Spectacular badland on rhyolite tuff in North Hungary

Gergely Horváth

horvger@caesar.elte.hu

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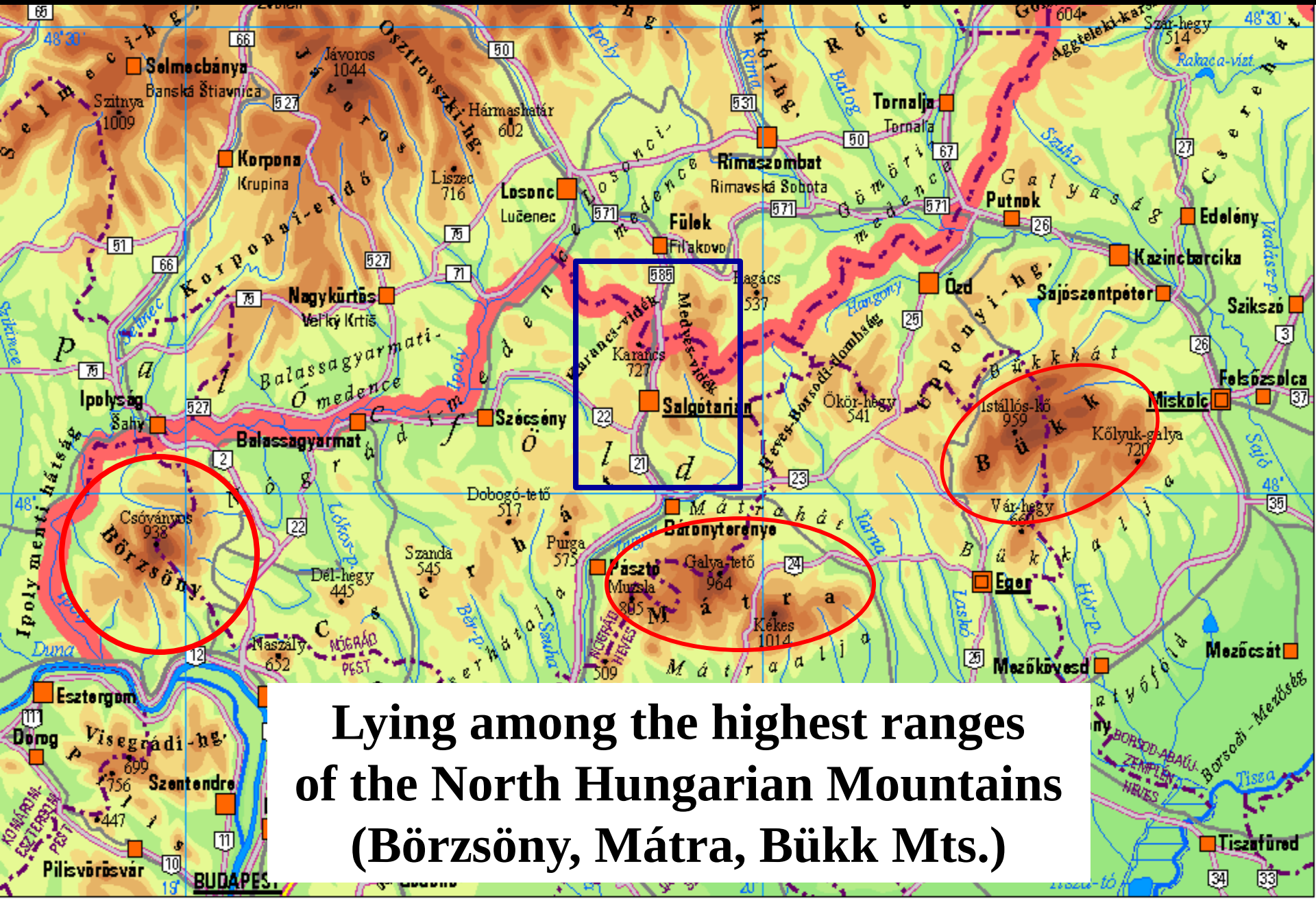
Rhyolite tuffs

In north Hungary at several different places odd greyish white walls and other barren whitish patches can be seen: outcrops of rhyolite tuffs

Interesting and attractive mezo- and microforms, formed mostly by erosional processes, can be seen

The biggest outcrop at village Kazár is the ‘only Hungarian badland’

The Karancs–Medves Region



Lying among the highest ranges of the North Hungarian Mountains (Börzsöny, Mátra, Bükk Mts.)

Novohrad–Nógrád Geopark

1587 km^2

SLOVAKIA

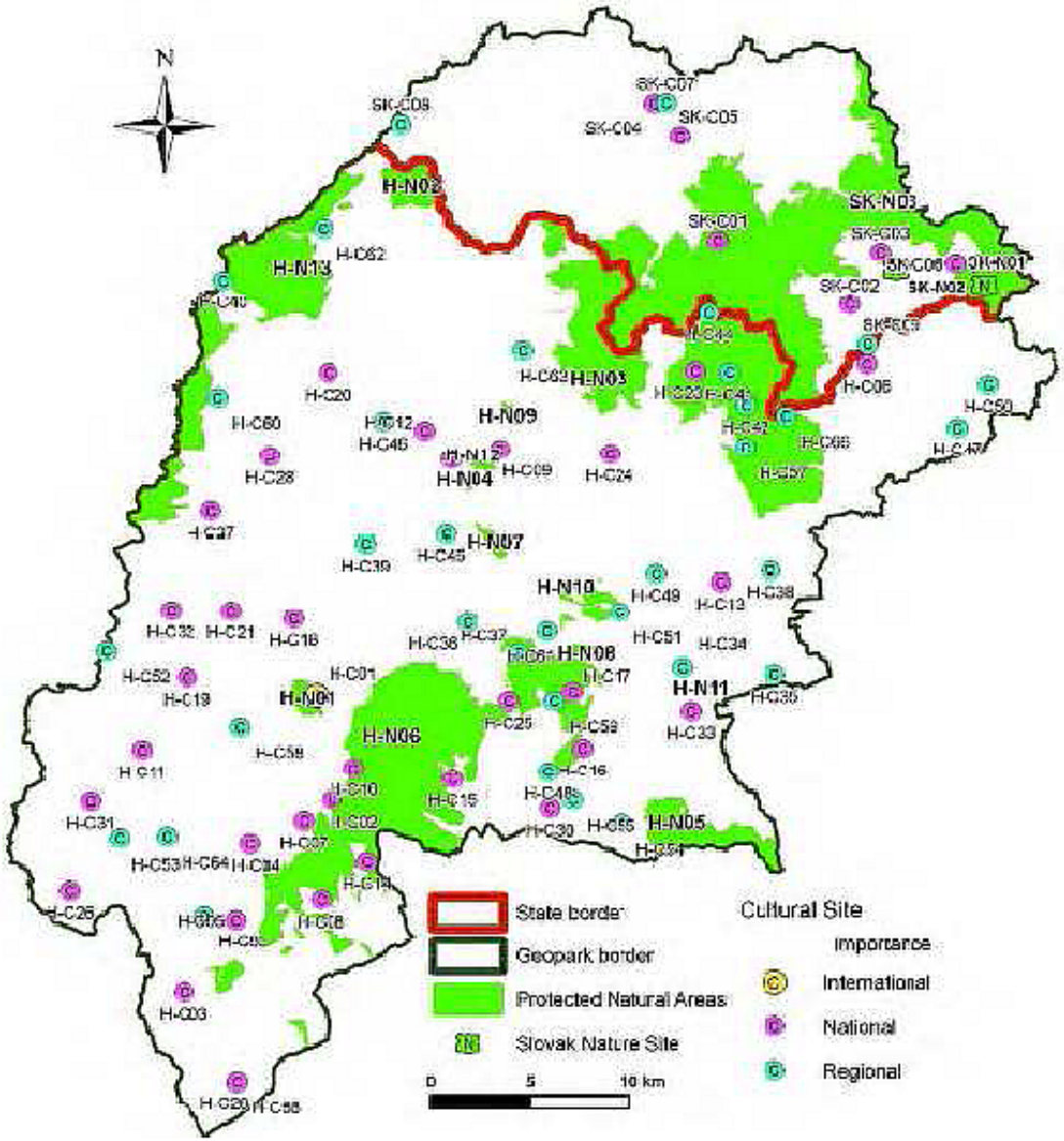
336 km^2 in Slovakia

1251 km^2 in Hungary

HUNGARY

NOVOHRAD NÓGRÁD GEOPARK

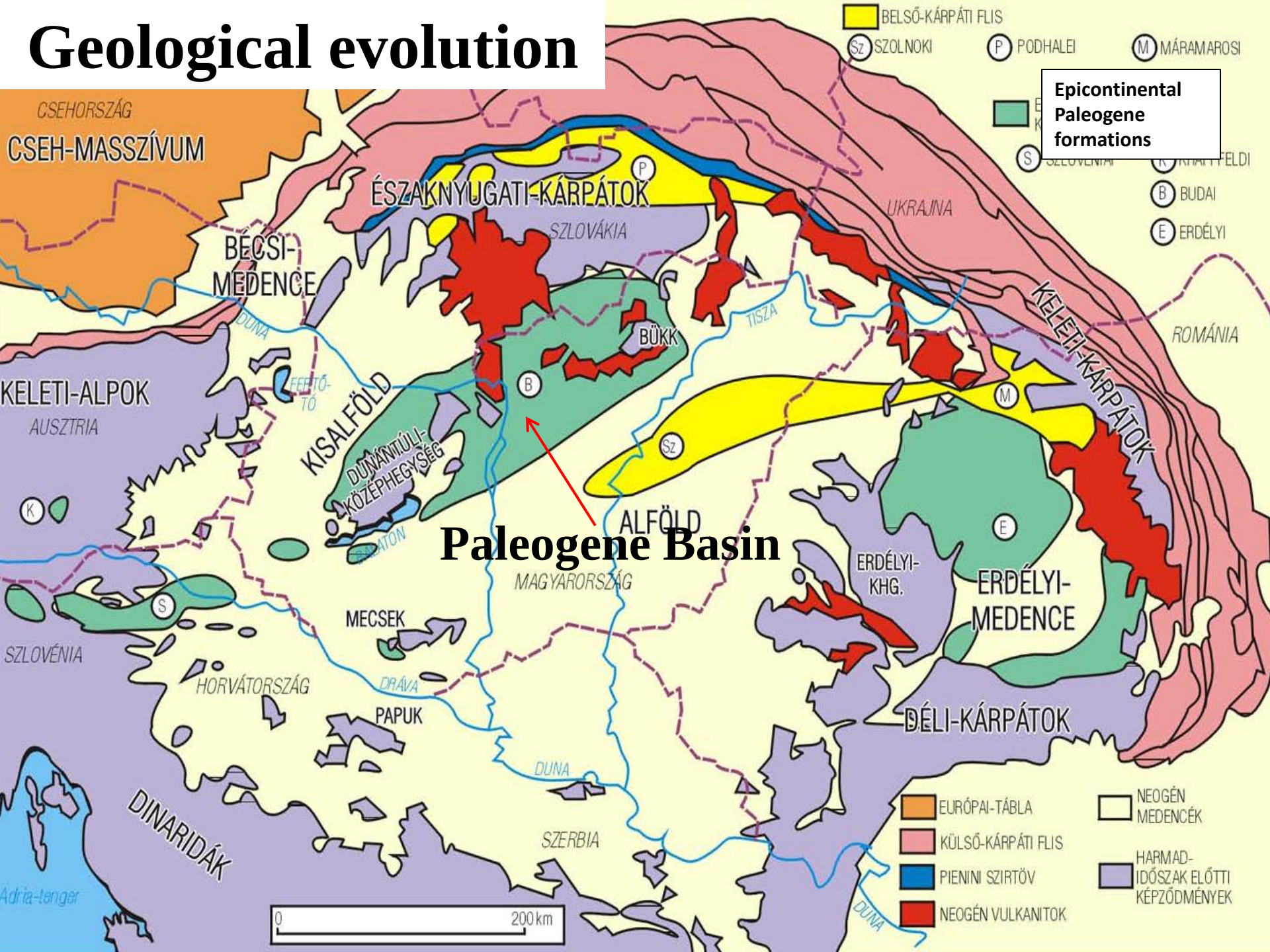
Main values of the geopark



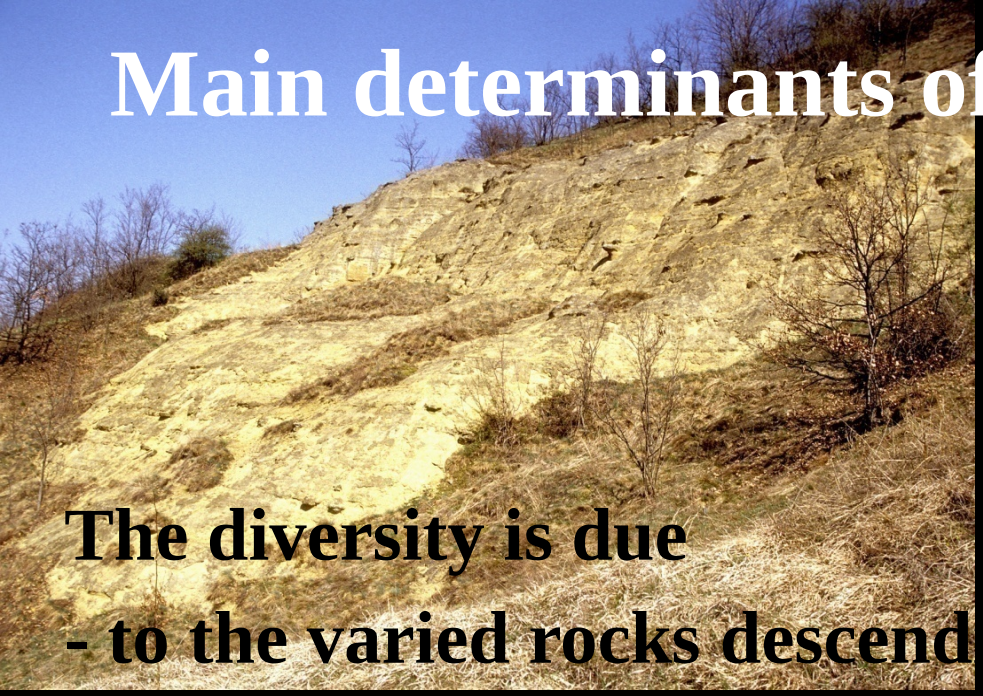
16 natural value of
2 international,
12 national and
2 local
importance

75 cultural value:
1 international,
38 national and
36 local
importance

Geological evolution



Main determinants of landscape diversity

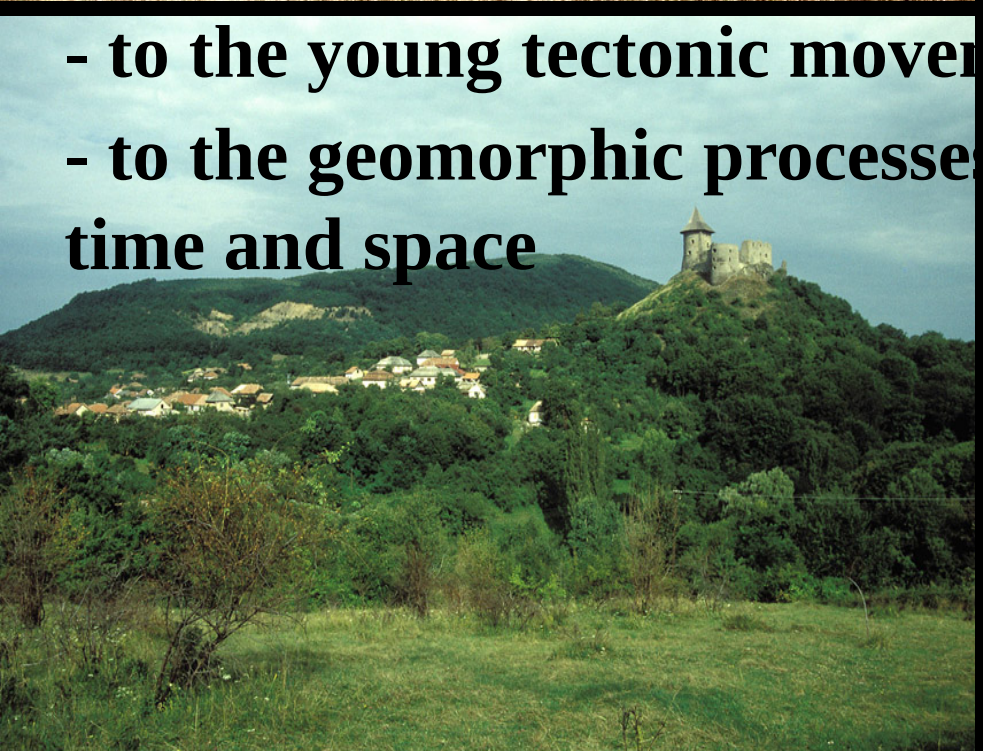


The diversity is due

- to the varied rocks descending from different eras

- to the young tectonic movements

- to the geomorphic processes often changing both in time and space



Geology

- Oldest rocks in embankment: less known metamorphic rocks
- mainly from Neogene and partly Palaeogene sediments: near-shore neritic sediments such as sandstone, clay marl and schlieren are dominant
- and Neogene volcanic rocks: rhyolites, andesites and basalts from different volcanic epochs
- lavas and tuffs

Lowest surfaces are covered by mainly fluvial sediments: sands, sandy gravels, pebbles

Frequent tectonic movements

Landscape is determined by series of faulted and erosionally dissected hilly ridges

The relief

Variagated hilly lands and middle mountains

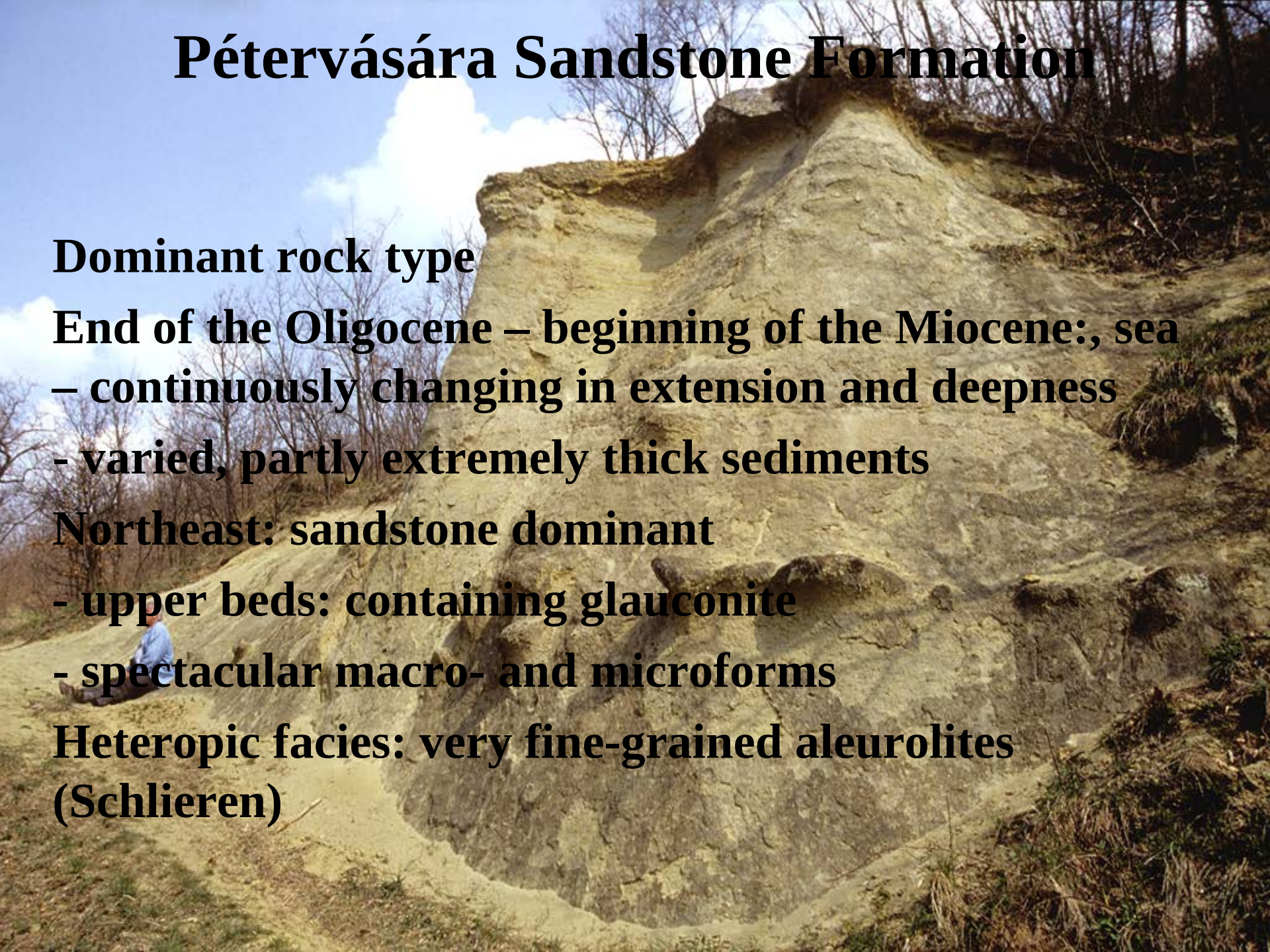
Considerable diffences in altitude between valley bottoms (150–200 m) and tops (600–700 m)

- max. Karancs, 729 m

Significantly dissected

- relative relief 100-200 m/km^2, partly > 300 m/km^2
- valley density 3–5 km/km^2, partly > 7 km/km^2,
- in some cases ~ 10 km/km^2

Pétervására Sandstone Formation



Dominant rock type

End of the Oligocene – beginning of the Miocene:, sea – continuously changing in extension and deepness

- varied, partly extremely thick sediments

Northeast: sandstone dominant

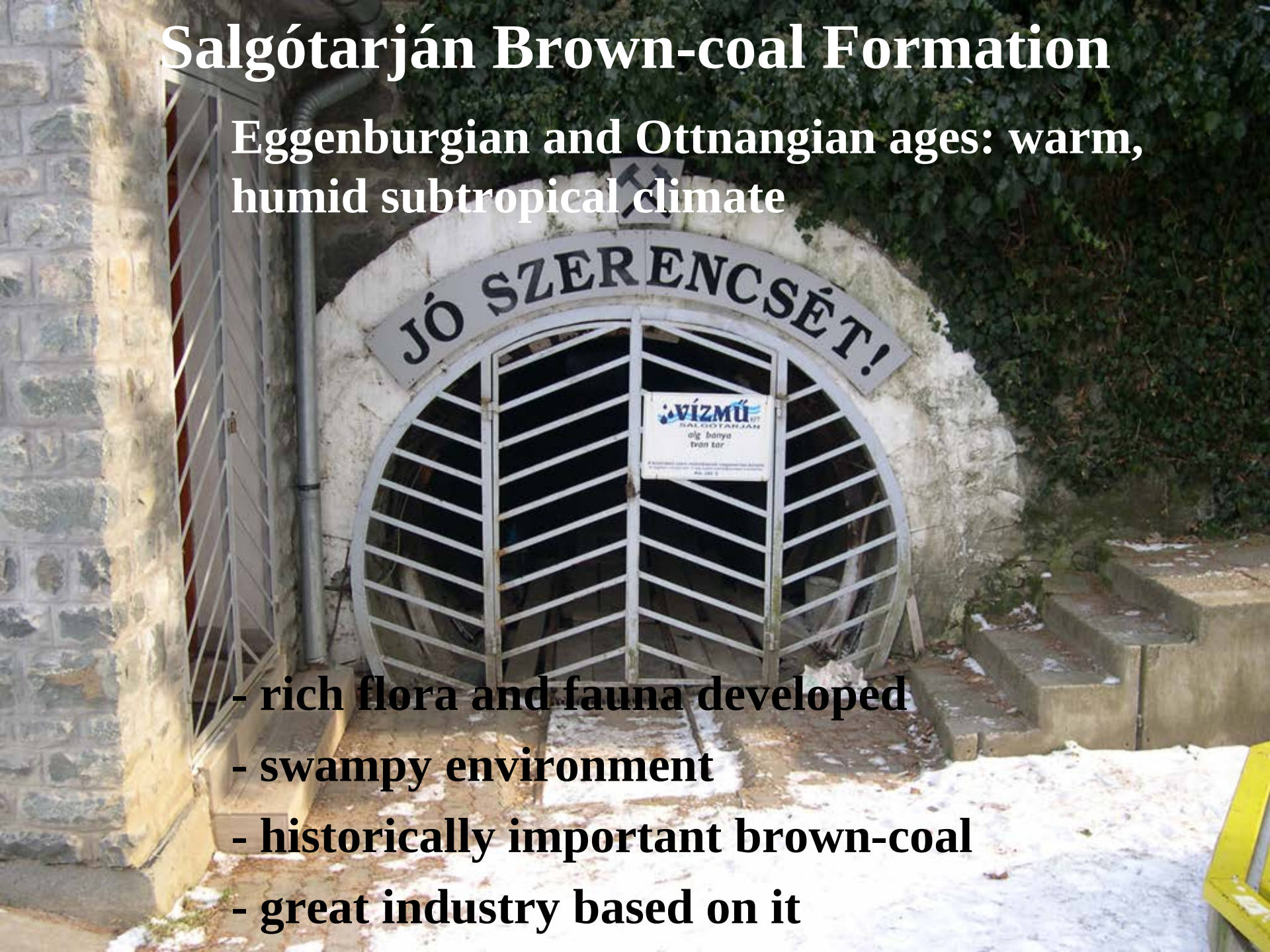
- upper beds: containing glauconite

- spectacular macro- and microforms

Heteropic facies: very fine-grained aleurolites (Schlieren)

Salgótarján Brown-coal Formation

Eggenburgian and Ottnangian ages: warm, humid subtropical climate



- rich flora and fauna developed

- swampy environment

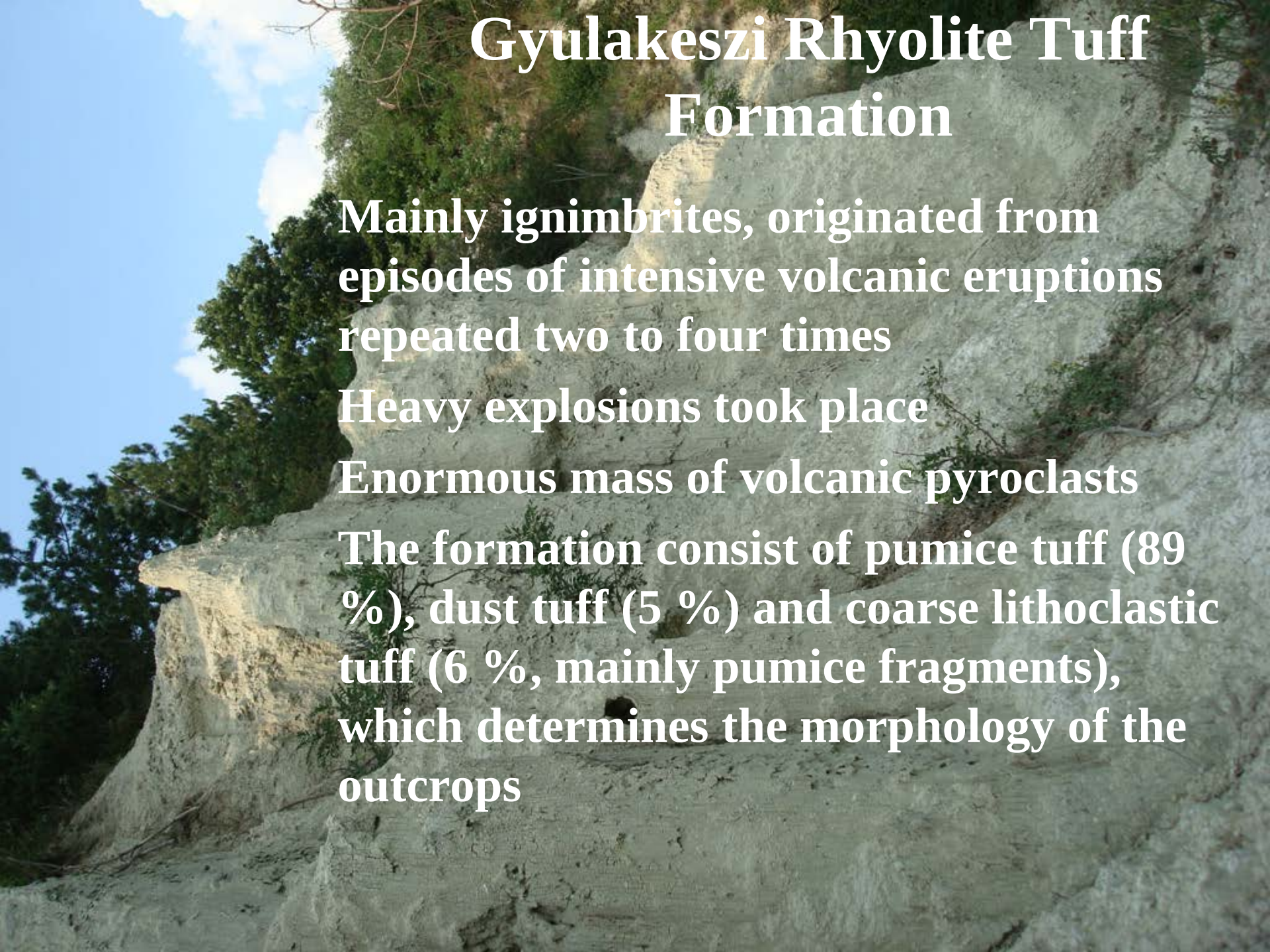
- historically important brown-coal

- great industry based on it

Gyulakeszi Rhyolite Tuff Formation

- The formation known as “lower rhyolite tuff”
- Ottnangian age – beginning of volcanic activity
- Greyish white, white, biotitic, pumiceous rhyolite-rhyodacite; usually thick-bedded and poorly layered
- The formation occurs on the surface in several parts of the North Hungarian Middle Mountains
- Famous outcrops in the Karancs-Medves Region, and in the Bükkalja (the southern foreland of the Bükk Mountains)

Gyulakeszi Rhyolite Tuff Formation



- Mainly ignimbrites, originated from episodes of intensive volcanic eruptions repeated two to four times
- Heavy explosions took place
- Enormous mass of volcanic pyroclasts
- The formation consist of pumice tuff (89 %), dust tuff (5 %) and coarse lithoclastic tuff (6 %, mainly pumice fragments), which determines the morphology of the outcrops

Geological map of North Hungary

Rhyolite tuffs

Gyulakeszi Rhyolite Tuff Formation

- Phraeotomagmatic activity, typical ignimbites
- Seperated small cones, necks, or line of craters
- Main centre is not know; products cover big area, layers thickness 10-30 m
- Has also been discovered in several boreholes throughout the country and its thickness varies between 30–400 m
- The radiometric–palaeomagnetic age of the formation was previously considered to be 18.5–21 million years, marking the Ottnangian Stage
- According to a recent radiometric age measurement (Pálfy et al. 2012) the deposition of the tuff occurred later, only 17 million years ago, in the Carpathian Stage

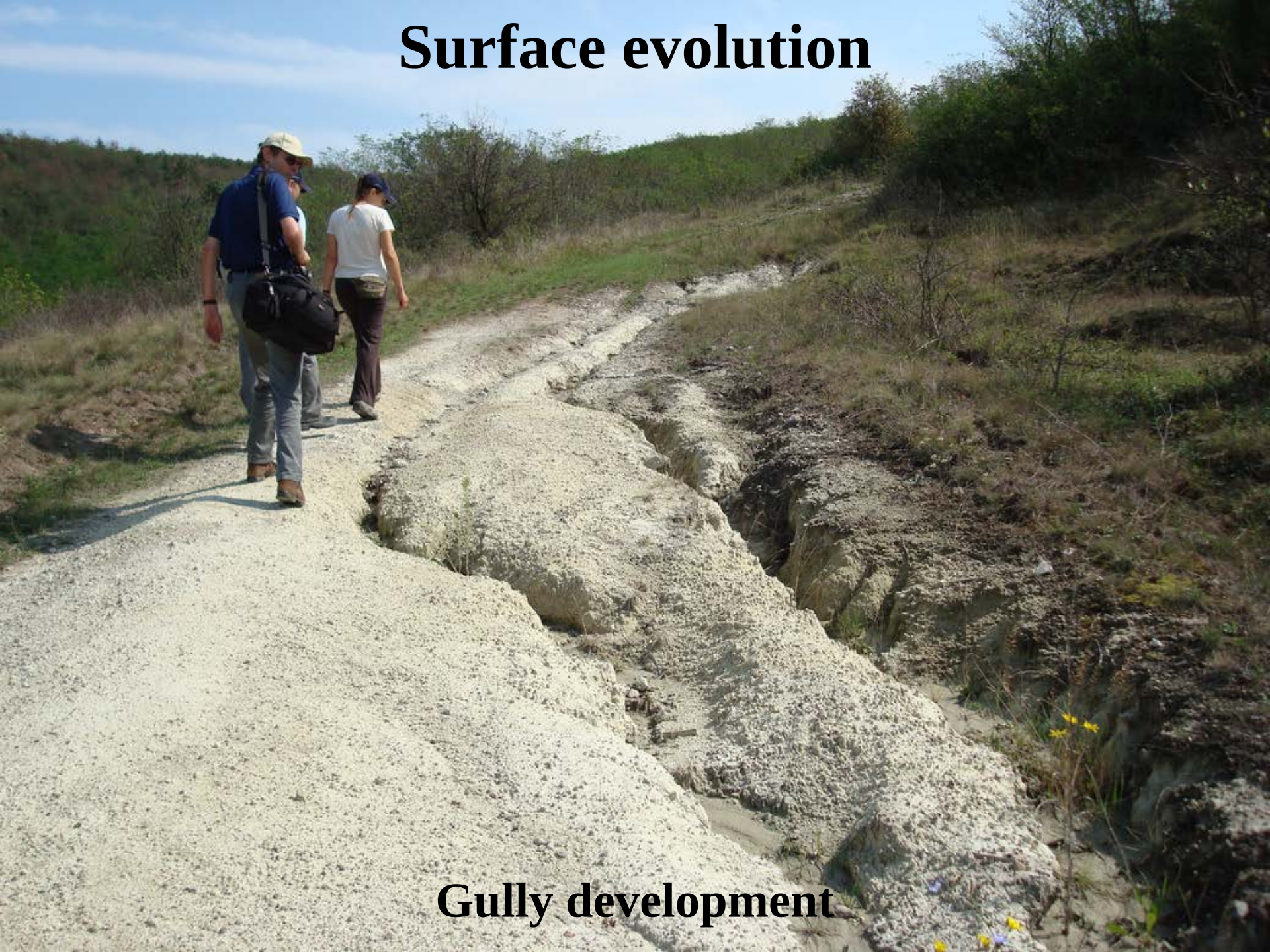
Main characteristic of outcrops

Typical barren landscape

Surface evolution

Increasing barren surface

Surface evolution



Gully development

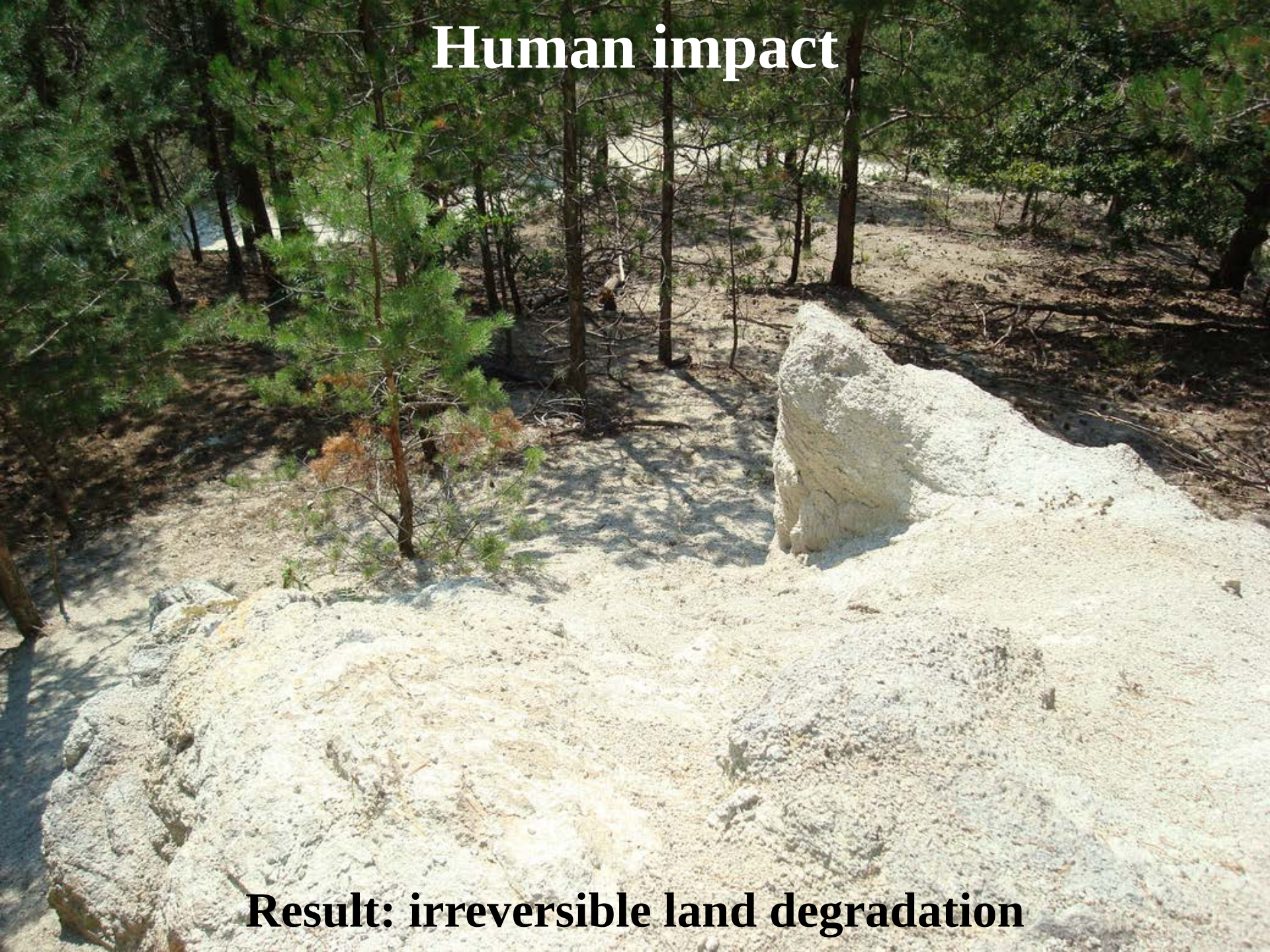
Human impact

Quick development along roads

Human impact

Deforestation and stock raising triggers erosional processes

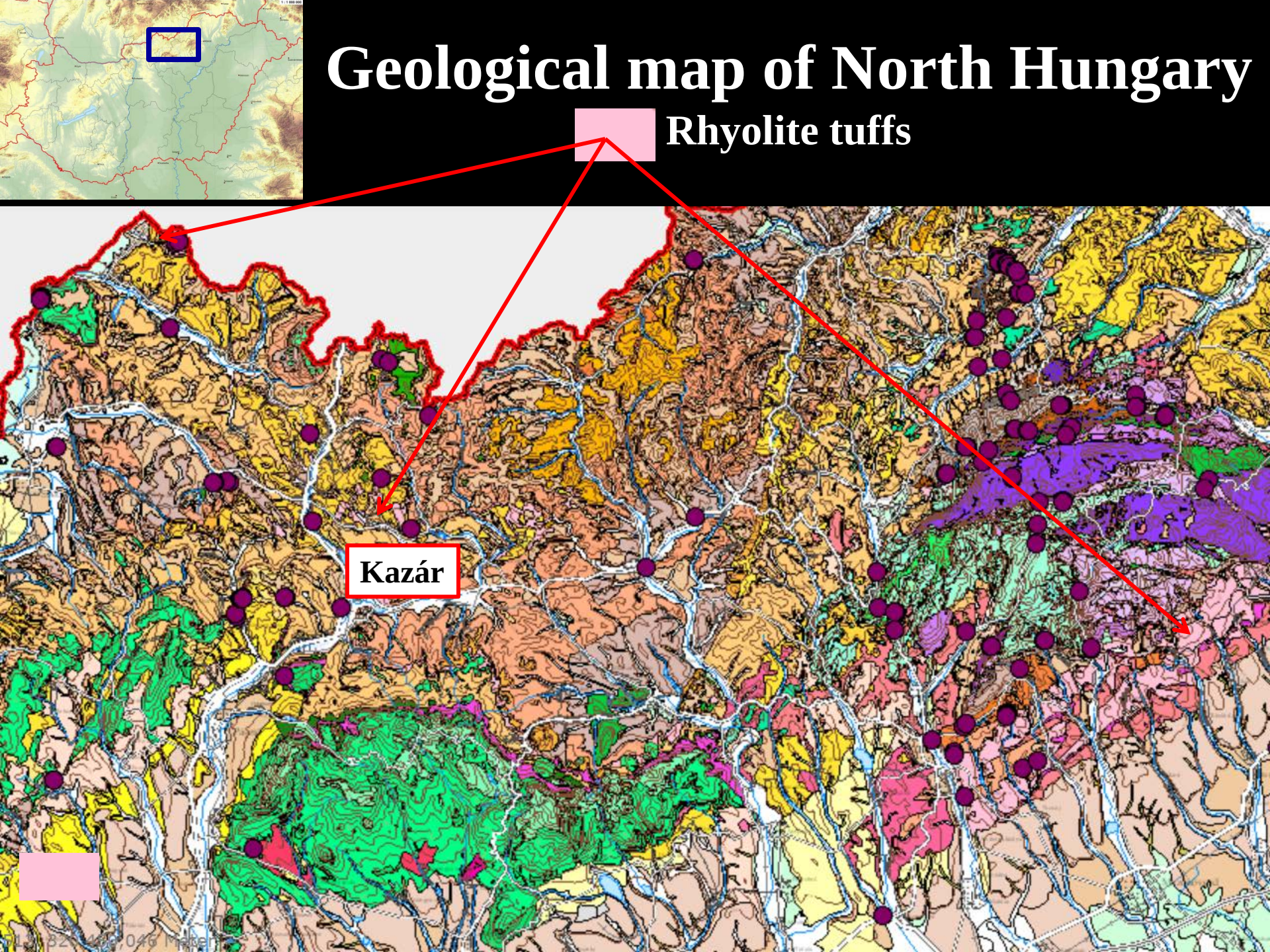
Human impact



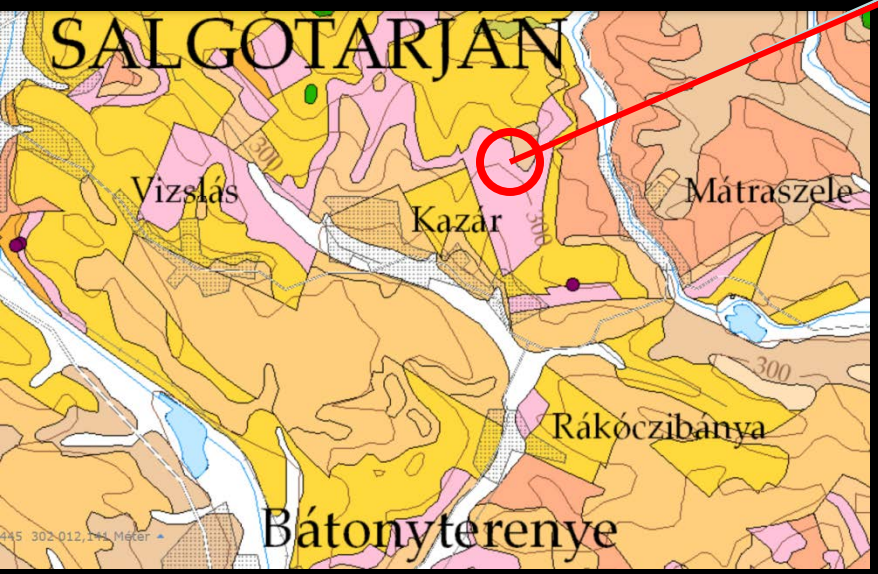
Result: irreversible land degradation

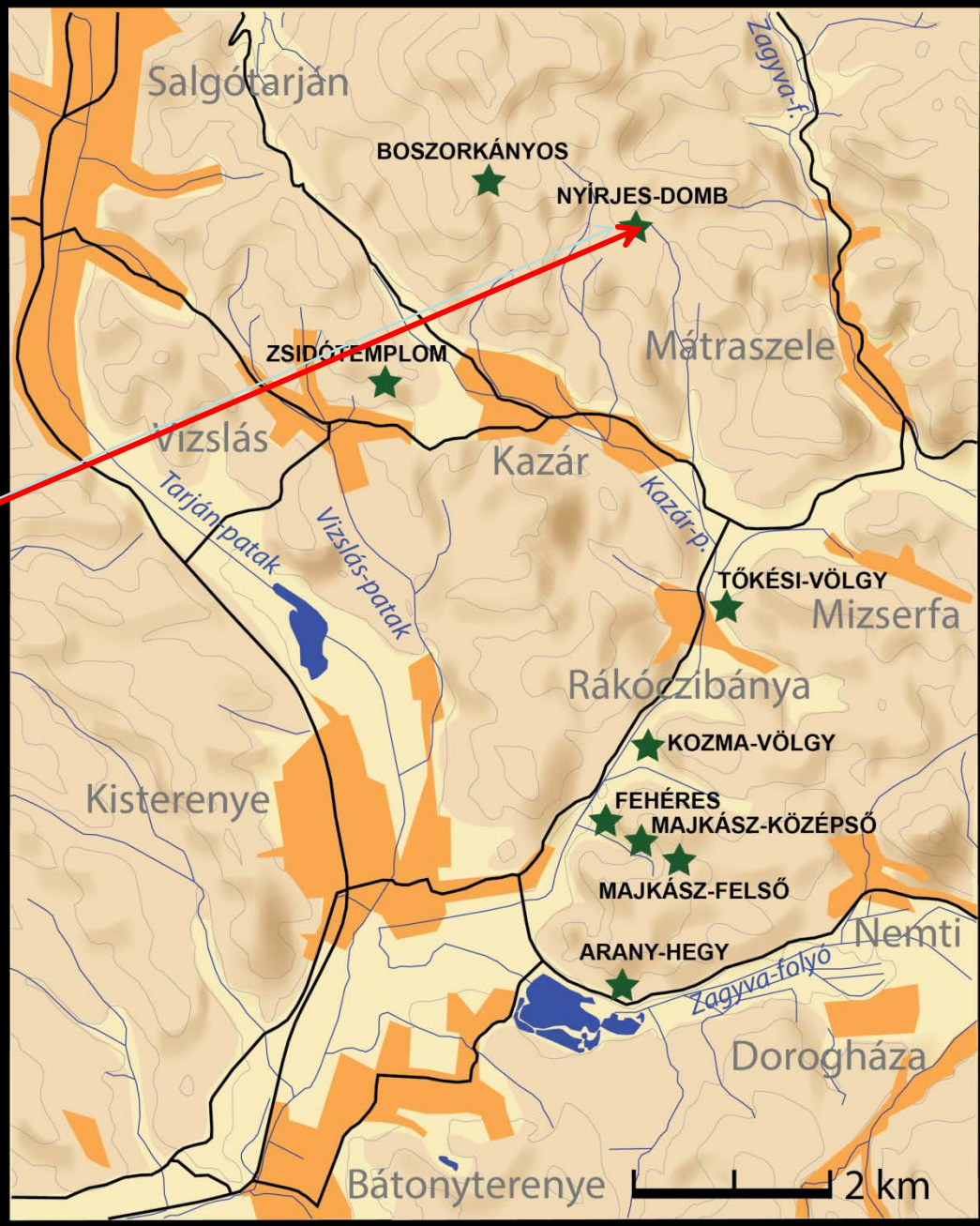
Human impact

Increasing degradation of landscape


Geological map of North Hungary
Rhyolite tuffs
Kazár

Kazár badland





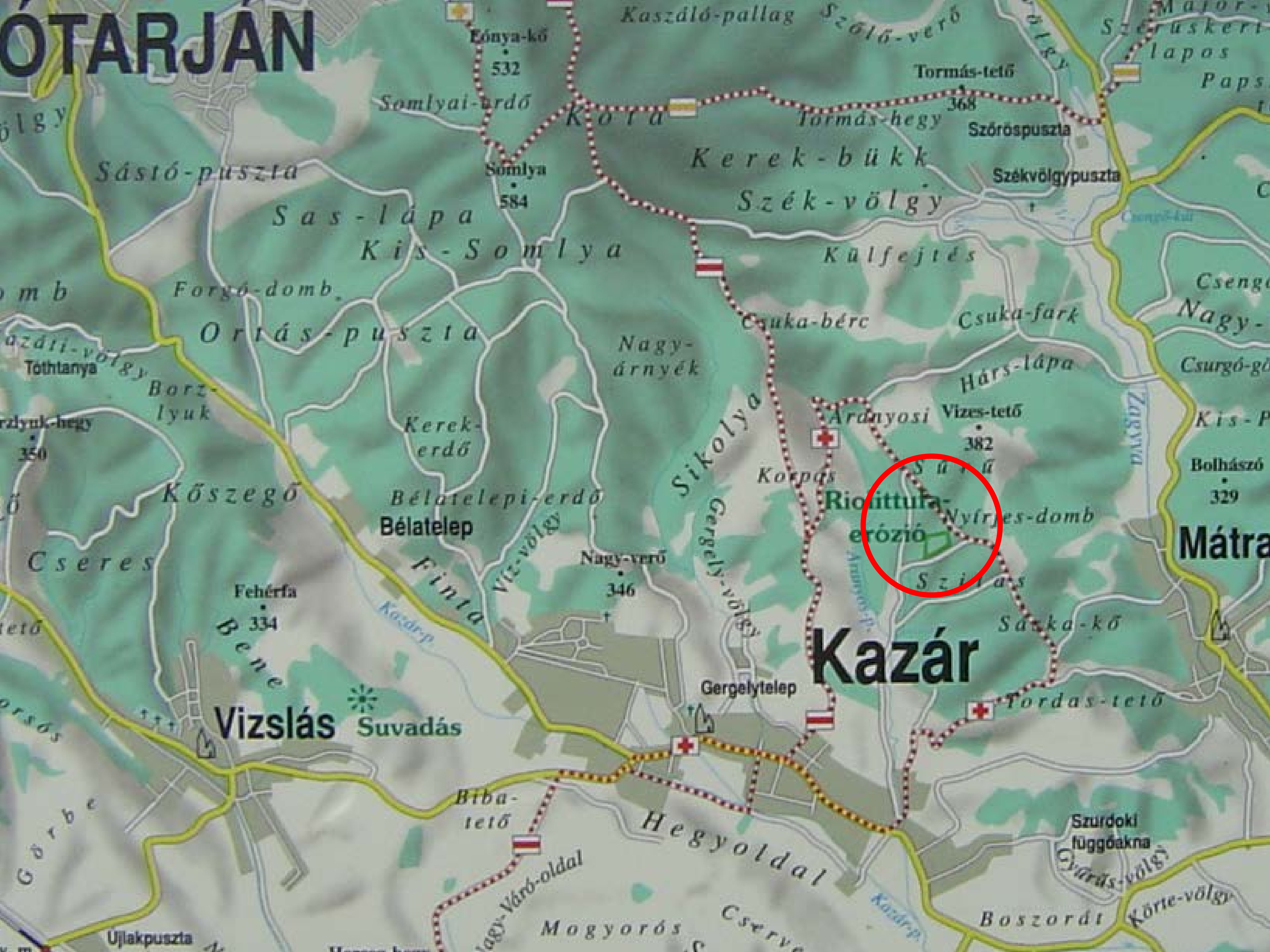
Rhyolite tuff

Kazár badland from the air

Area ~1 ha

Kazár badland

The biggest outcrop

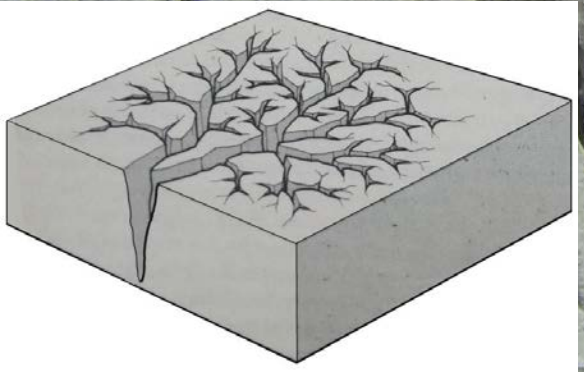


ÓTARJÁN
Kaszáló-pallag
Szőlő-verő
Eónya-kő
532
Somlyai-erdő
Kota
Tormás-tető
368
Tormás-hegy
Szőröspuszta
Kerek-bükk
Székvölgypuszta
Szék-völgy
Somlya
584
Sástó-puszta
Sas-lápa
Kis-Somlya
Külfejtés
Forgó-domb
Ortás-puszta
Csuka-bérc
Csuka-fark
Nagy-árnyék
Hárs-lápa
Tóthtanya
Borz-lyuk
Kerek-erdő
Sikolya
Árnyosi
Vizes-tető
382
Korpás
Riolittufa-erózió
Nyírjes-domb
Zagyva
Bolhászó
329
Kőszegő
Bélatelepi-erdő
Bélatelep
Gergely-völgy
Mátra
Cseres
Viz-völgy
Finta
Nagy-verő
346
Szilas
Fehérfa
334
Bene
Sátka-kő
Kazár
Gergelytelep
Tordas-tető
Vizslás
Suvadás
Biba-tető
Hegyoldal
Szurdoki függőakna
Nagy-Várő-oldal
Mogyorós
Boszordi
Körte-völgy
Újlakpuszta

Kazár badland

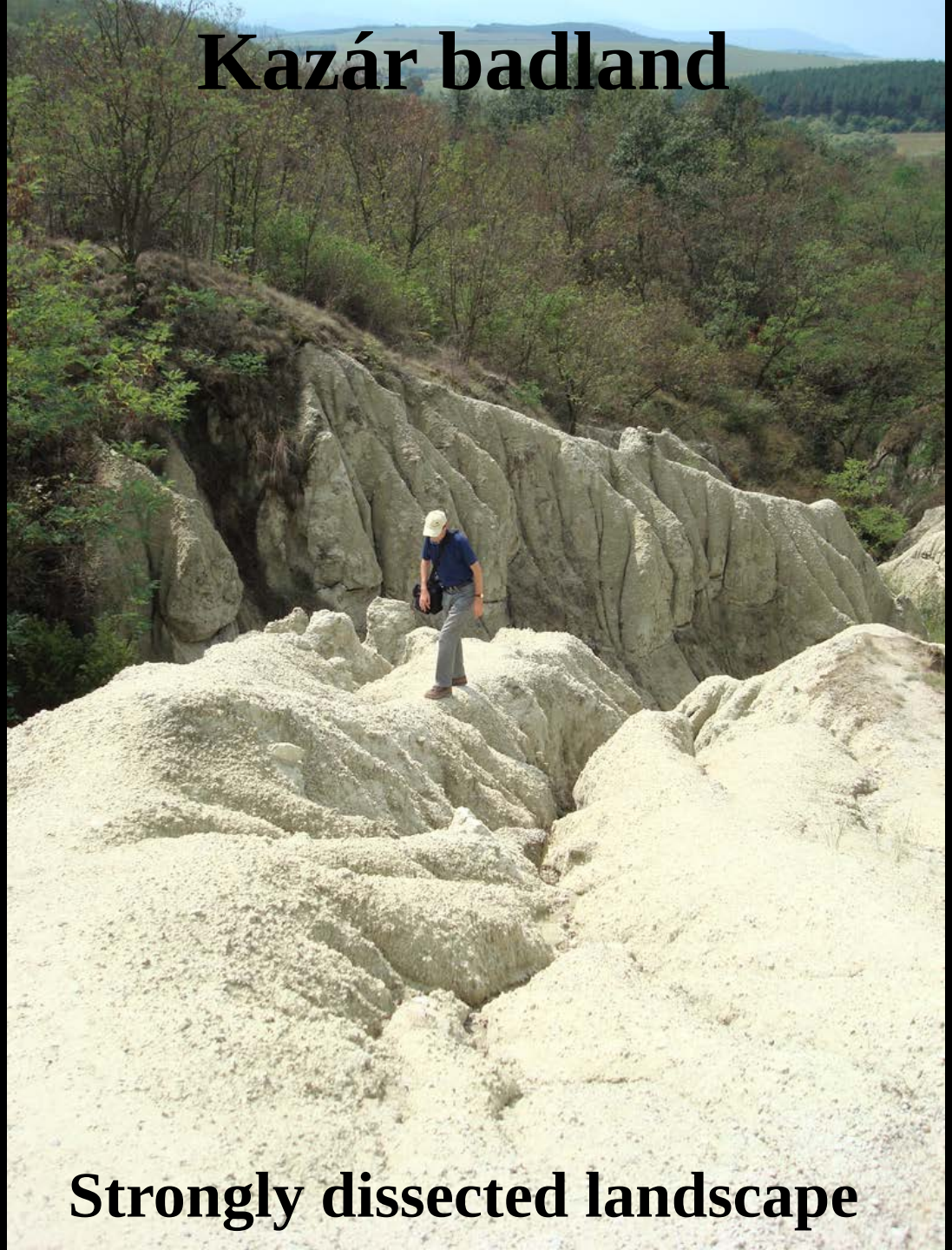
Altitude 270-300 m

Kazár badland



Gully erosion

Kazár badland

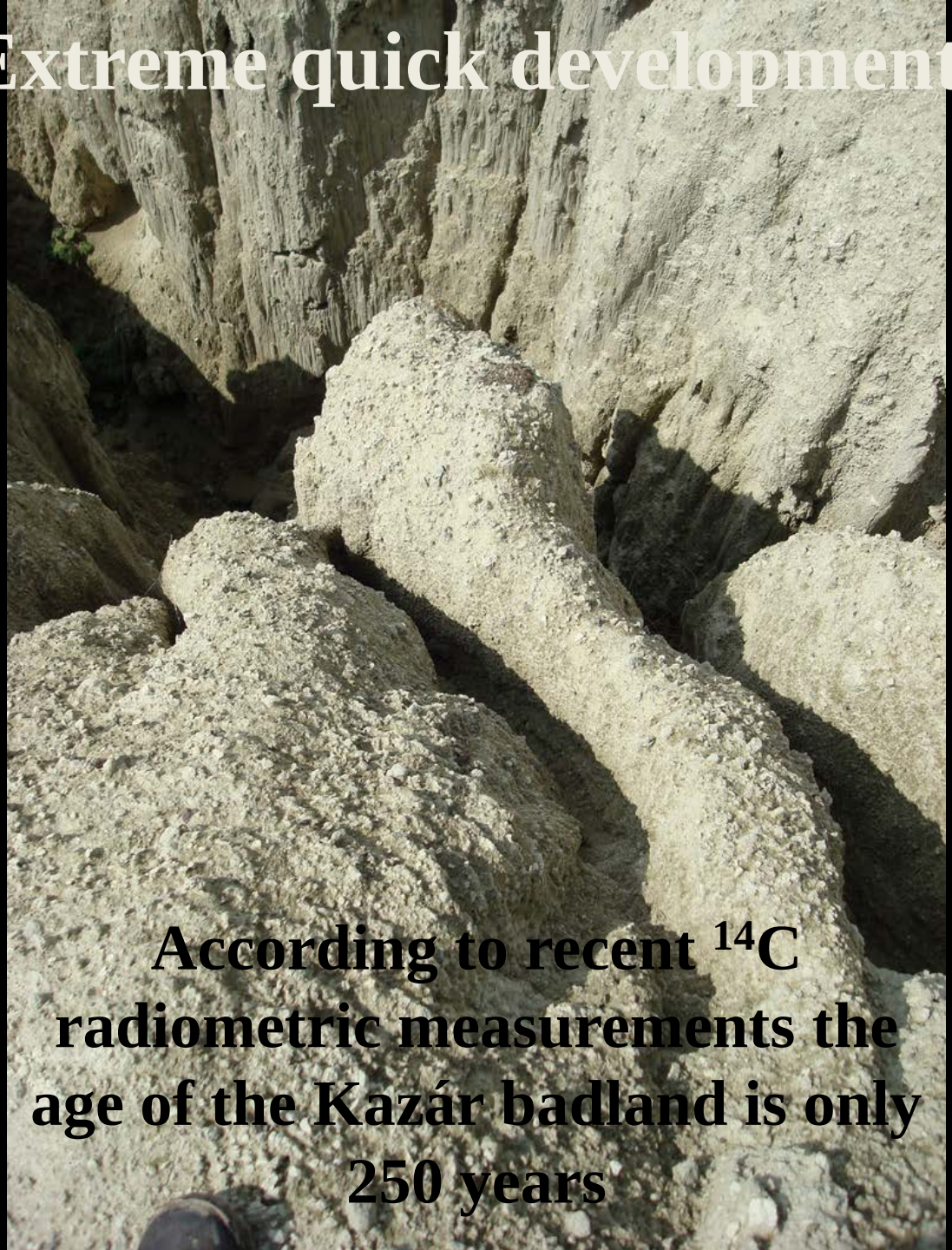


Strongly dissected landscape

Kazár badland

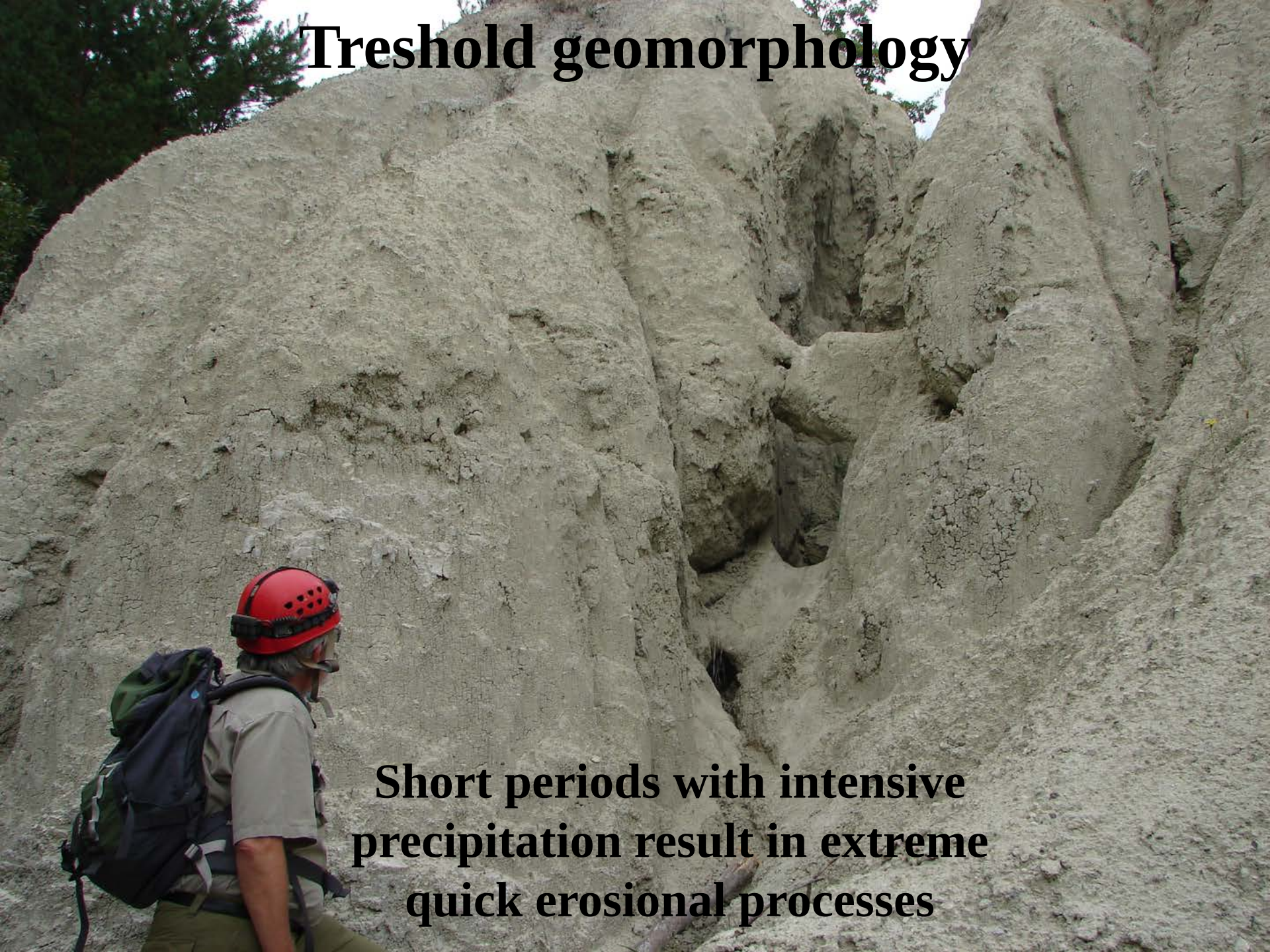
Attractive erosional ravines

Extreme quick development



According to recent ^{14}C radiometric measurements the age of the Kazár badland is only 250 years

Treshold geomorphology



Short periods with intensive precipitation result in extreme quick erosional processes

Role of tectonics

Fine fissures determine mass movements

Kazár badland

Deepest valley bottom

Complex surface development

Formed by erosion, suffosion, mass-movements

Kazár badland

Suffosion cavities

Kazár badland

Remnant of former suffosion cavities

Kazár badland

Natural cave made by suffosion

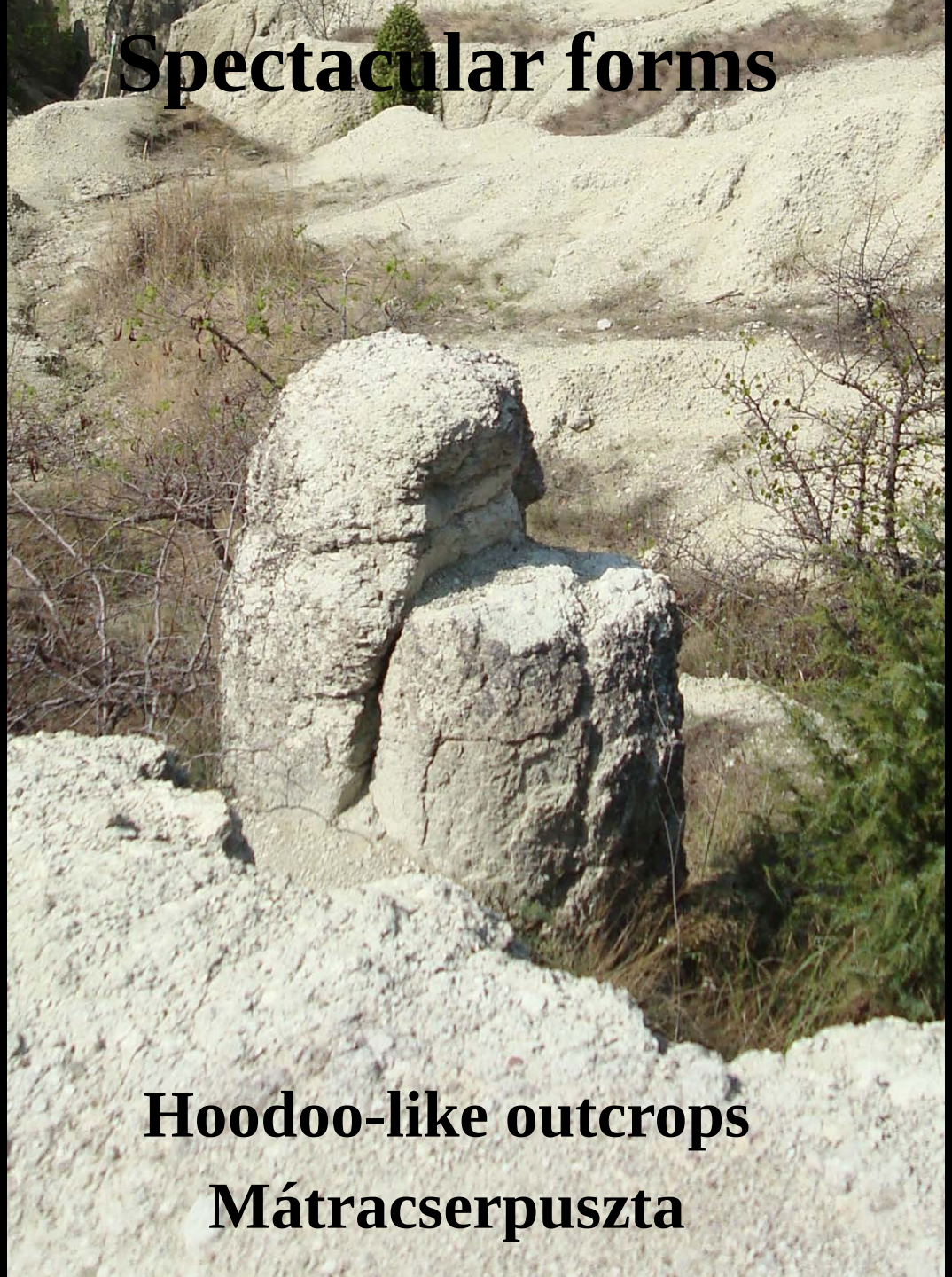
Gyulakeszi Rhyolite Tuff Formation

Eroded surface with spectacular microforms Rákóczibánya

Spectacular microforms

Candle-like microforms
Vizslás

Spectacular forms



Hoodoo-like outcrops

Mátracserpuszta

Secondary forms

Dried precipitation of soap-like wet weathered tuff

Conclusion

- Rhyolite-tuff surfaces are vulnerable, strongly damageable
- Human impacts (deforestation, stock-raising, alteration of runoff etc.) result in triggering barren landscape
- Landscape development consists of quick, intensive and slow, unobservable periods
- However, eroded surfaces can constitute spectacular landforms
- Microforms are especially notable on rhyolite tuff surfaces

Geological map of North Hungary

Rhyolite tuffs

Ipolytarnóc

Ipolytarnóc, „prehistoric Pompeii”

won “European Diploma”

Sandstone surface covered by rhyolite tuff

Fossil footprints at Ipolytarnóc

- volcanic ash buried a subtropical jungle

- under the rhyolite tuff 3,000 animal footprints of 11 species preserved on sandstone surface

- one of the world's richest fossil footprint site

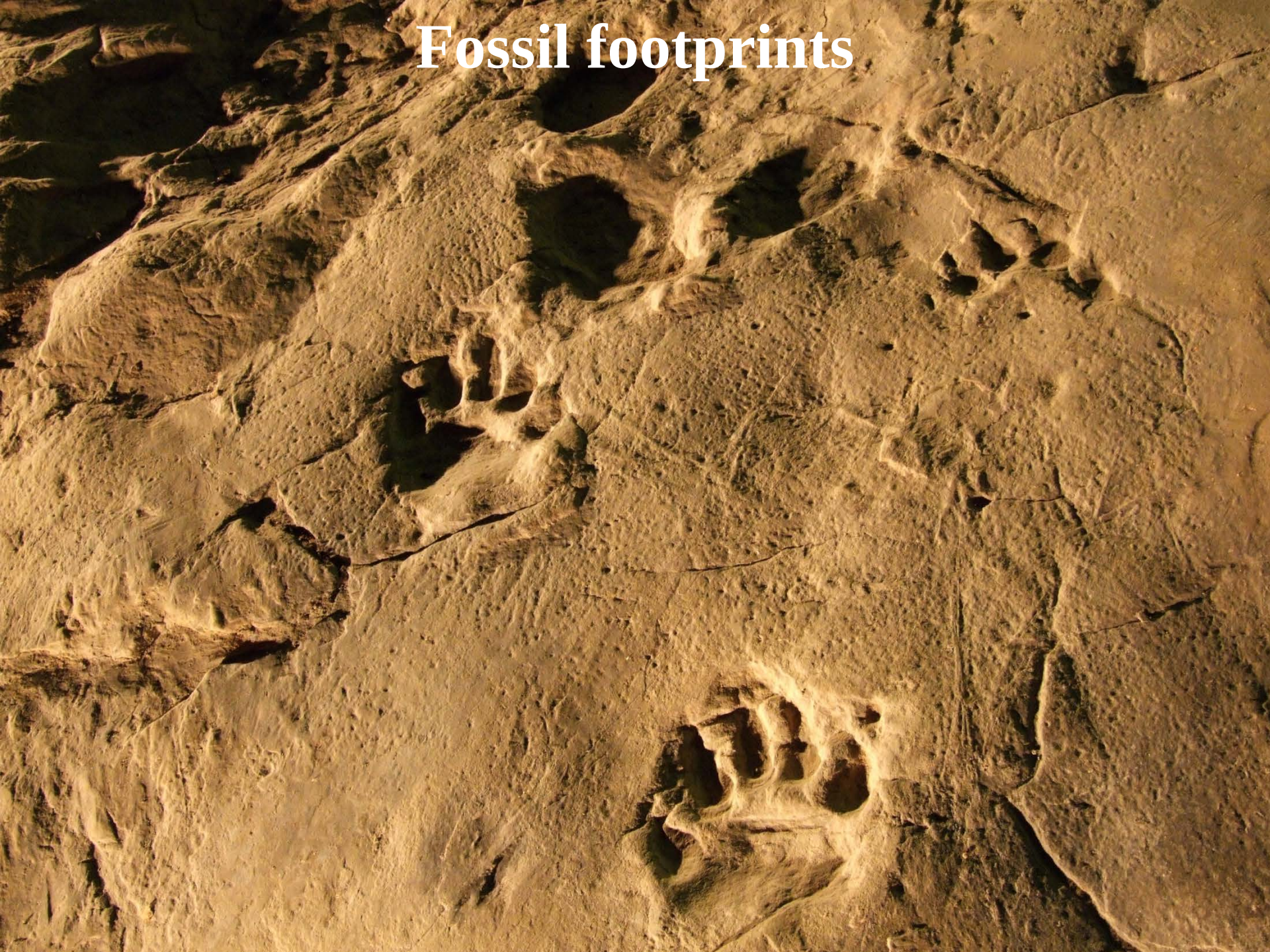
Fossil footprints

- Completely undamaged petrified footprints of extinct animals: rhinos, birds, carnivores and deer-like animals
- Dating back to the Lower Miocene period

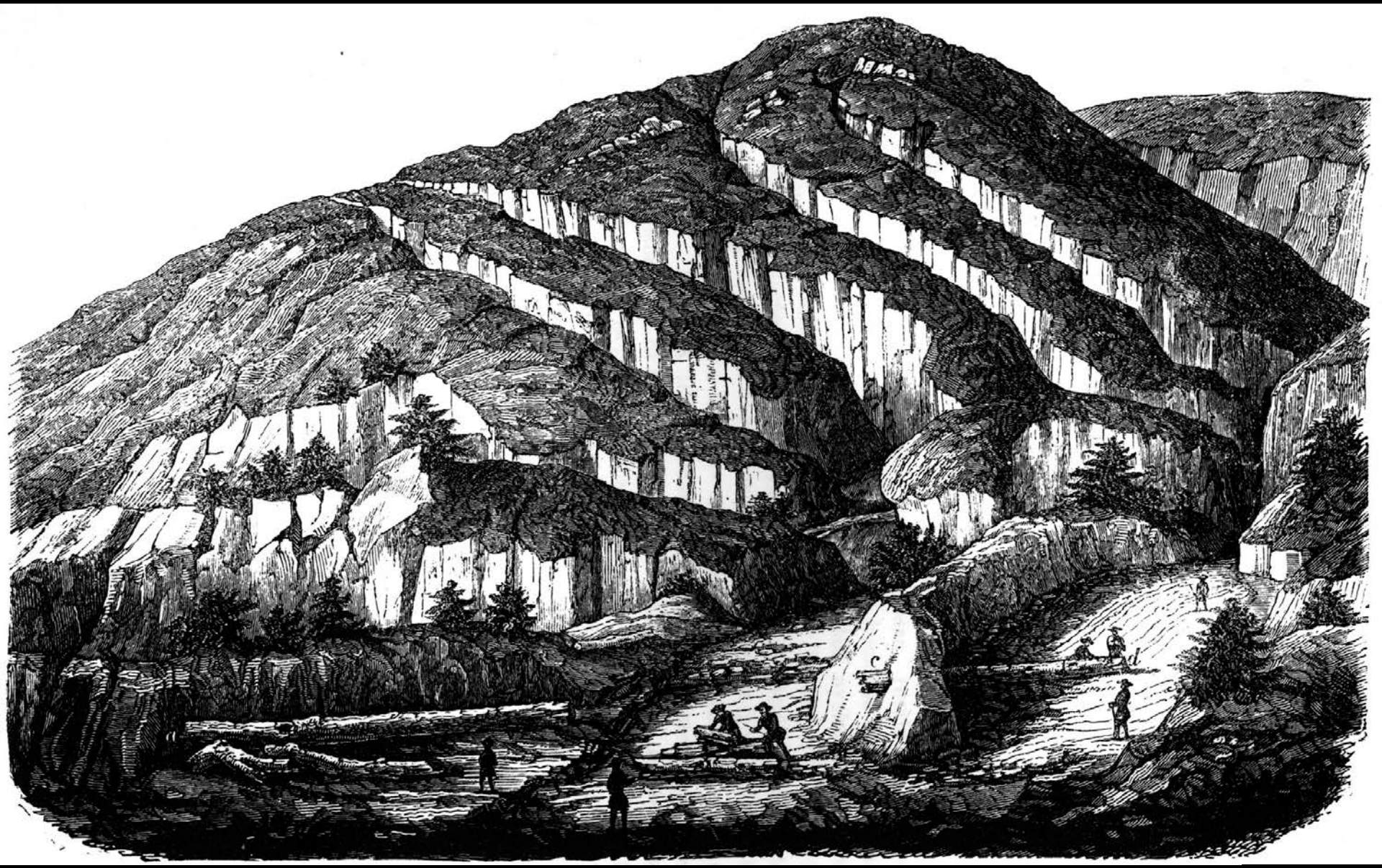
Have remained on the surface due to the big debris of a pyroclastic flow that has buried the once existed habitat

Petrified trunk

Fossil footprints



Kubinyi, F.-Vahot, I. 1864



Petrified trunk

Miocene leaf fossil


Thank you for your attention!