MASS MOVEMENTS ON THE FRUŠKA GORA MOUNTAIN

Introducing an excellent natural laboratory for slope movement monitoring

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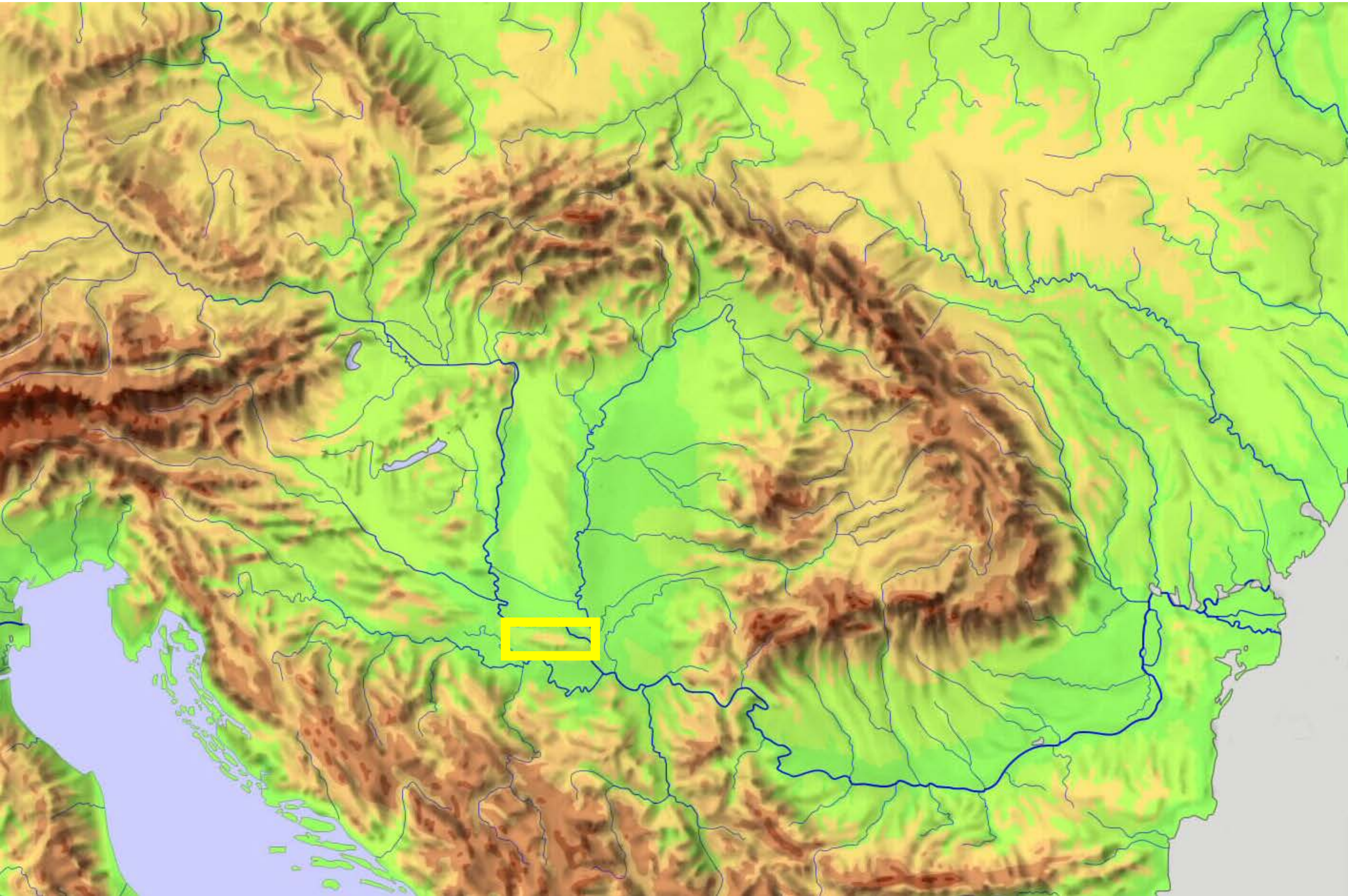
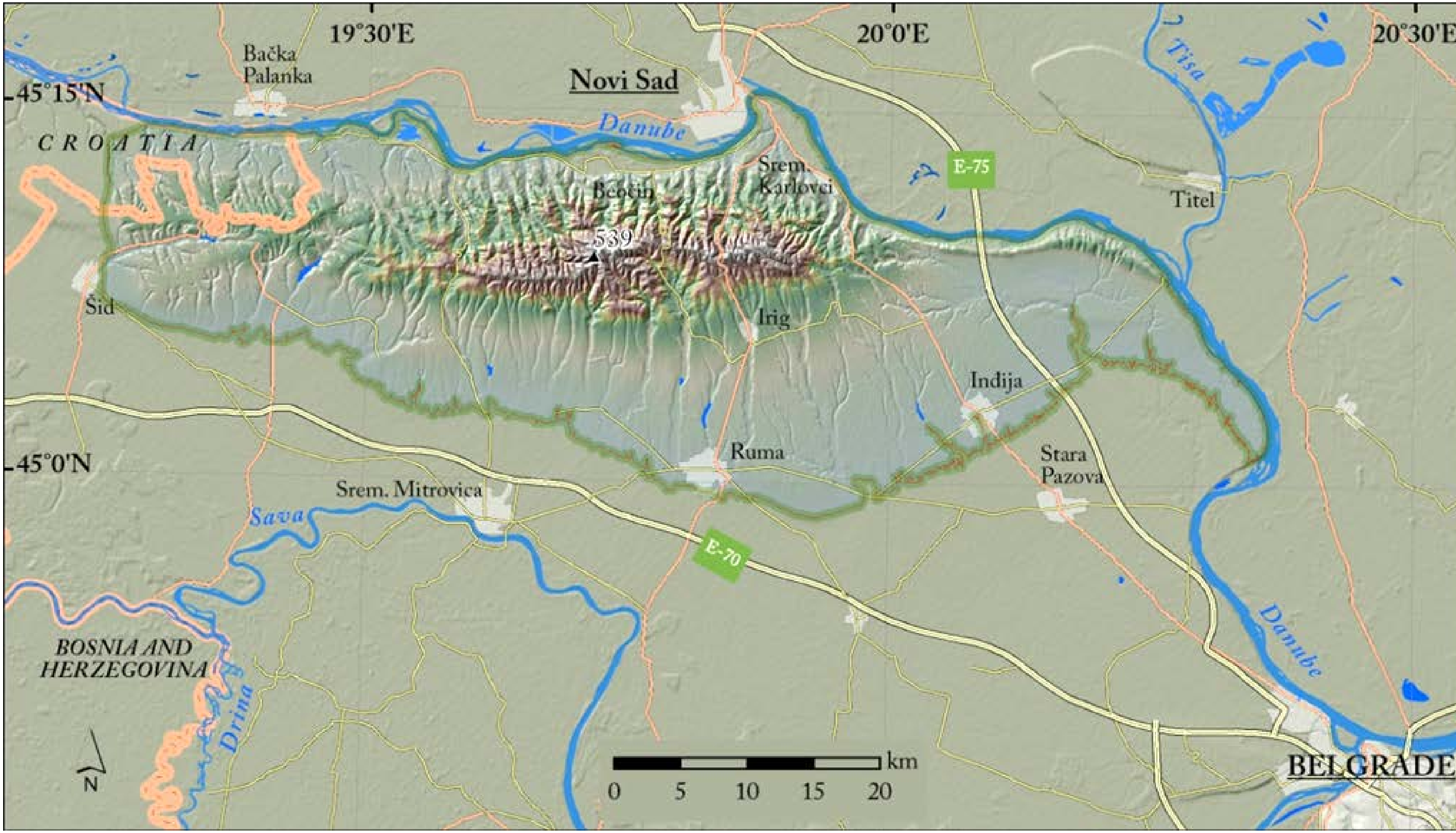
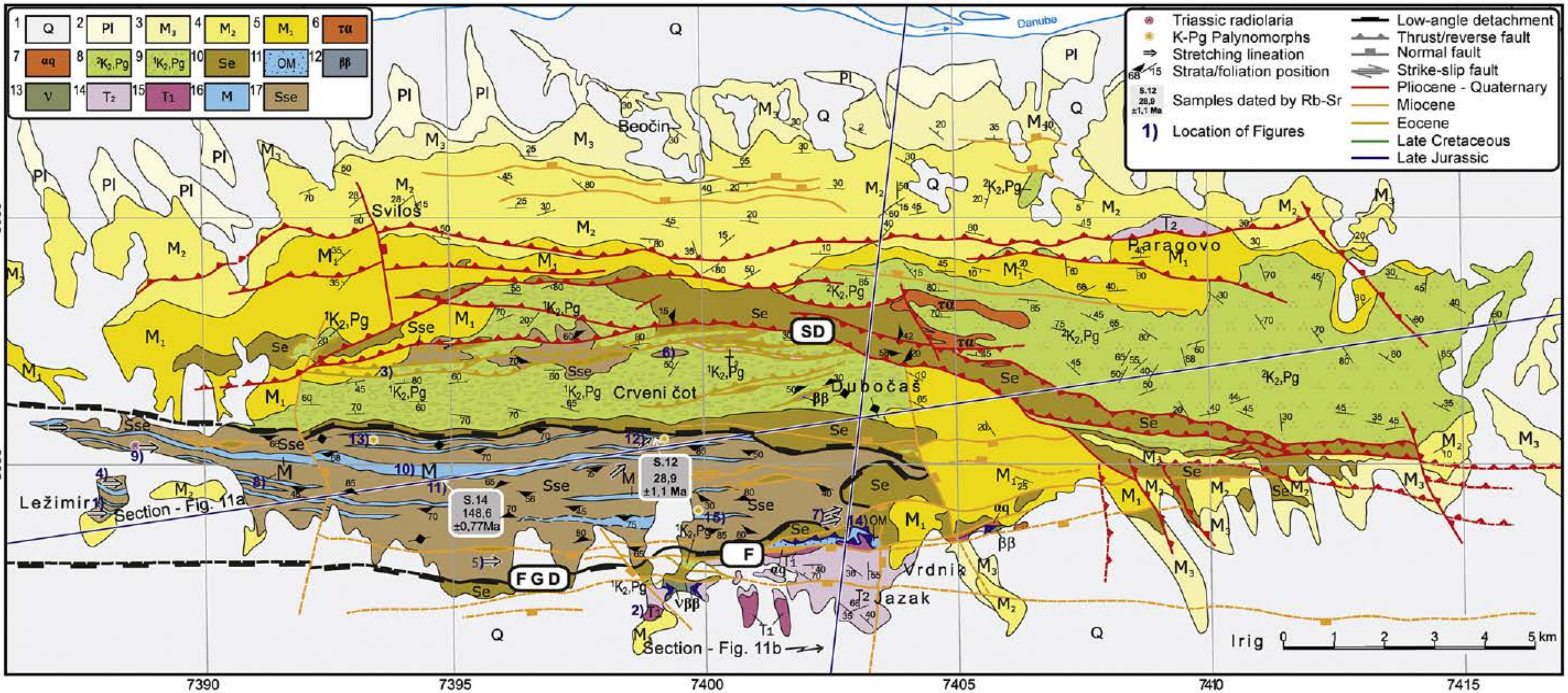
FRUŠKA GORA - SERBIA



RESEARCH AREA - FRUŠKA GORA

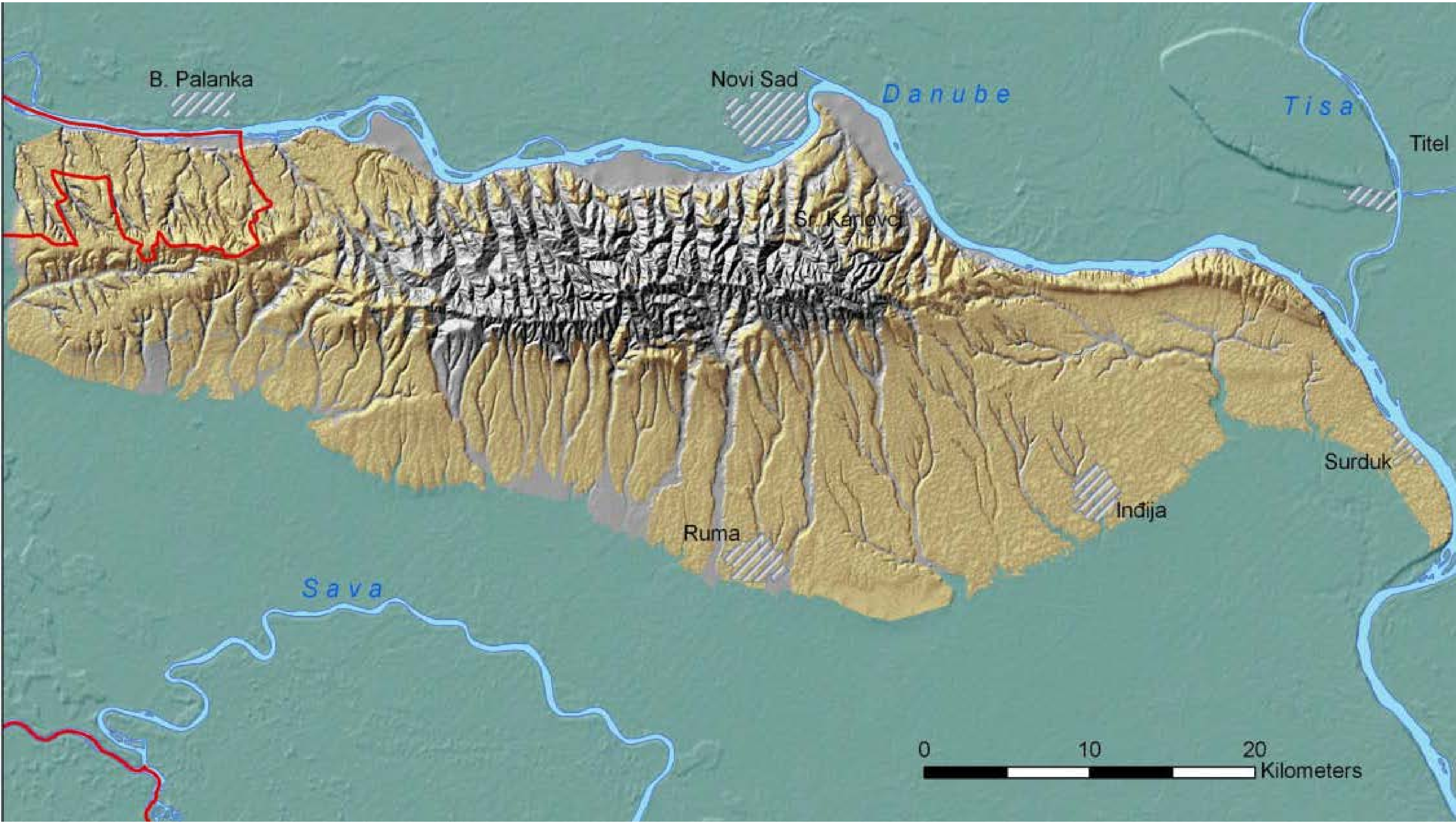


DIVERSE GEOLOGICAL STRUCTURE

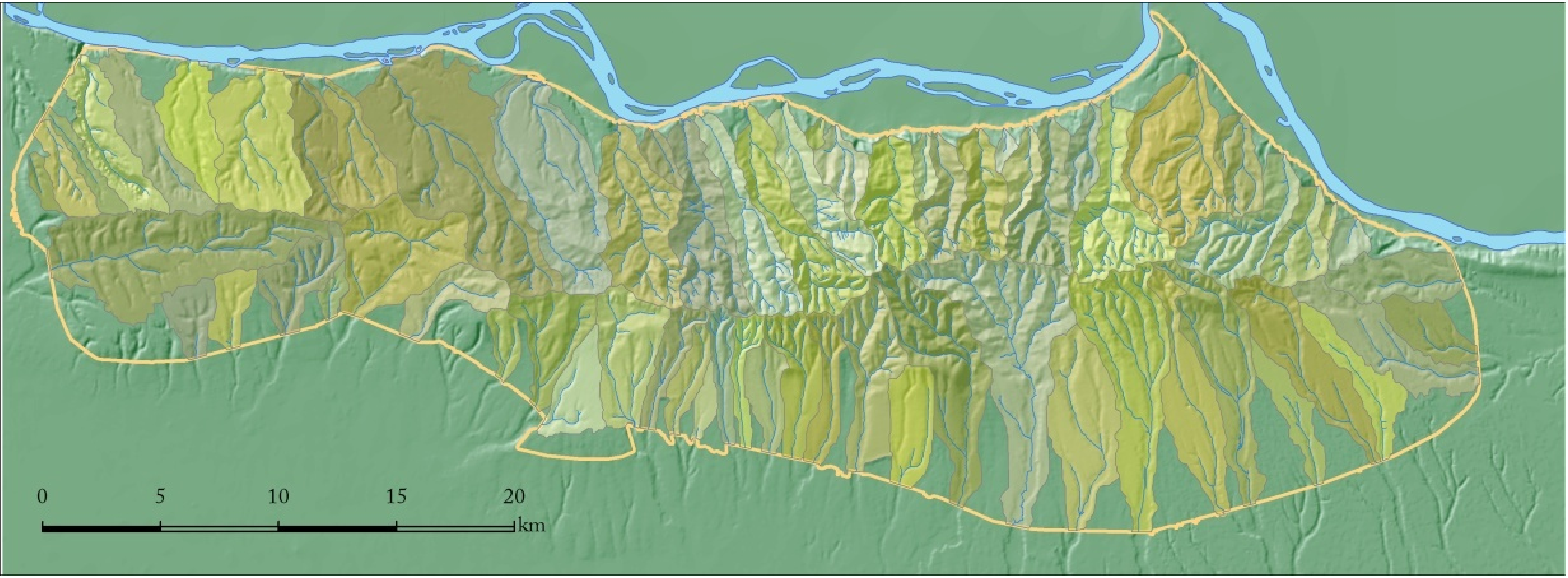


Toljić et al., 2013

QUATERNARY SEDIMENTS

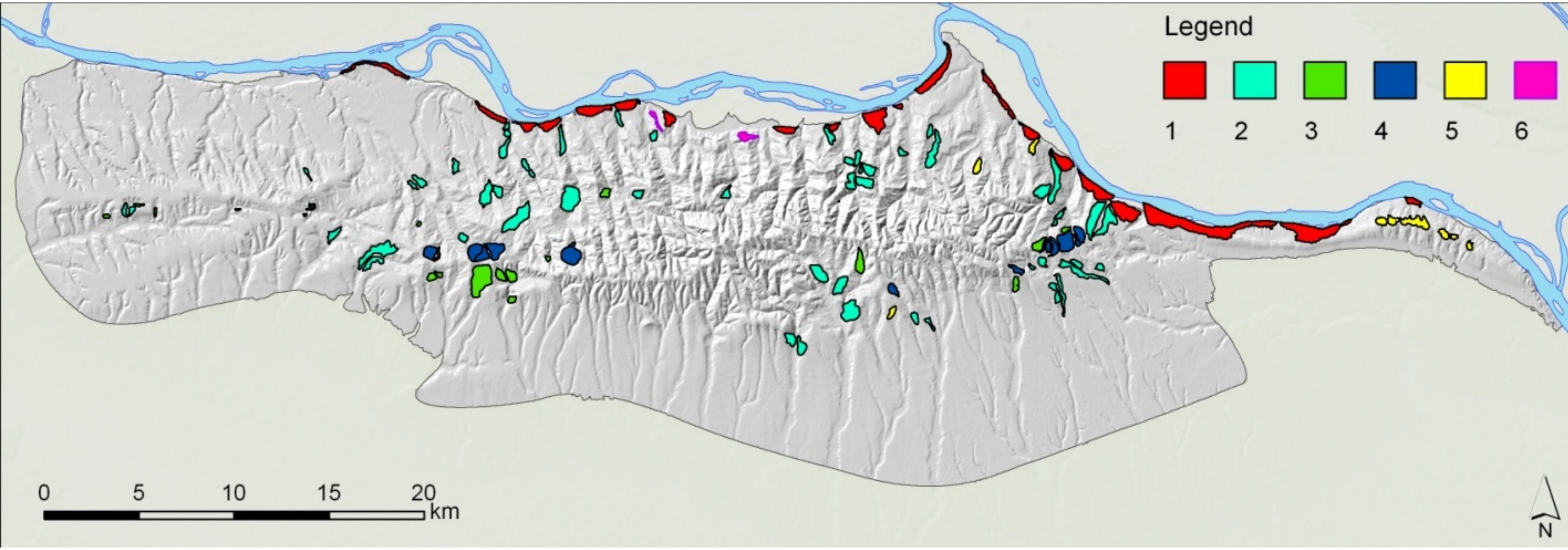


RICH SURFACE HYDROLOGY



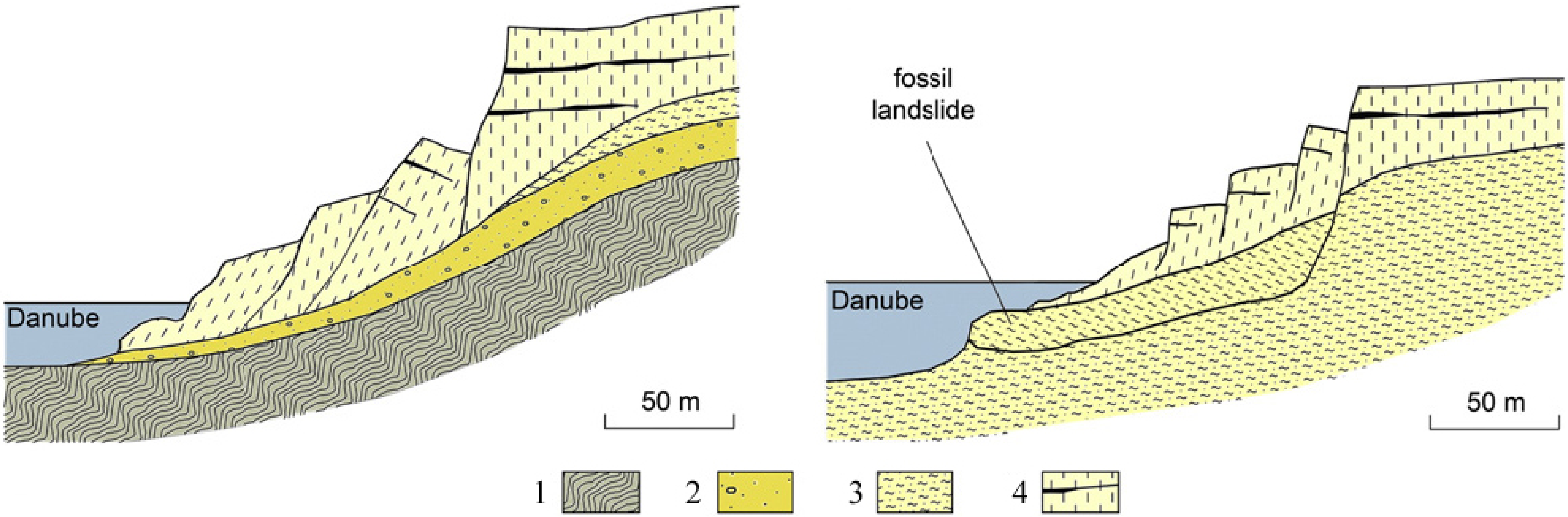
MORE THAN 60 SMALLER STREAM SYSTEMS

FRUŠKA GORA – MASS MOVEMENTS INVENTORY



Landslide type	number	area km^2	% of total landslide area	% of research area
1 – "Danube"	22	13	32	1.3
2 – concave valley	**55**	**17**	**41.9**	1.7
3 – steep "V" valley	23	3.8	9.4	0.4
4 – stream source area	12	4.4	10.8	0.4
5 – loess scarp	8	2	4.9	0.2
6 - anthropogenic	2	0.4	1	0.04
TOTAL	**122**	**40.6**	**100**	**4.3**

1. “DANUBE TYPE” LANDSLIDES

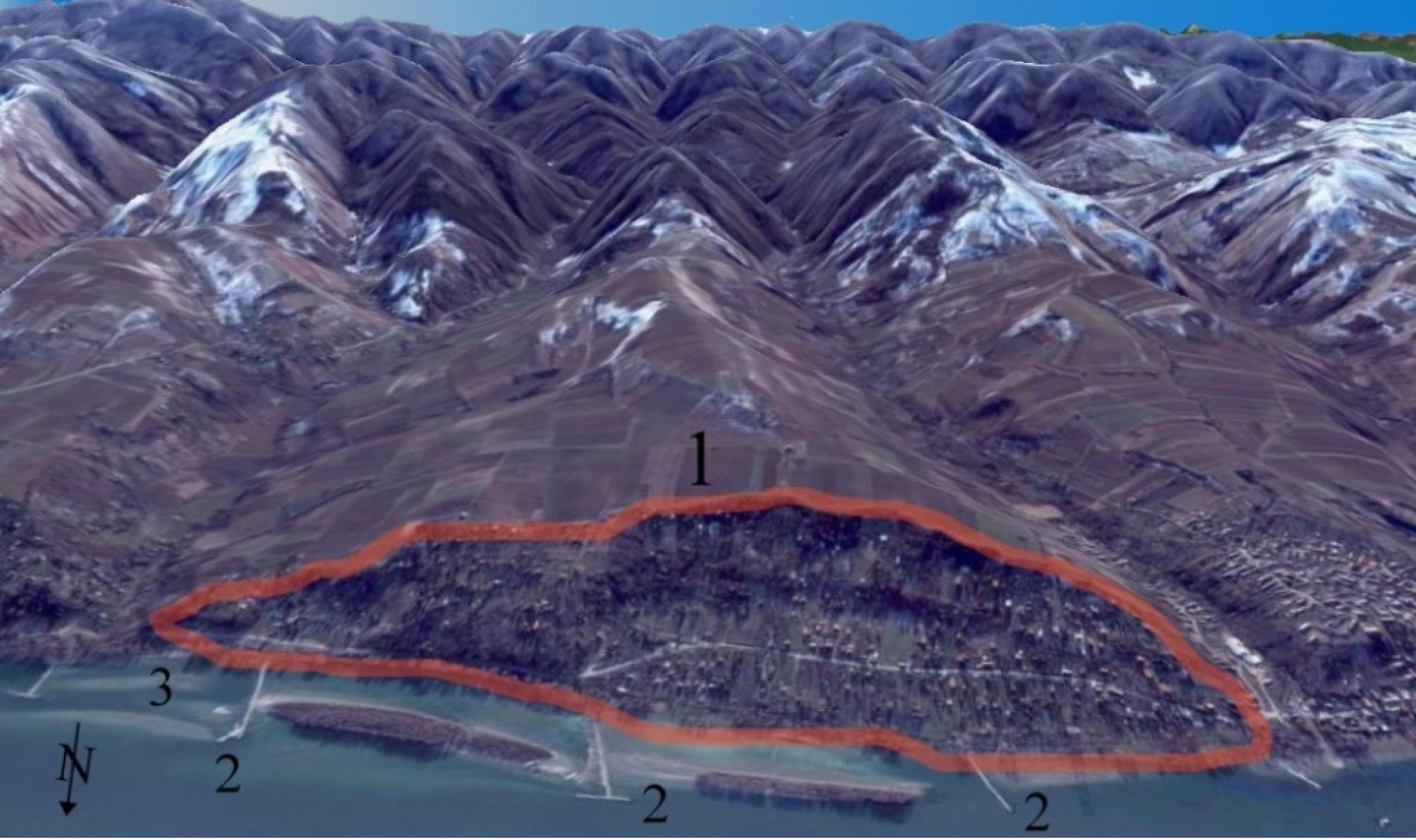


Schematic geological cross section of typical Danube type deep landslide:

a) in saturated loess (groundwater percolates from the porous bedrock toward loess as clay layer wedges down (left)
b) b) loess slabs seized by reactivated fossil landslide (right)

1 - phylitte
2 - gravelly sand (M1)
3 - sandy clay
6 - loess with loam layers (Q)

According to Marjanović M. (Marjanović et al., 2011)



1 - The typical form of a “Danube“ type landslide, near the village of Banoštor.

2 - Stone jetties constructed to reduce erosion and stabilize slope

3 - Accumulated material contributing to slope stabilization

1. “DANUBE TYPE” LANDSLIDES

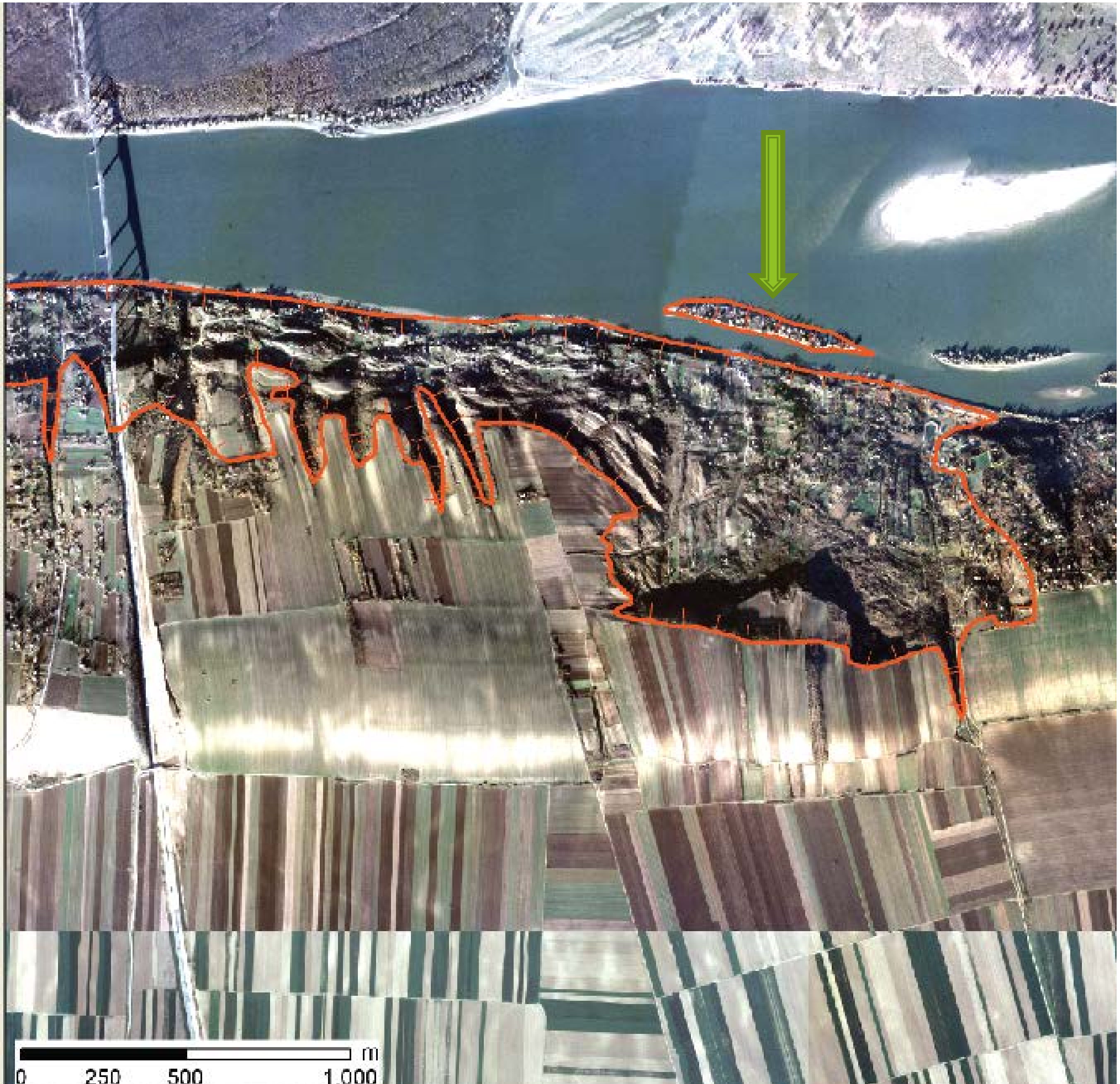
Typical deep landslide area beside the Danube near Krčedin (6.4.2005. Photo: Mészáros M.)

1. “DANUBE TYPE” LANDSLIDES

Bridge founded on deep landslide on the Belgrade-Budapest motorway

(2008. 9. 10., Mészáros M.)

Riverine island formed in large landslide in 1941



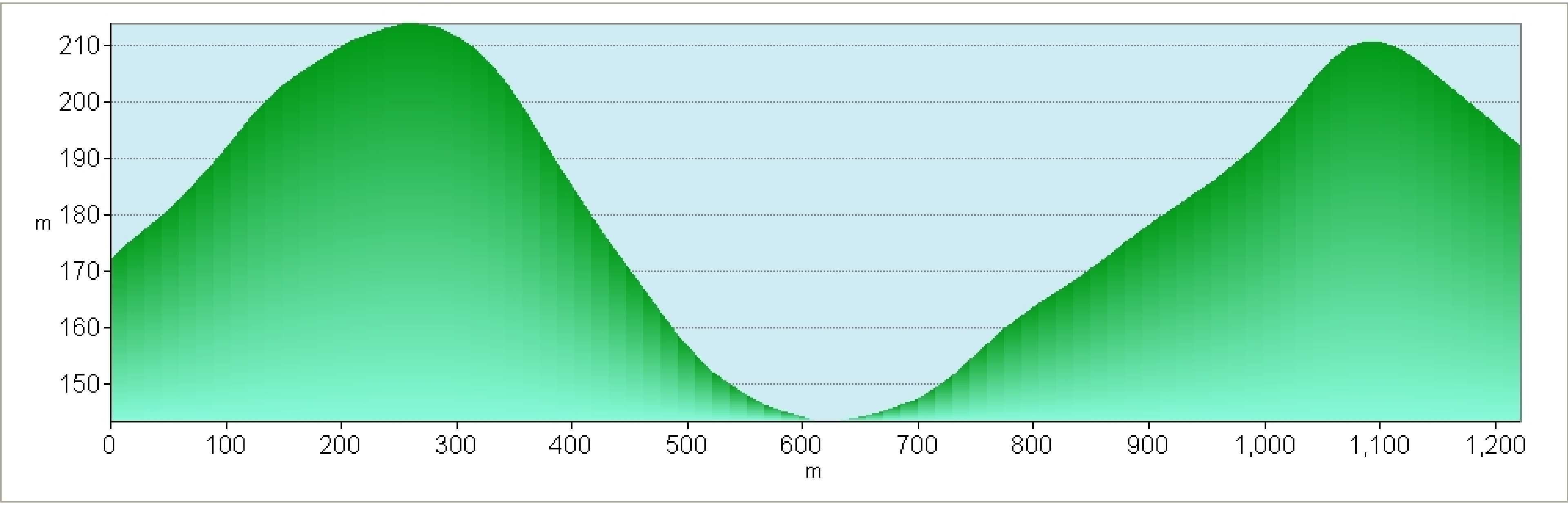
1. “DANUBE TYPE” LANDSLIDES

Another bridge founded on deep seated landslide - Liberty bridge – Novi Sad

1. "DANUBE TYPE" LANDSLIDES

REPAIR OF A ROAD DAMAGED IN SLOPE MOVEMENT NEAR SREMSKI KARLOVCI (2006. 04. 20., Mészáros M.)

2. CONVERGENT, CONCAVE UNSTABLE SLOPES

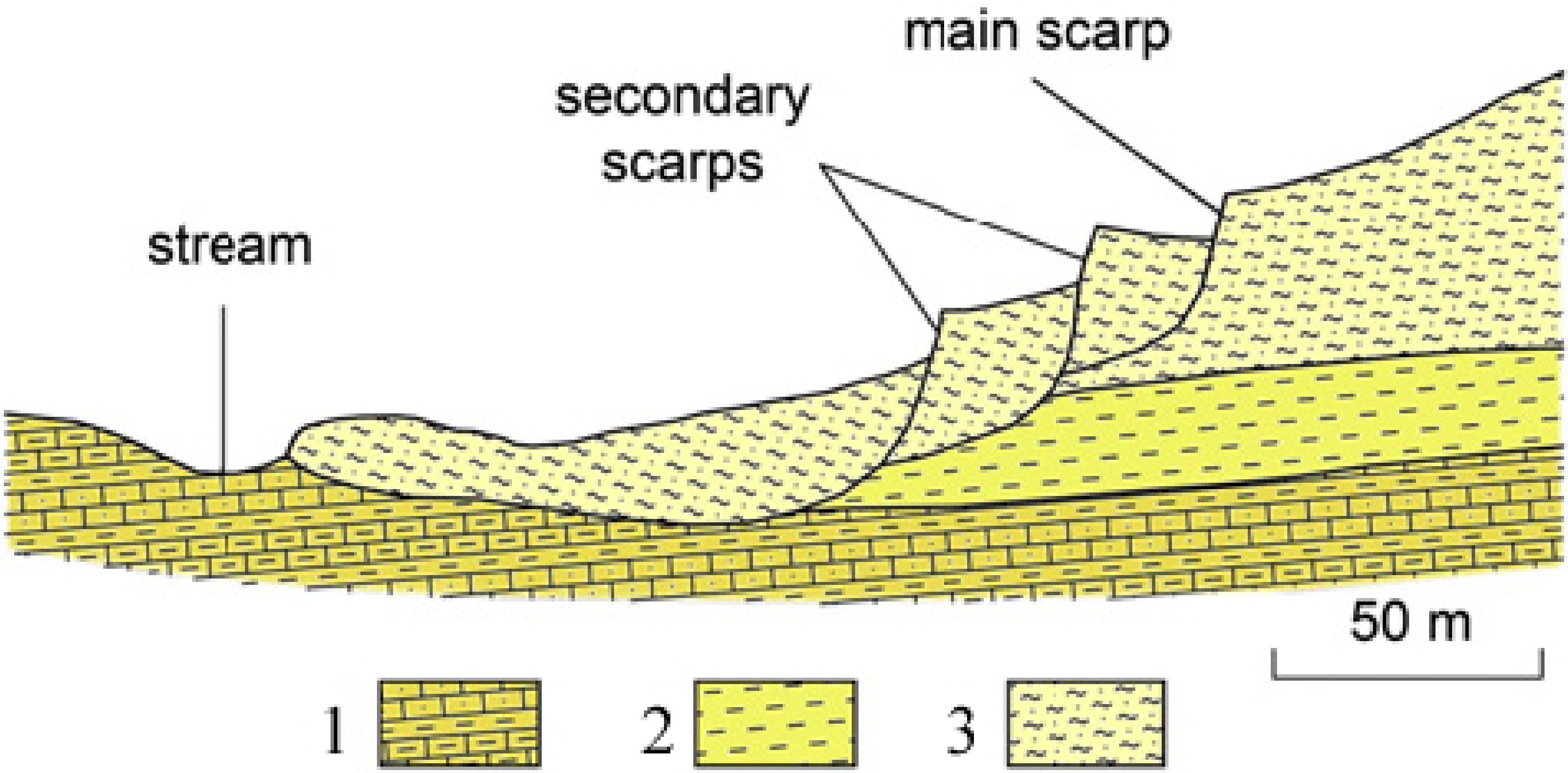


Schematic cross-section profile of the typical convergent, concave stream valleys affected by landslides (Neštin stream)

2. CONVERGENT, CONCAVE UNSTABLE SLOPES

(Čerević, 2006. 5. 5. photo: Mészáros M.)

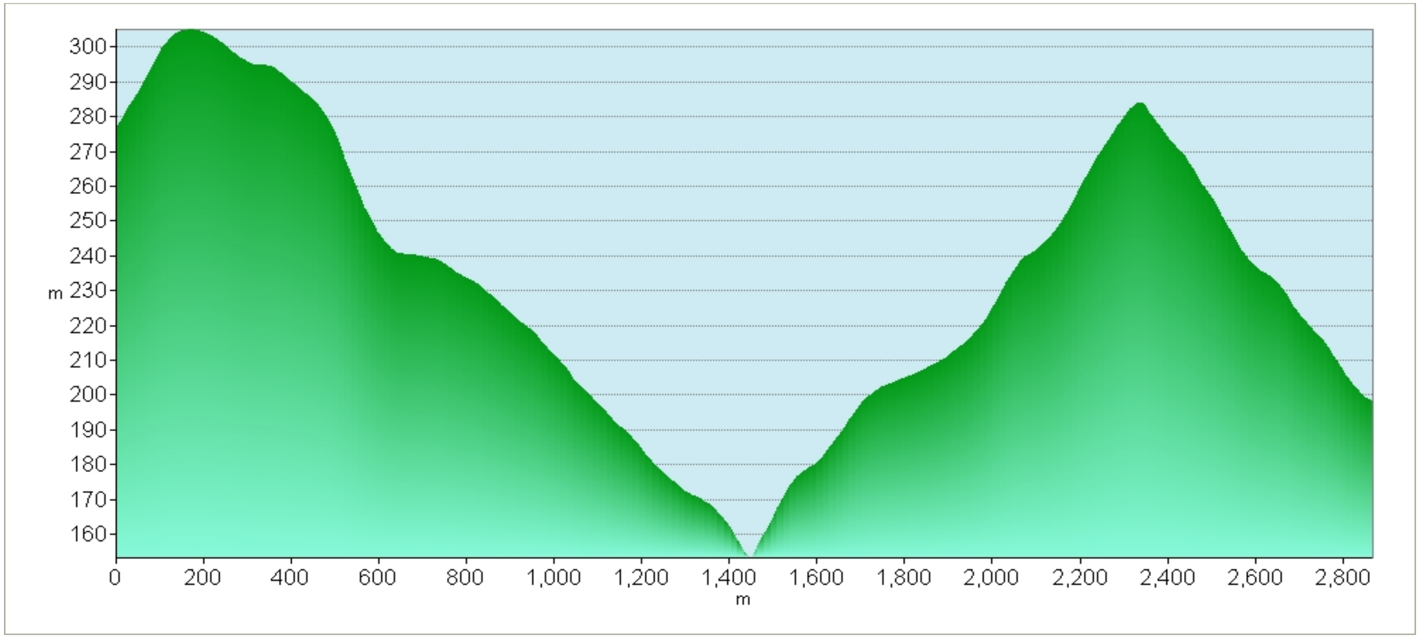
2. CONVERGENT, CONCAVE UNSTABLE SLOPES



Schematic geological cross-section, deep seated landslide in clay
1-limestone and marlstone
2-marl
3-sandy clay.

According to Marjanović M. ([Marjanović et al., 2011])

3. DIVERGENT, CONVEX, “V” SHAPED VALLEY SIDES



Schematic cross-section profile of the typical convergent, concave stream valleys affected by landslides (Neštin stream)

A typical valley form in the uppermost stream section in the central parts of the mountain. Despite the very steep slope, only minor, shallow landslides form, because of the underlying metamorphic and igneous geologic formations. (3.9.2006. photo: Mészáros M.)

A road damaged by landslide in the vicinity of Rakovac (18. 07. 2006. photo: Mészáros M.)

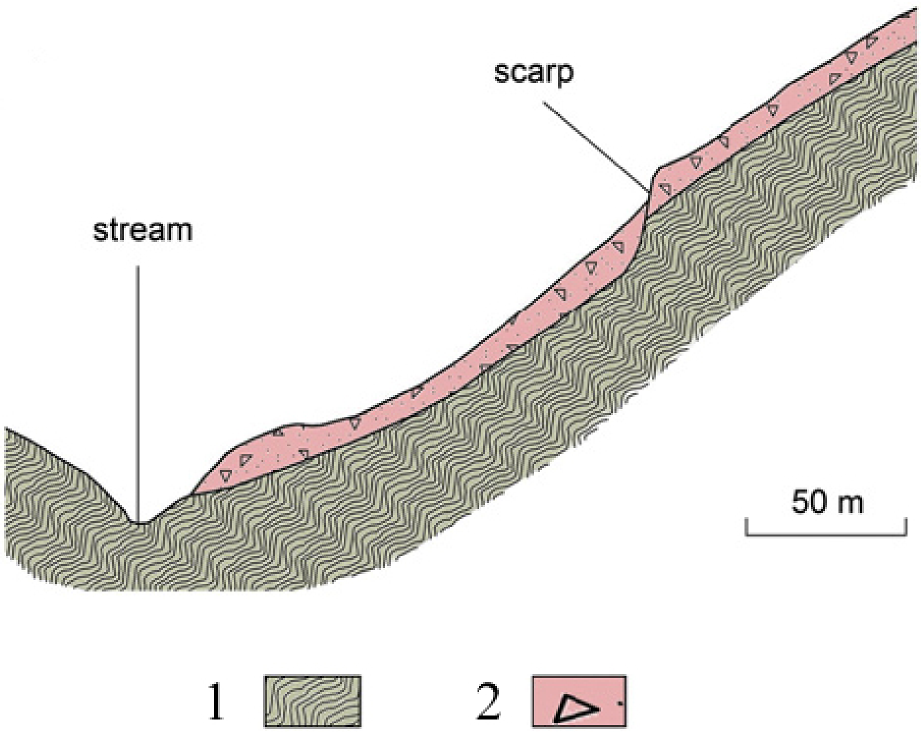
4. LANDSLIDES ABOVE THE STREAM SOURCE AREA

A number of landslides can be found in the source areas of streams. In the central parts of the mountain, where the oldest metamorphic rocks are uncovered on the surface and the shallow soil layer is under dense forest, conditions are limited for landslide formation. The majority of this type of unstable slopes are located at the contact of the metamorphic and Quaternary zone, or form entirely in loess and loose neogene limnic and marine sediments.

5. LOESS SCARP FALLS AND TOPPLES

Occur on tectonically or topographically predisposed locations, where the thick loess cover ends in steep walls or vertical scarps. The slumped mass increases the weight on unstable slopes beneath, and in combination with saturated aquifers which often drain on the contact of loess with the neogene clay layers in the base cause movements. The deep cracks formed in the brittle dry loess mass increase infiltration of water in the shear zones and further destabilize the mountainside. Loess covers large parts of the Fruška Gora, and other type of landslides very often form in loess, leaving landslide scars in form of vertical loess scarps („Danube” type landslides as well as all types of mass movements in stream valleys)

SHALLOW LANDSLIDES



Shallow landslide schematic cross section 1- phyllite, green schist (Paleozoic), 2 – deluvial cover (Quaternary) according to Marjanović M. (Marjanović et al., 2011)

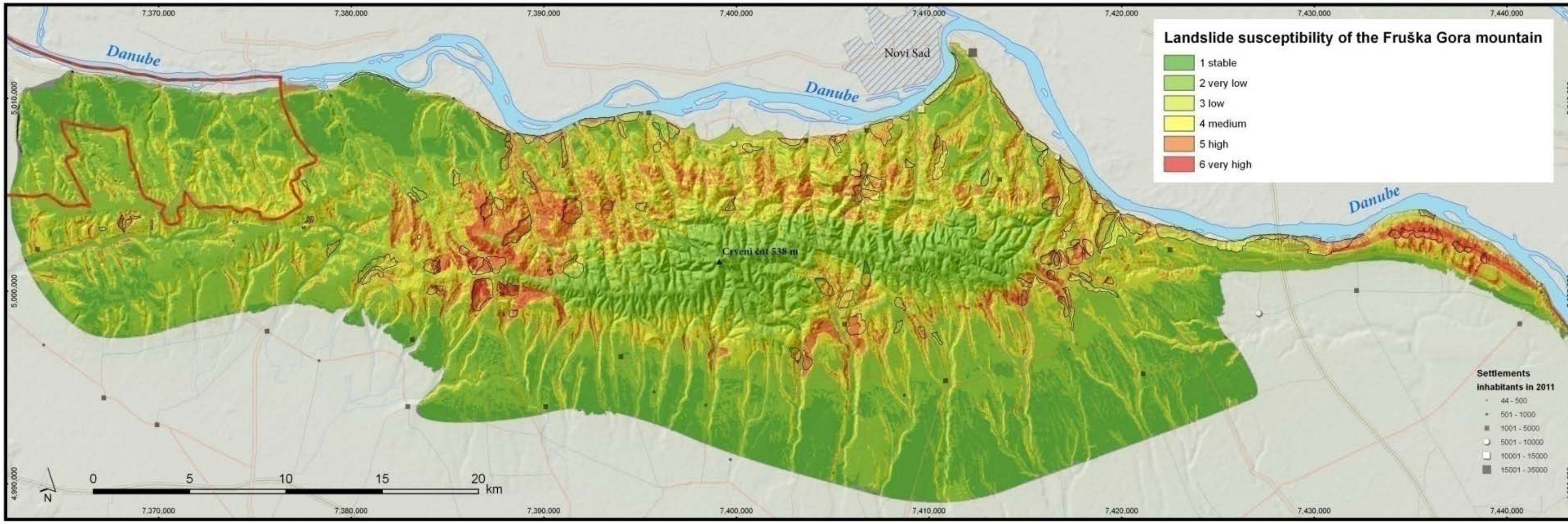
SHALLOW LANDSLIDES

A house damaged by a shallow landslide in the vicinity of Banoštor (21. 04. 2006. photo: Mészáros M.)

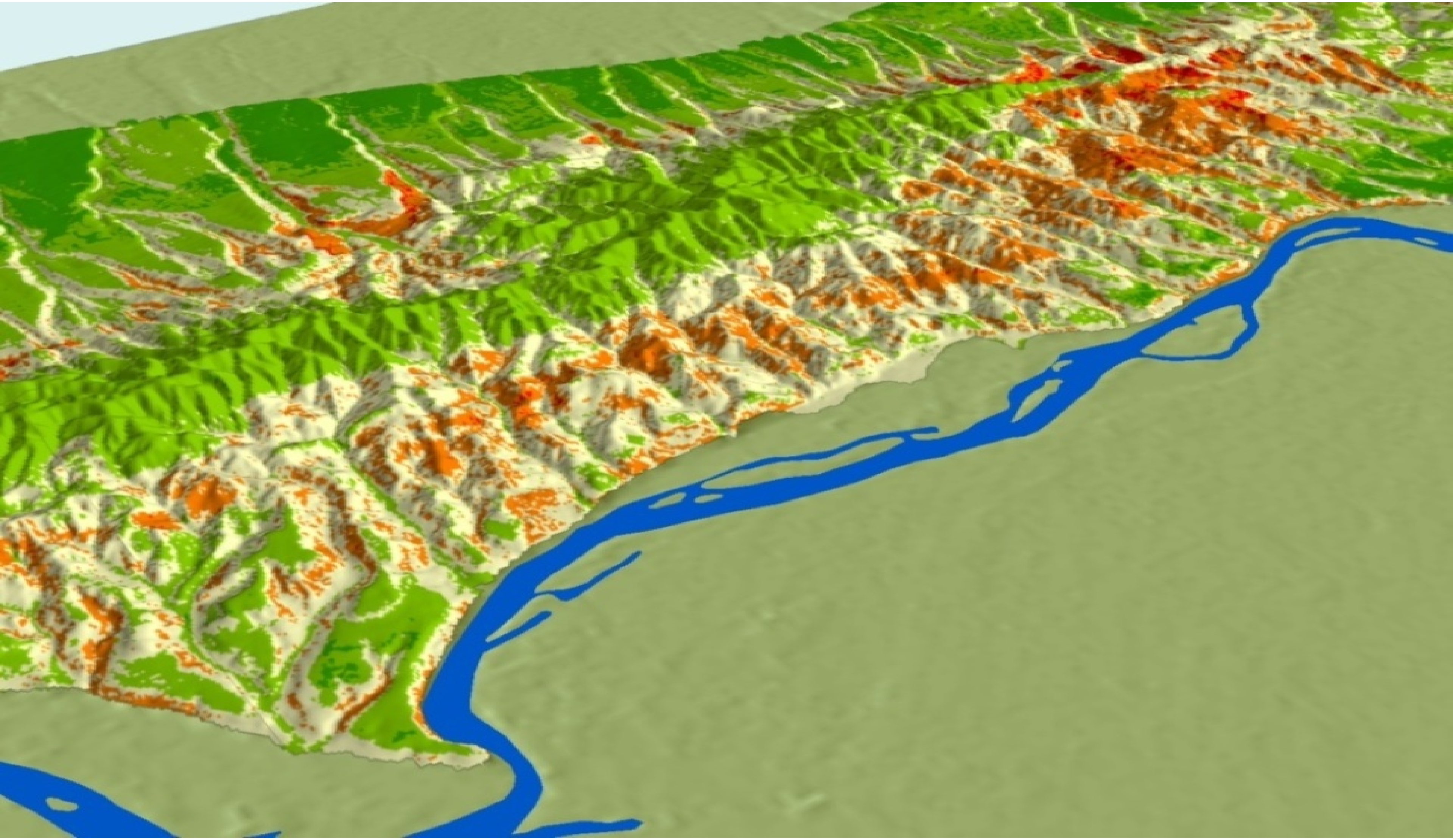
SHALLOW LANDSLIDES

A road obstructed by earth flow near the village of Banoštor (21. 04. 2006. photo: Mészáros M.)

FRUŠKA GORA – LANDSLIDE SUSCEPTIBILITY MAP



FRUŠKA GORA – LANDSLIDE SUSCEPTIBILITY



LANDSLIDE SUSCEPTIBILITY:

GREEN – low
YELLOW – medium
RED – high

2.7 x vertical exageration

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Welcome to INQUA Loess Focus Group

In the honour of Prof. Tungsheng Liu

Beijing, China, 21st October 2013

Wenying Jiang, (former Ph.D. student of Prof. Liu), vice president Shiling Yang and president of INQUA Loess Focus Group Slobodan Markovic visited the grave of one of the most important loess researchers which world ever had - Prof. Tungsheng Liu.

It is always a great honour to remember our teachers, people who gave us knowledge and open door to science.

It is just a cycle of the dust...

Archive for the Loess Letters of Dr. Ian Smalley

The page developed at Michigan State University, in the Department of Geography, to house PDFs of the Loess Letter collection of Dr. Ian Smalley.

Read and download all published issues of Loess Letters here »

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VERSITA

Central European Journal of **Geosciences**

The INQUA Loess Commission as a Central European Enterprise

Review Article

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Abstract: The International Union of Quaternary Research (INQUA) organized the study and consideration of the Quaternary Period (the last 2.6 million years in Earth's history) via a set of commissions, sub-commissions, working groups, projects and programmes. One of the most successful and best records was the Loess Commission (LC) which functioned assub-commission and then commission from 1961 to 2003, resulting in 40 years of useful activity. The history of the LC can be divided into three phases: 1, from 1961-1977 when the President was Julius Fink; 2, from 1977-1991, with President Marton Pecsi; 3, from 1991-2003 with Presidents An Zhi-Sheng and Ian Smalley.

Fink, from Vienna, and Pecsi, from Budapest, gave the LC a distinctly Central European aspect. The nature of loess in Central Europe influenced the nature of the LC but the settings for phases 1 and 2 were quite distinct. Phase 1 was a small scale academic operation, carried out in German. As phase 2 began in 1977 the scope expanded and Central Europe became a base for worldwide loess studies. where the LC language changed to English. Phase 2 was run from a National Geographical Institute and demonstrated a different approach to loess research, although the basic programmes of continent-wide mapping and stratigraphy remained the same. The Commission benefited from this change of style and emphasis. In phase 3 the administration moved away from Central Europe but the Finkian ethos remained solid.

Keywords: Loess Commission • Central European loess • loess history • Julius Fink • Marton Pecsi

"The real voyage of discovery consists not in seeking new landscapes but in having new eyes."

Marcel Proust

1. Introduction

It could be claimed that European loess research started in the heart of the continent, possibly via the studies of Italian scholar and soldier Luigi Ferdinando Marsigli [1]. He described noticeable loess-palaeosol exposures along the Danube river valley in his outstanding six volume work

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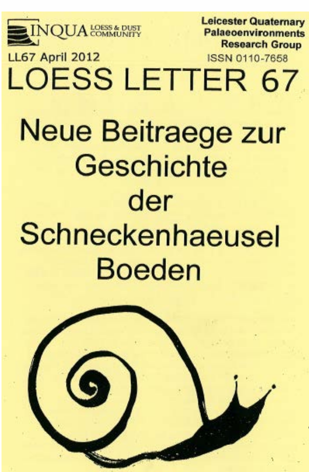
INQUA loess community become quite successful and best recorded unit of this international association

1961-1969 INQUA Sub-Commission
1969-2003 INQUA Commission
2003- INQUA Focus Group

Previous Presidents:
Julius Fink 1961-1977
Marton Pecsi 1977-1991
An ZhiSheng 1991-1999
Ian Smalley 1999-2003
Ludwig Zoeller 2003-2011



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