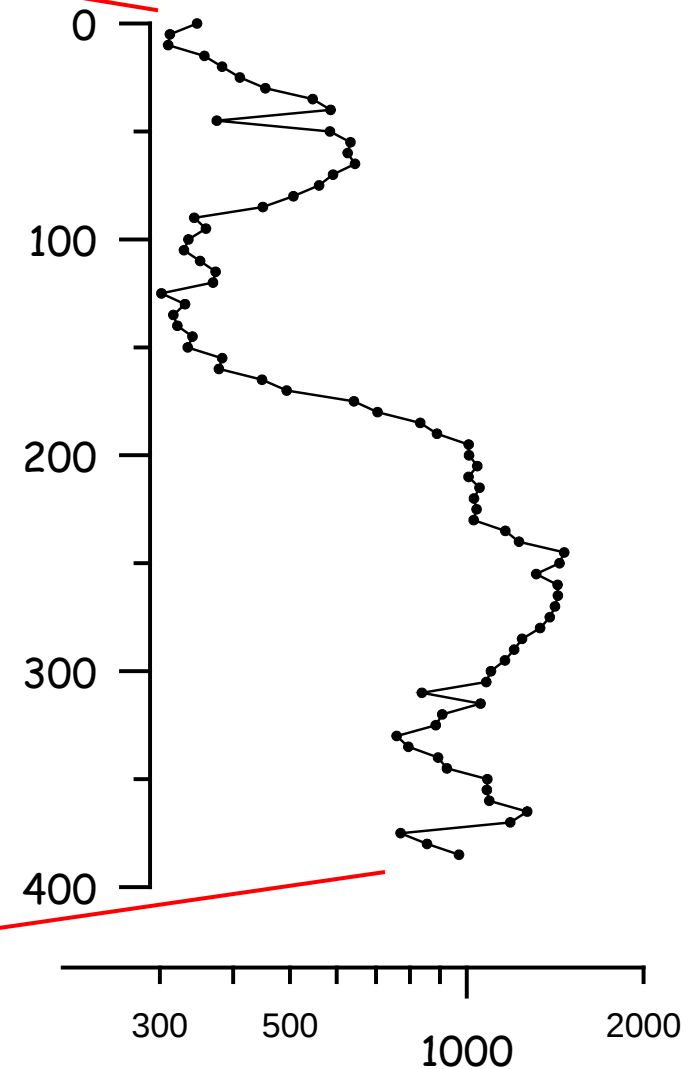
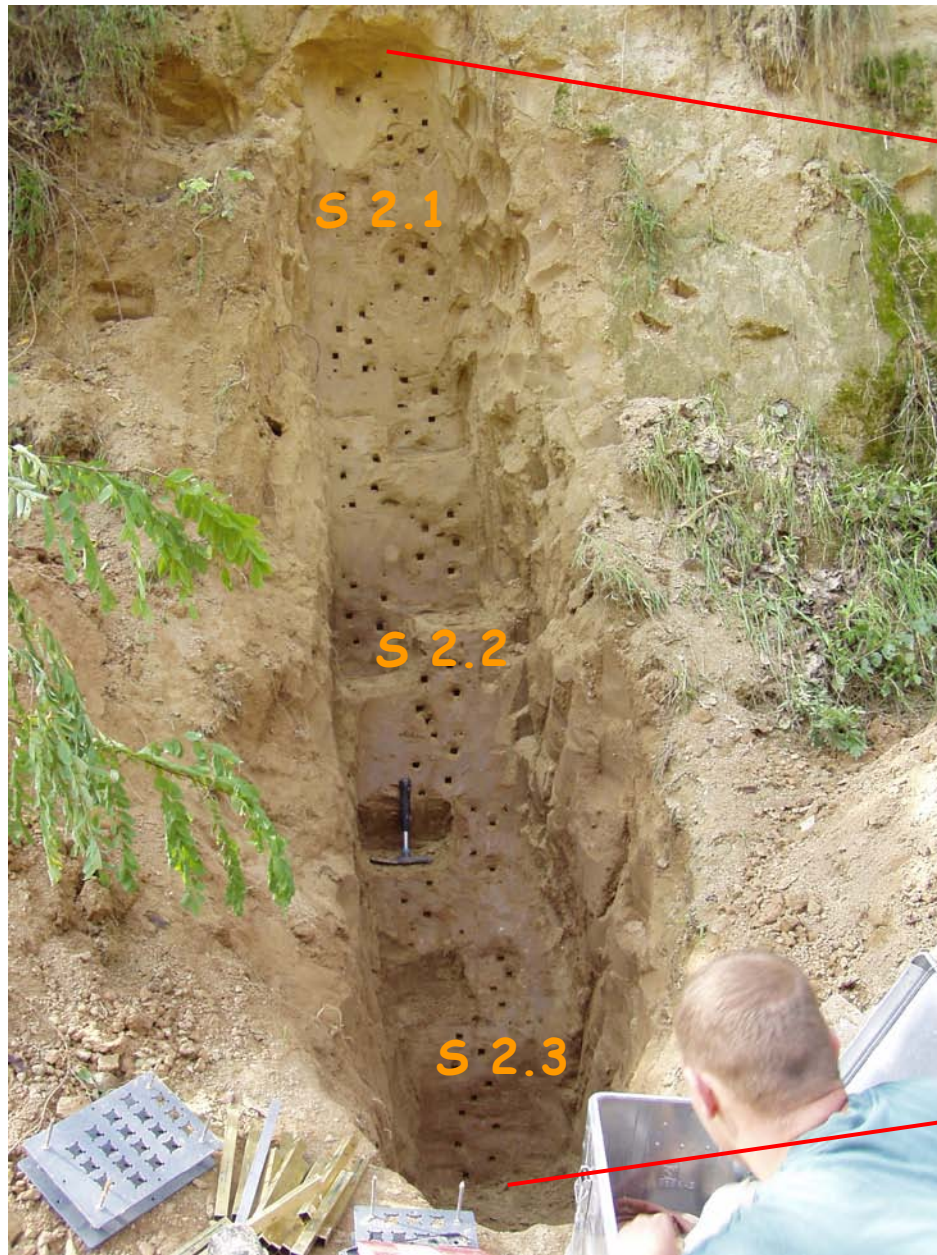
Global climate changes

Regional environmental responses

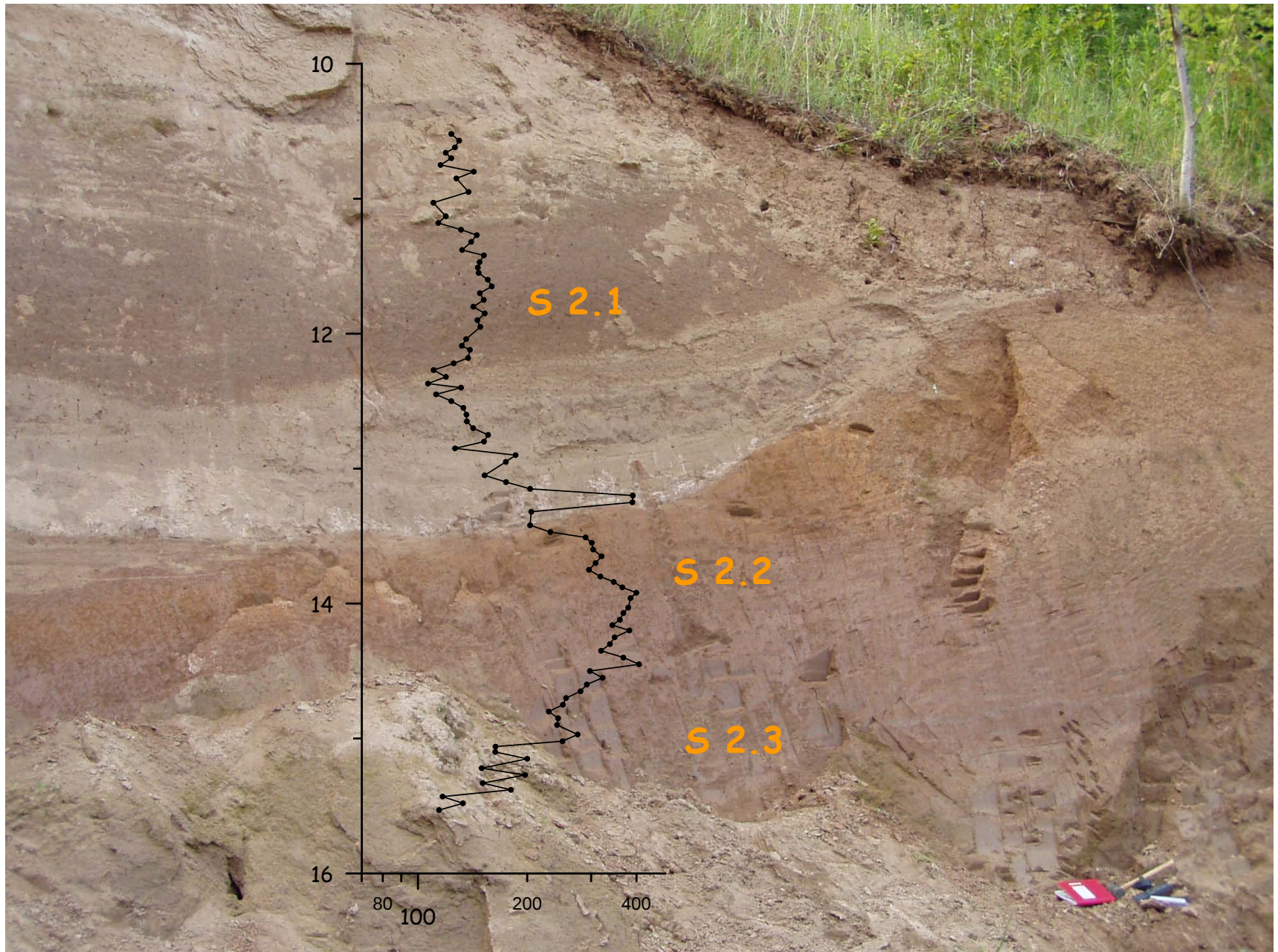
Mircea Voda, Dobrogea, Romania

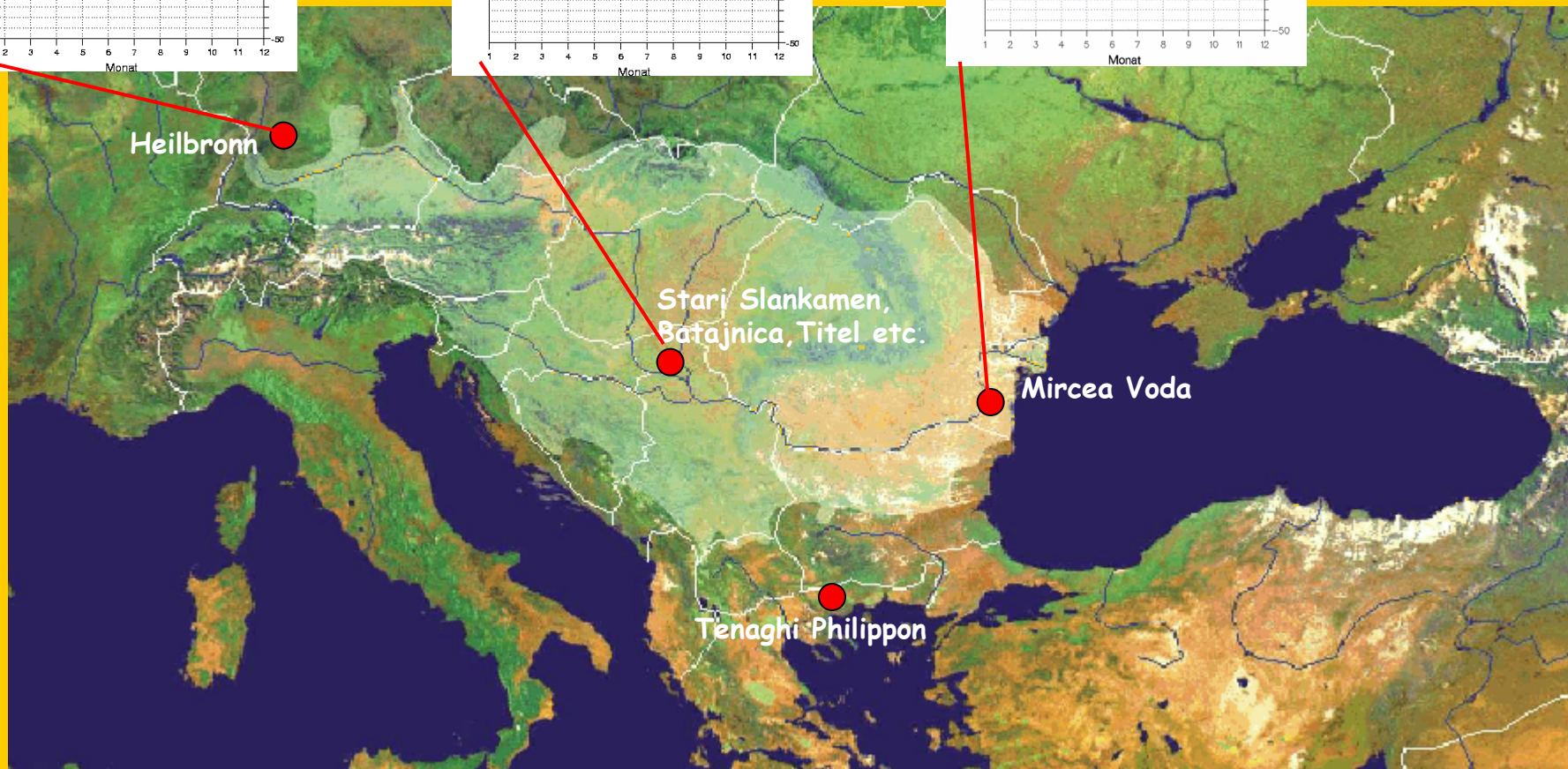
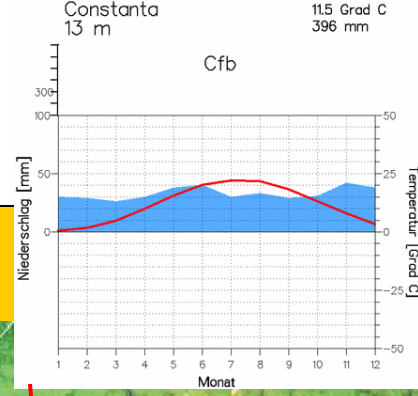
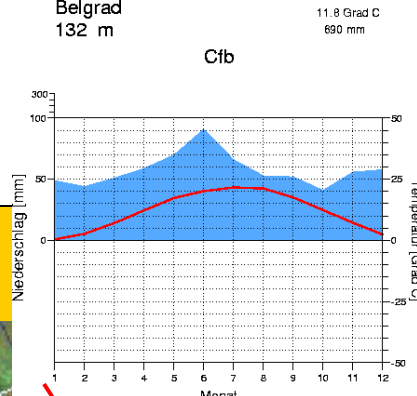
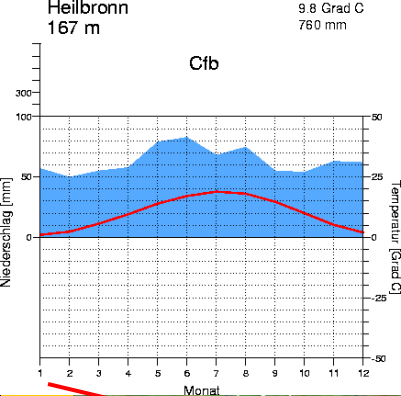


Mošorin loess gorge, Titel-plateau, Vojvodina, Serbia



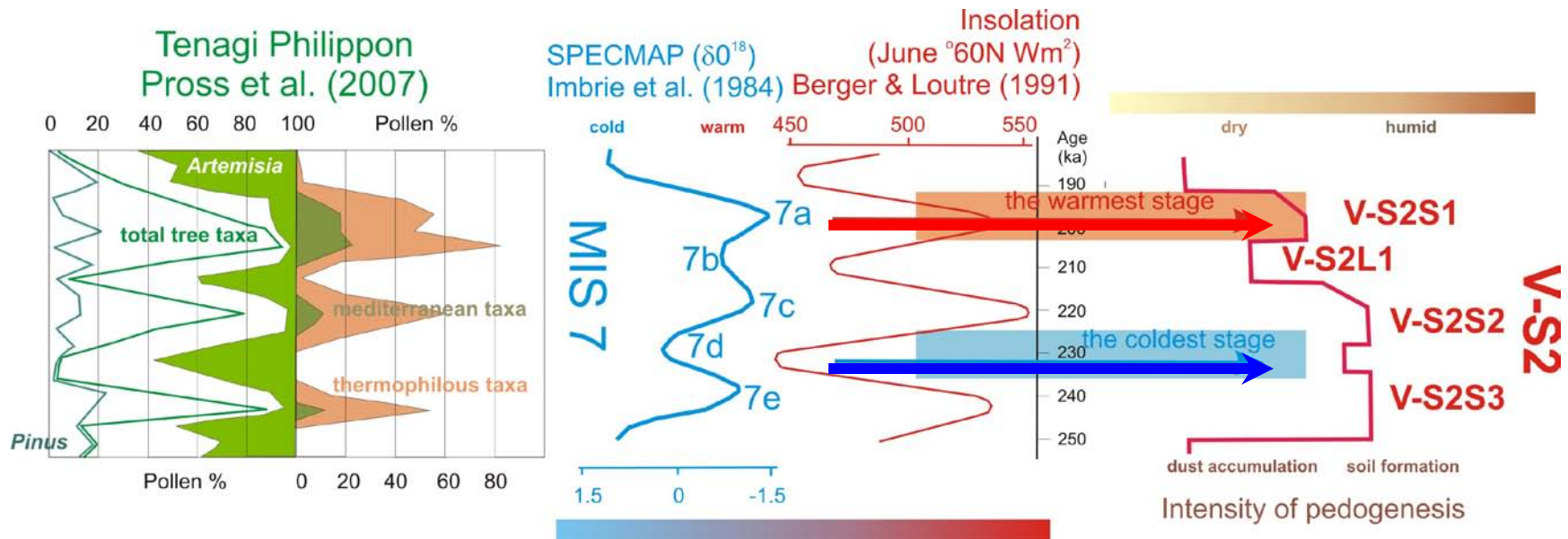
Heilbronn-Frankenbach, Germany





Global climate changes

Regional environmental responses



$< T < ETP$ dry climate

$> T > ETP$ humid climate

The Middle Pleistocene paleoclimatic reconstruction

- Variations of sedimentological, magnetic and geochemical proxies, dust accumulation rates, and intensity of pedogenesis demonstrate evidence for the **Middle Pleistocene** climatic and environmental **transition**.
- The onset of loess deposition in Vojvodina region indicate **direct link** to the **temporally and spatially** progressive **aridization** of **interior Eurasia** since the lower Pleistocene.



CONCLUSION

... Danubian loess is an important link between Pleistocene paleoenvironments of Europe and Asia

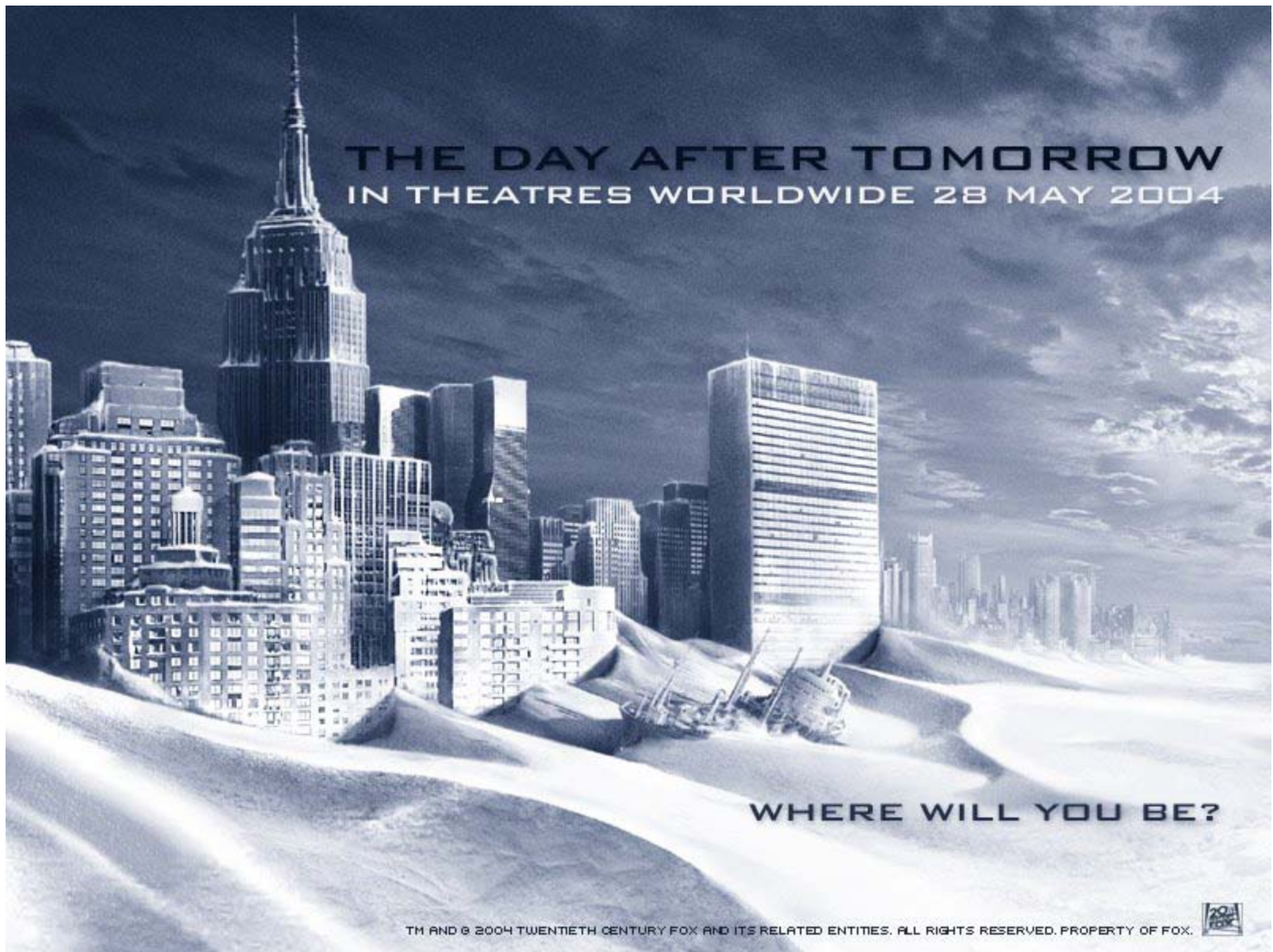
PRESENTED RESULTS

OPEN QUESTION:

**CAN WE EXPECT
PROGRESSIVE FUTURE
ARIDIZATION OF THE
EUROPEAN CONTINENT?**



**Lessons from the past
are important base
for future prediction**



Thank you for your attention!