



Katedra mineralógie, petrológie a ložiskovej geológie

Prírodovedecká fakulta Univerzity Komenského

Katedrálny seminár 2021

Integrated research of Slovak Neogene basins – new absolute (radioisotopic) data



Projects

- Completed projects
 - Geodynamics of the Alpine-Carpathian junction area constrained by dating of the Cenozoic evolutionary phases in the Vienna and Danube basins, APVV-16-0121,
 - Palaeoclimate record and Miocene climate variability in Central and Eastern Paratethys, APVV-15-0575,
- Current project
 - Calibration of the authigenic $^{10}\text{Be}/^{9}\text{Be}$ dating method for geochronological models of the latest Cenozoic of the Carpathian-Pannonian region., APVV-20-0120,
 - Rifting and subsidence history of back-arc basins across the Western Carpathians ,VEGA-1/0526/21



Methods used in integrated studies

- **Petrography/petrology (sample description and composition, selection samples from radioisotopic dating, diagenetic alterations, provenance)**
- **Geochemistry**
 - **Anorganic (redox condition of bottom water, paleosalinity proxy, character of volcanism)**
 - Organic including biomarkers (redox condition, paleosalinity and climatic proxy)
- Sedimentology including interpretations seismic-reflection sections
 - depositional settings
- Paleontology
 - biostratigraphy
 - ecology
- Radioisotopic dating methods

Results – new radioisotopic data from volcanic, pyroclastic and volcanoclastics

► Paleontological localities:

- Kuchyňa tuff: rhyolitic fall deposits in terrestrial environment
- Mučín and Lipovany: ignimbrites and tuff in terrestrial environment

► Marine basin fill:

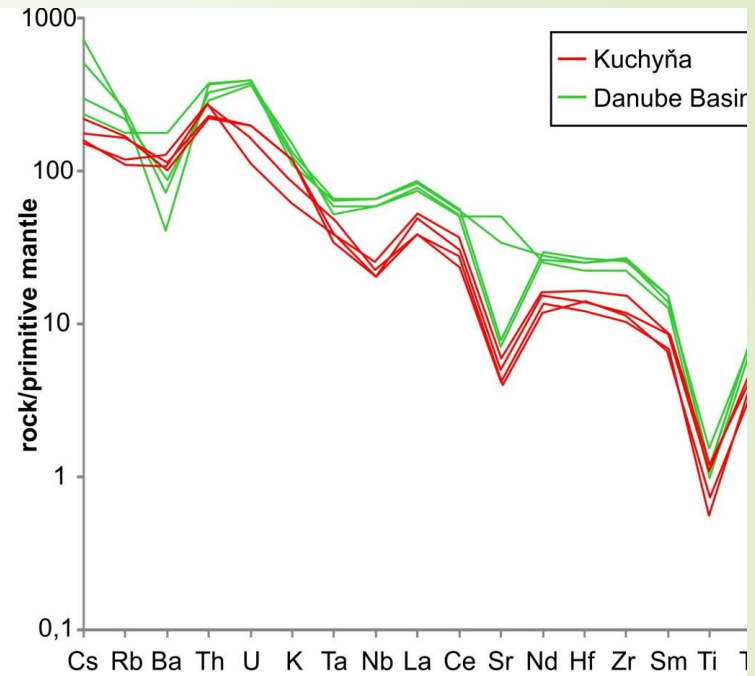
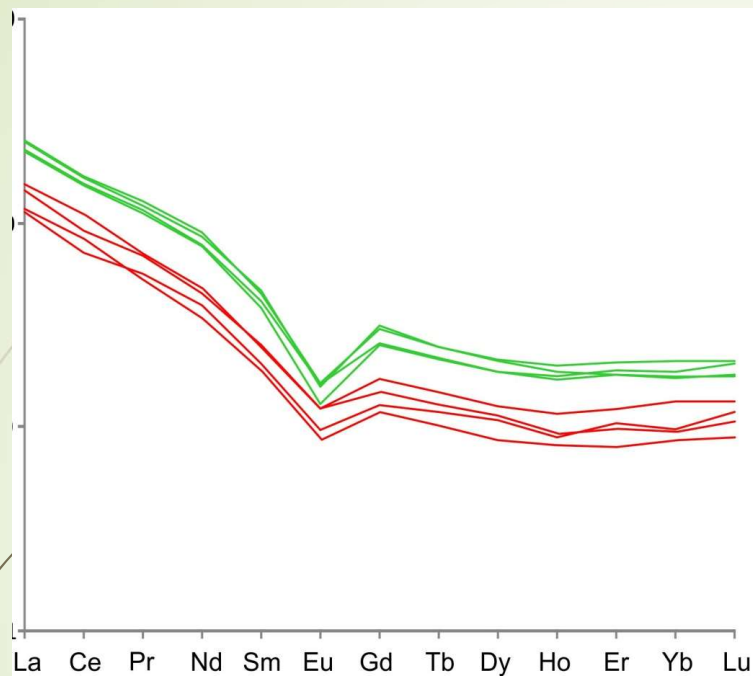
- Trakovice-4: crystallovitroclastic tuff
- Madunice-3: strictly volcanic sandstone
- Kráľová-1: lapilly tuff in (buried Kráľova volcannic centre)
- Nová Vieska-1: vitrocristalloclastic tuff
- Modrany-2: crystallovitroclastic tuff
- Kamenica nad Hronom: crystalloclastic tuff in coastal environment



Paleontological localities



- **Kuchyňa tuff**
- Fall deposits containig fossil leafs association
- $^{40}\text{Ar}/^{39}\text{Ar}$ sanidine age 15.23 ± 0.04 Ma (Rybár et al. 2019)
- **Significance of research**
- Evergreen forest and subtropical humid climatic condition in 15.23 Ma
- the paleo-wind direction at the time of the Kuchyňa tuff deposition was from S-SE towards the N-NW (in recent position)
- Pre-dated marine Badenian flooding in Vienna Basin
- Different chemical composition compared to analysed Danube basin tuff
- the need of lithostratigraphy correction

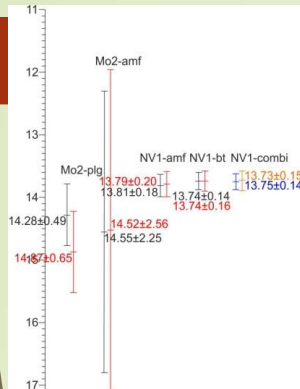


Mineral composition of crystallovitroclastic tuff:

Vienna Basin – Kuchyňa Tuff: sanidine, plagioclase (andesine), annite, pargasite, quartz, glass shards, pumice, accidental clasts

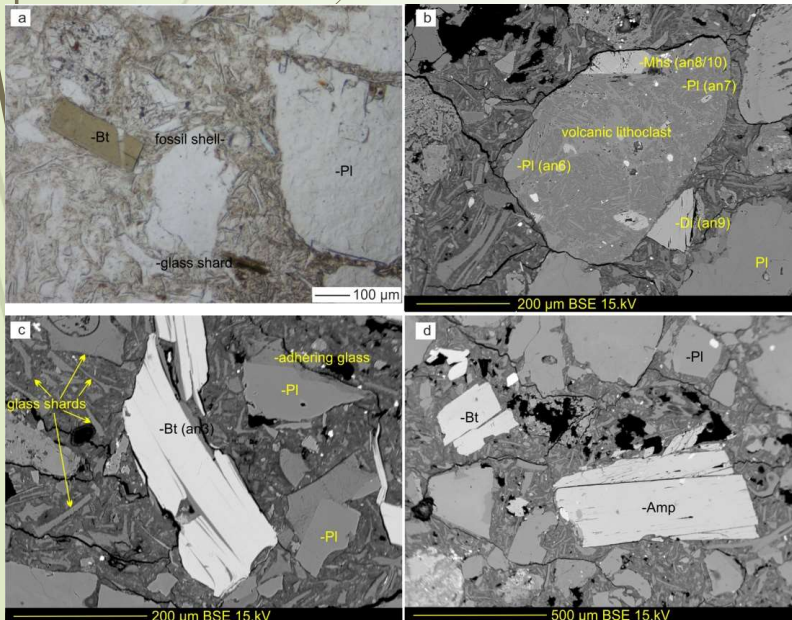
Danube Basin – Trakovice, Madunice wells: plagioclase (labradorite-bytownite), hastingsite, annite, glass shards, pumice, accidental clasts

Danube basin - marine fill

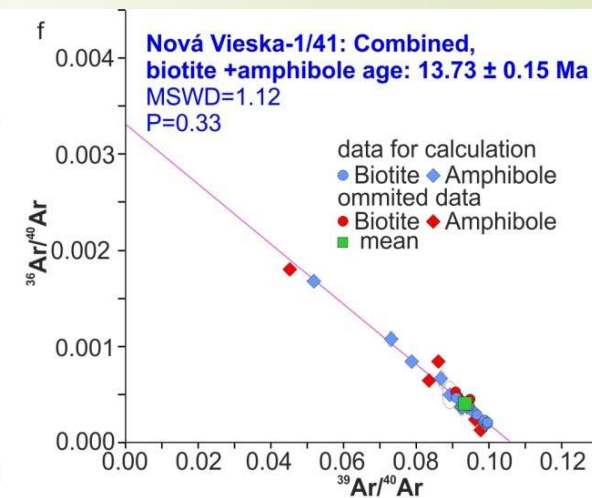
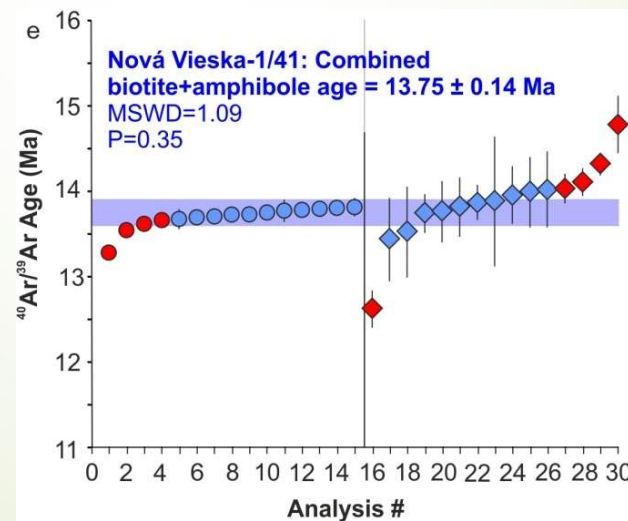


in processing

- Fine, crystallovitroclastic tuff
- Four analyzed layers (Trakovice-4, Cífer-2, Špačince-4, Modrany-2 wells)
- Zeolitization, decay of mafic minerals and small crystall size does not allow accurate dating



- Coarse vitrocristalloclastic tuff (Nová Vieska-1 well)
- The lowermost sample for dating (1655-1652 m)

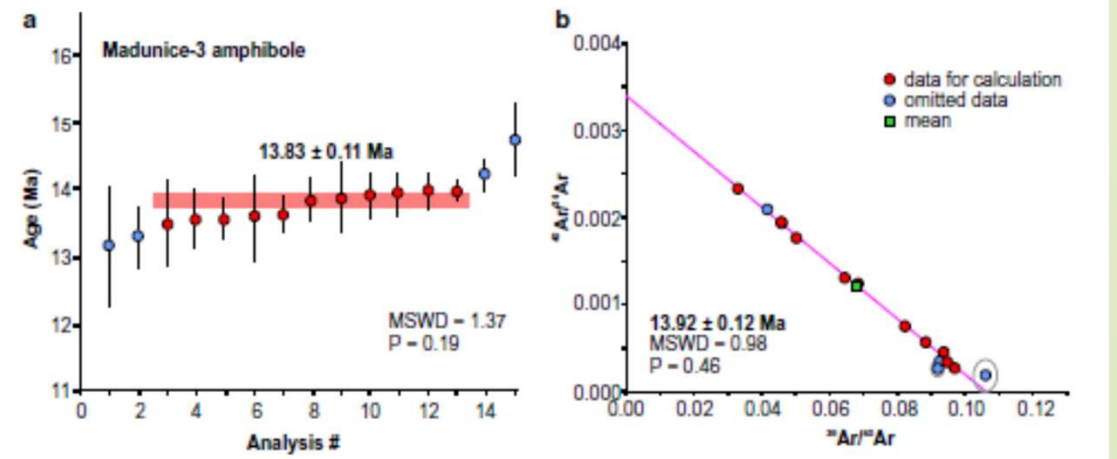
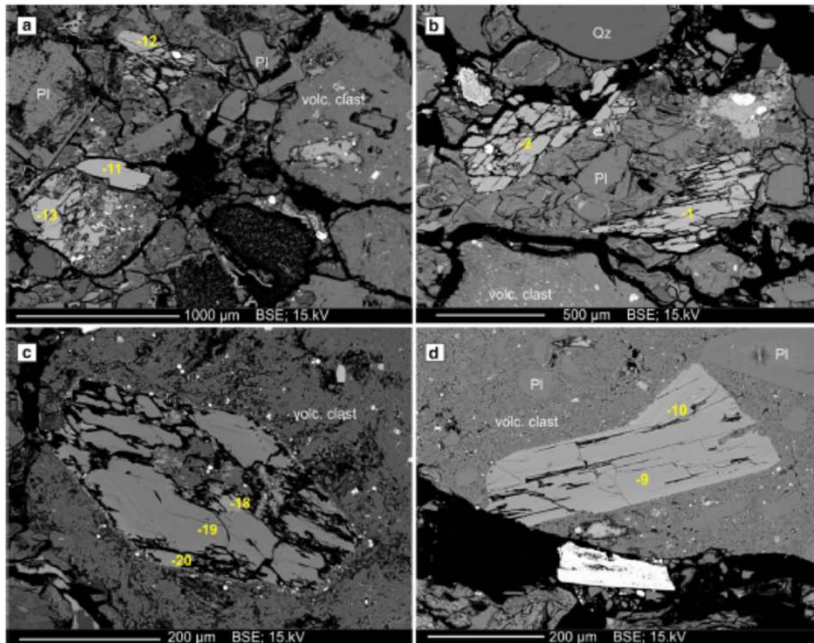


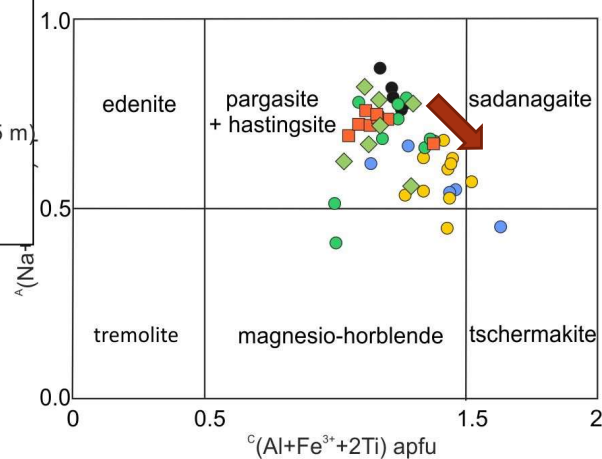
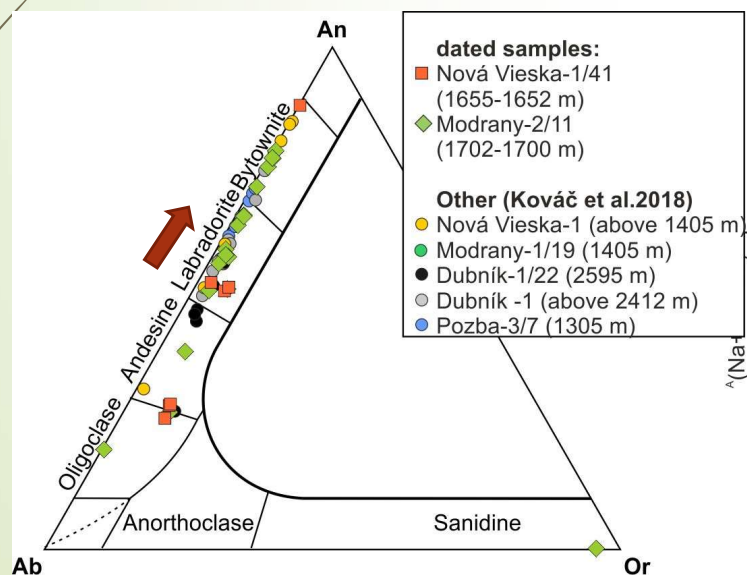
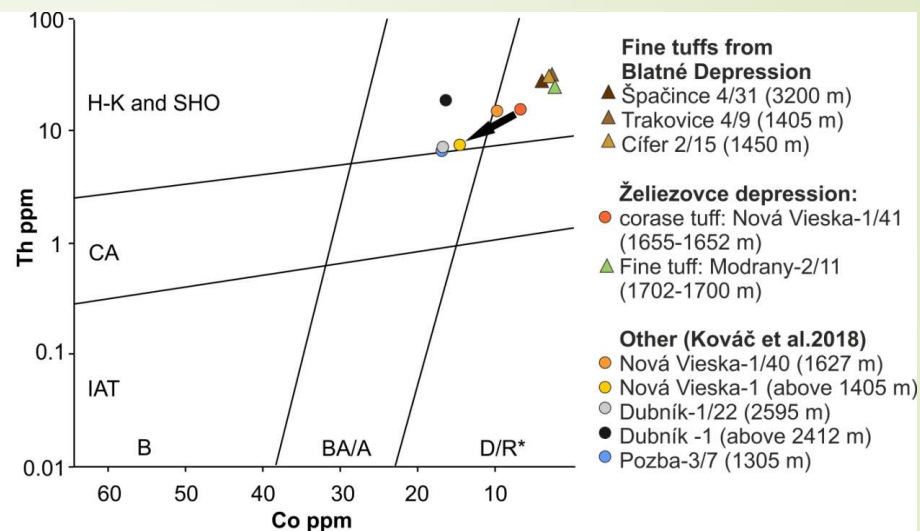
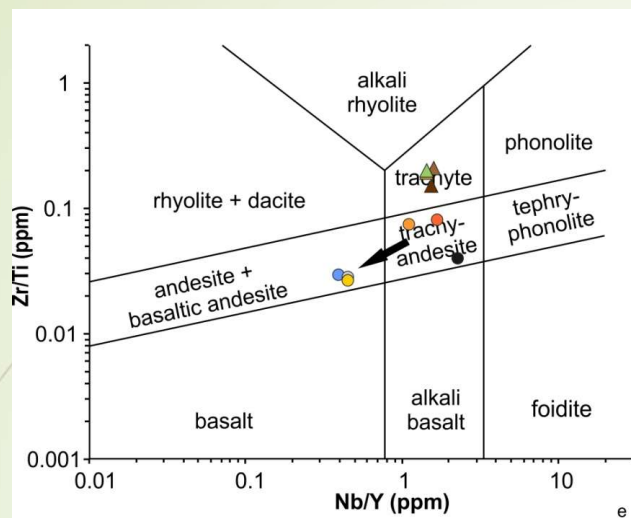
Danube basin - marine fill

- **Lapilly tuff** (Králová-1 well = buried volcanic center) – in processing
- plagioclases, biotite, pseudomorphs after mafic minerals, secondary minerals
- $^{40}\text{Ar}/^{39}\text{Ar}$ biotite age 14.09 ± 0.15 Ma

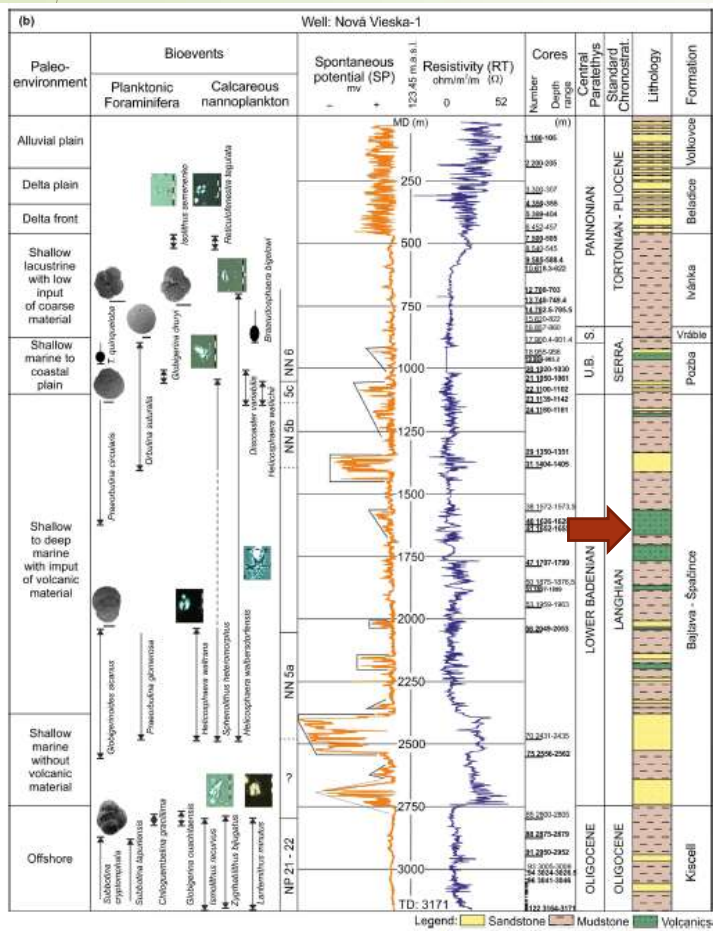


- **Volcanic sandstone** (Madunice-3 well)
- $^{40}\text{Ar}/^{39}\text{Ar}$ amphibole age (Šarinová et al., 2021)



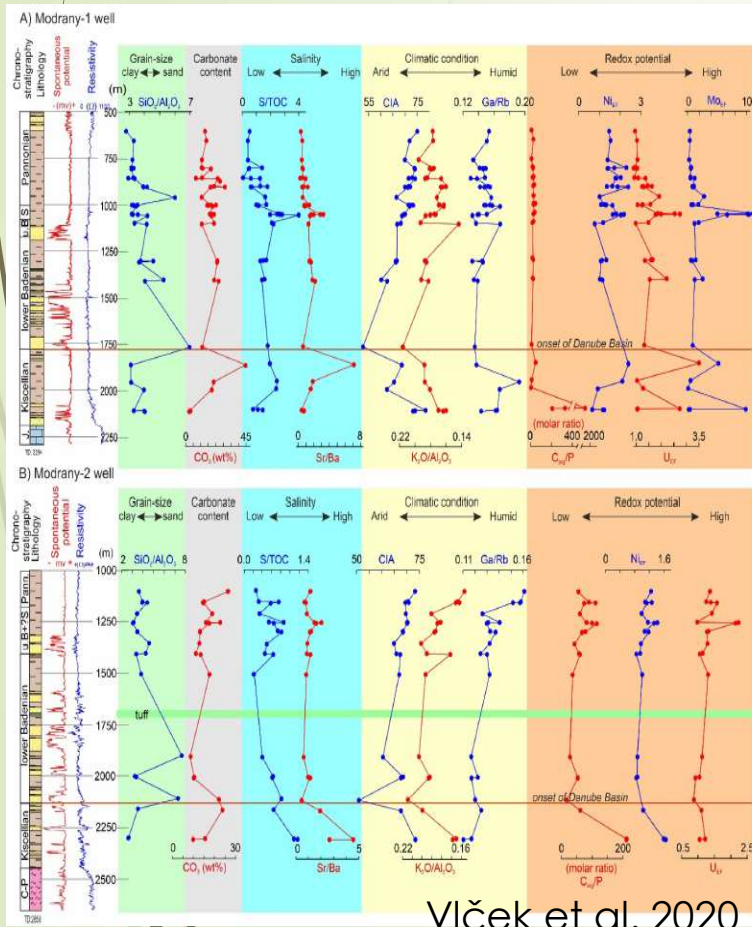


Danube Basin



- **Significance of research**
- The need of lithostratigraphic chart correction
- Major subsidence phase is late Badenian in age
- Calc-alkaline volcanism range is:
 - ca.14.3-13.8 Ma in west
 - ca.14.3-and younger (Štiavnica strovolcano) in east
- Trends in Želiezovce depression copies Štiavnica stratovolcano
- Amphibole (horblende) age 12.56 ± 0.10 Ma in Kamenica nad Hronom dated transition from coastal to terrestrial condition (Sant et al. 2020)
- The $^{40}\text{Ar}/^{39}\text{Ar}$ age of 13.83 ± 0.11 Ma (Madunice-3) supports the employment of *Globoturborotalita druryi* as an index fossil for the onset of the late Badenian

Others results and interest



■ Anorganic geochemistry


- Ecological proxy (redox condition, salinity proxy, carbonate content) – support of results from paleontological research
- Finding control factors influencing the $^{10}\text{Be}/^9\text{Be}$ dating method

■ Petrology of sediments

- Finding control factors influencing the $^{10}\text{Be}/^9\text{Be}$ dating method
- Provenance study

■ Significance of research

- Determination of correlation horizons
- Adjustment of paleoecological and paleogeographical models
- usability of $^{10}\text{Be}/^9\text{Be}$ dating



Thank you for your attention
Ďakujem za pozornosť