

Zeolite deposits in Slovakia

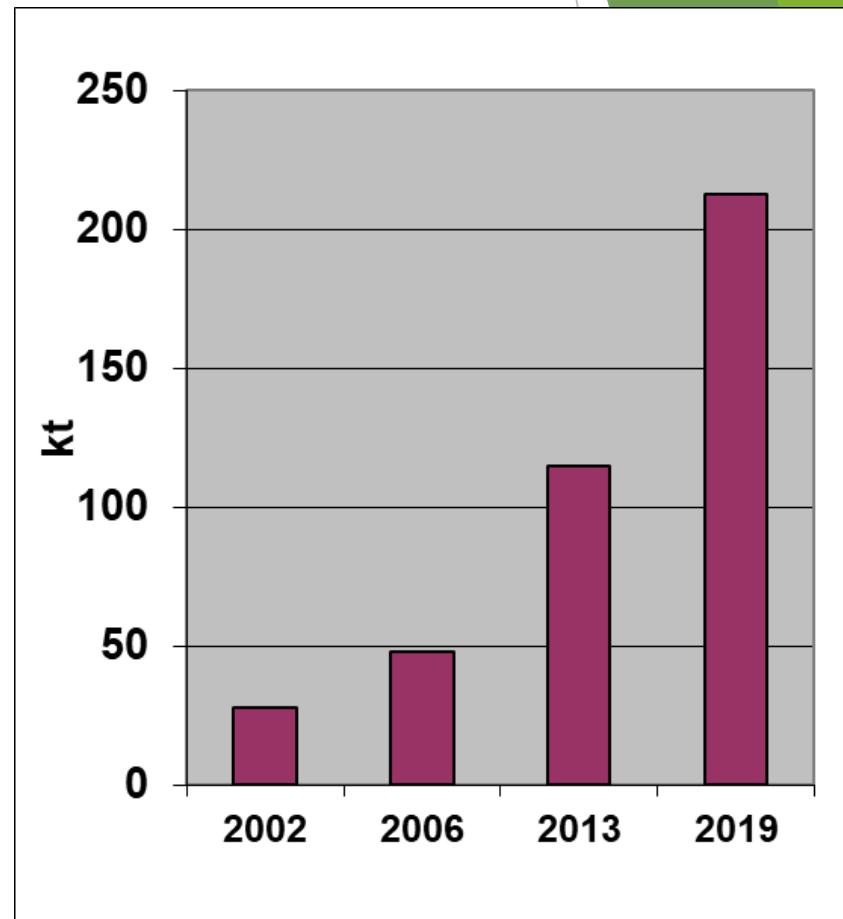
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Natural zeolite production in Slovakia

- ▶ 50s to 60s - rhyodacite volcanoclastic rocks (Hrabovec tuff)
- ▶ 70s - zeolitic (clinoptilolite) tuff (Šamajová and Kraus)
- ▶ 80s - intensive research of the zeolite use
- ▶ turn of the 20th and 21st century - transformation of Zeocem company and their orientation to zeolite processing

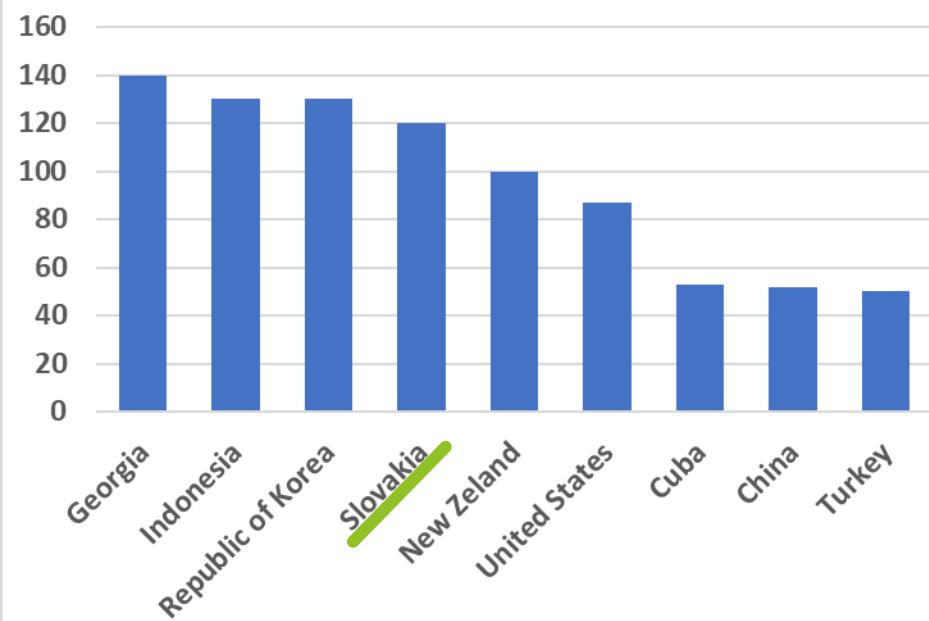


Slovakia - world producer of zeolite

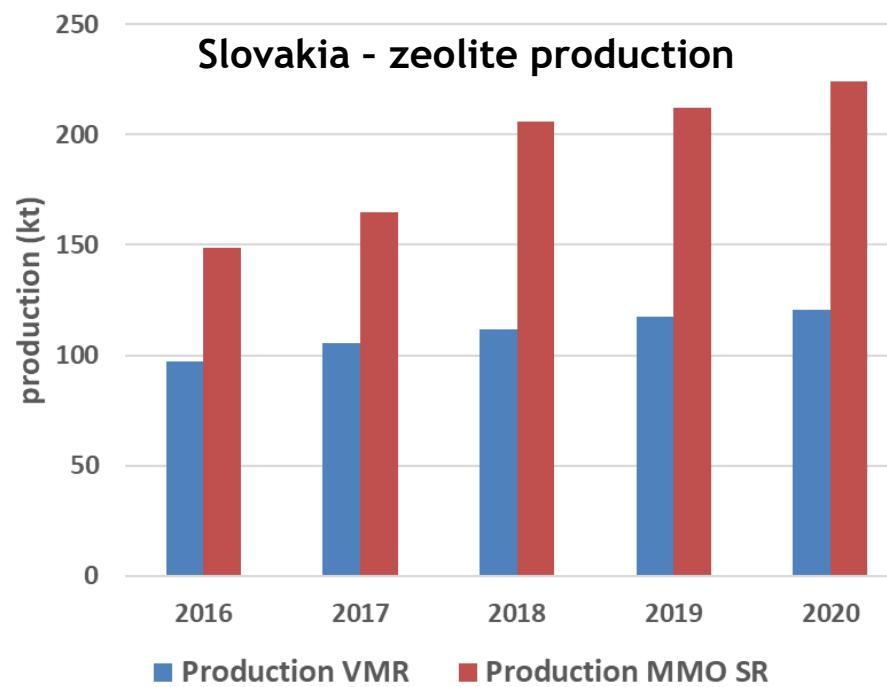
Slovak zeolite production: 2-4th in the world (~ 12 %)
1st in Europe, (~ 50 %)

Reserves in Slovakia: ~ 74 Mt

World zeolite production (944 kt) - USGS, 2021



Slovakia - zeolite production

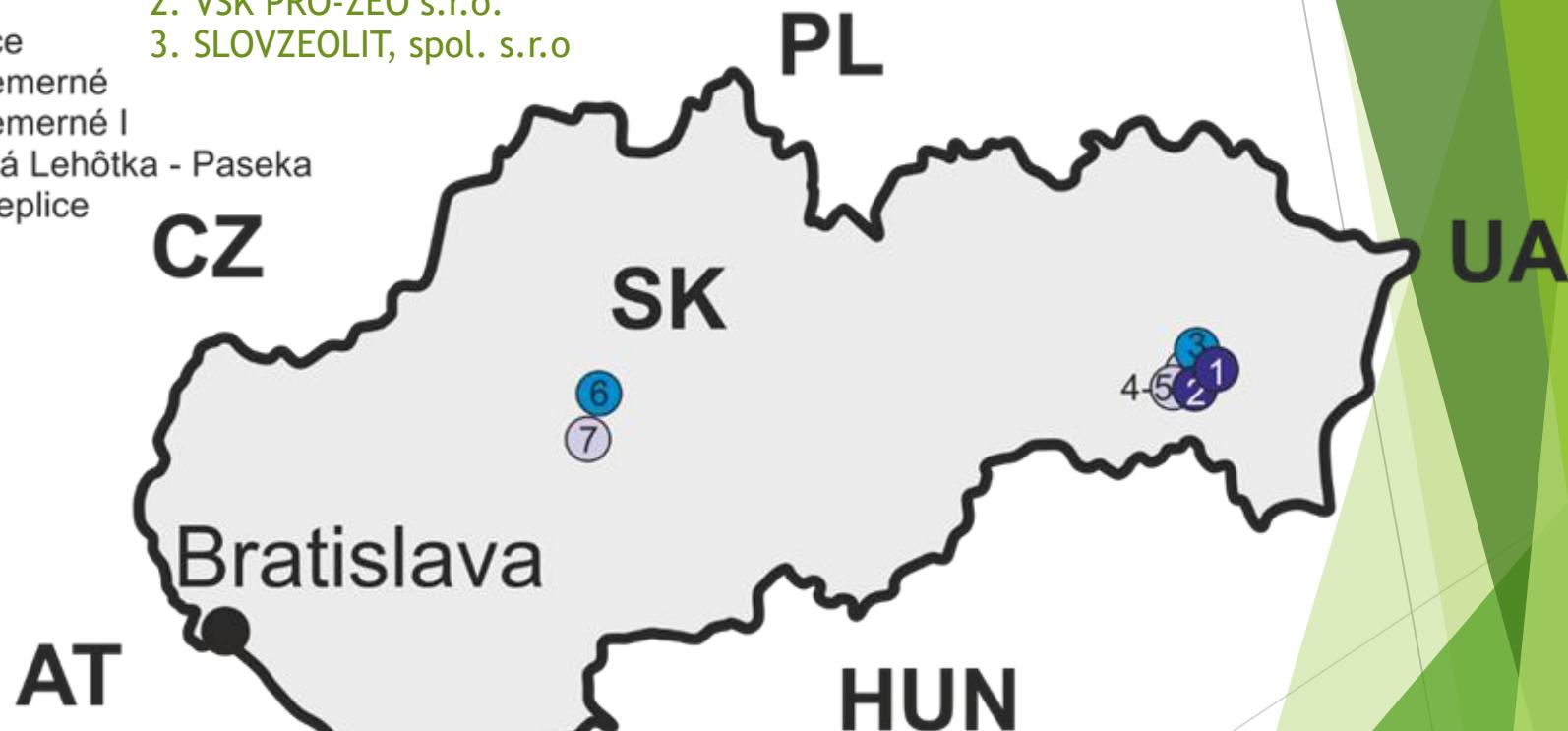


Source: Main Mining Office SR (MMO SR, Hlavný banský úrad SR) and Value Market Research (VMR, 2021).

Zeolite deposits in Slovakia

- 1 Nižný Hrabovec
- 2 Kučín
- 3 Majerovce
- 4 Pusté Čemerné
- 5 Pusté Čemerné I
- 6 Bartošová Lehôtka - Paseka
- 7 Sklené Teplice

6- Sedlecký kaolin - Slovensko s.r.o.

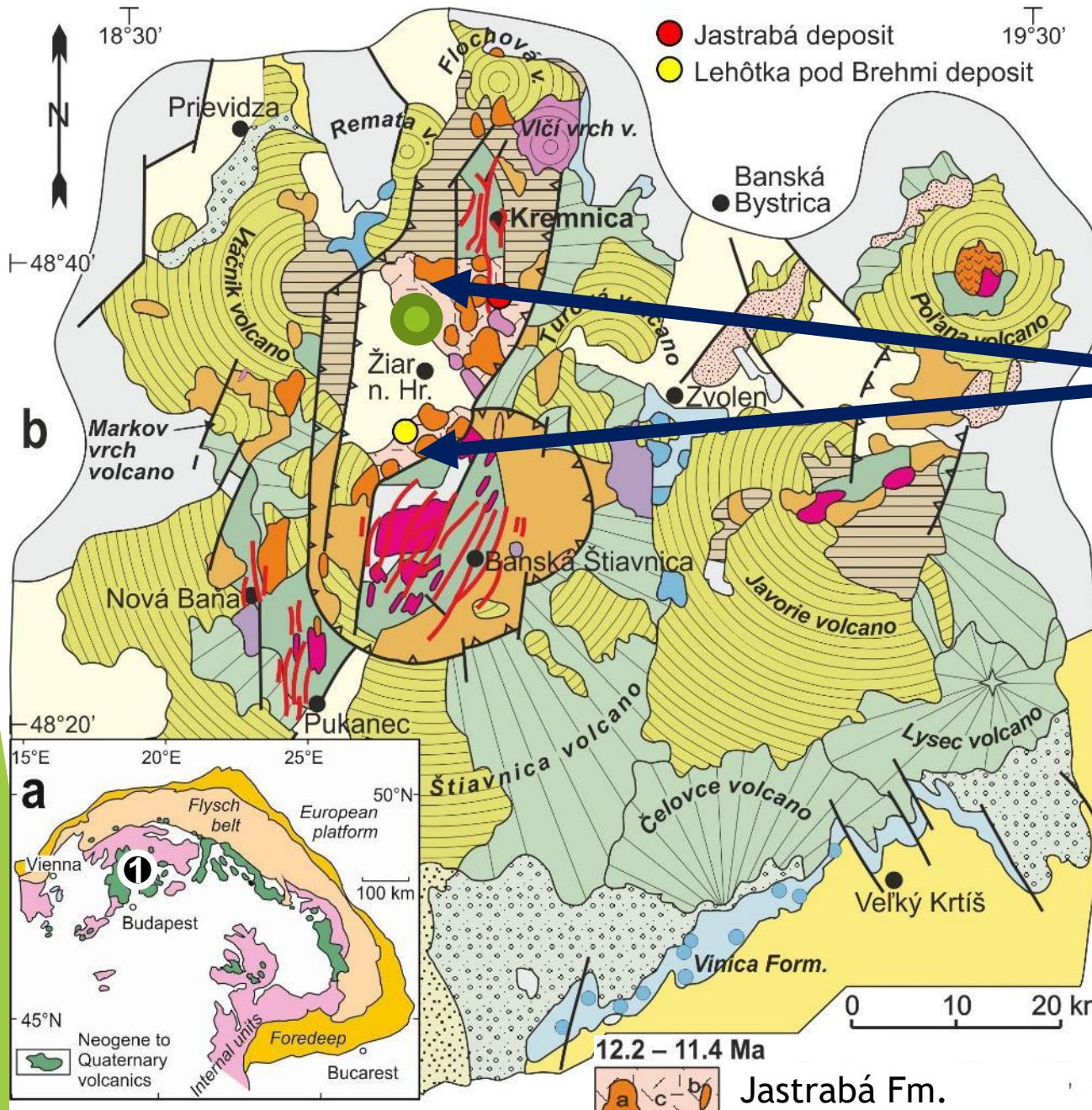


● mining and procesing zeolite

● mining zeolite

● inactive

Central Slovakia Volcanic Field



Bartošová Lehôtka
- Paseka

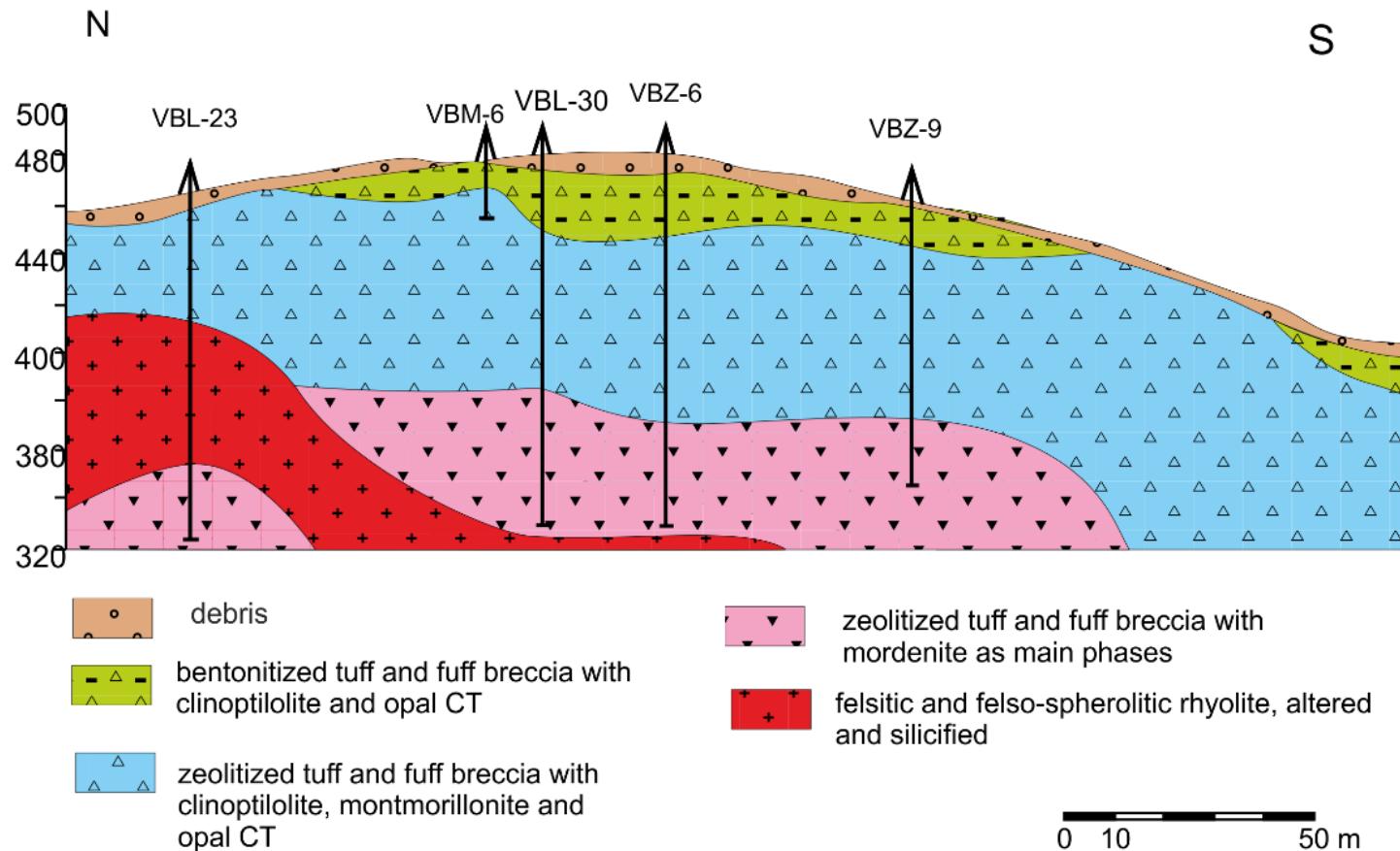
Jastrabá Fm.
- is represented
by
rhyolitic dykes,
extrusive domes,
cryptodomes,
lava flows and
related
volcanoclastic
rocks.

Bartošová Lehôtka - Paseka



Bartošova Lehôtka - Paseka

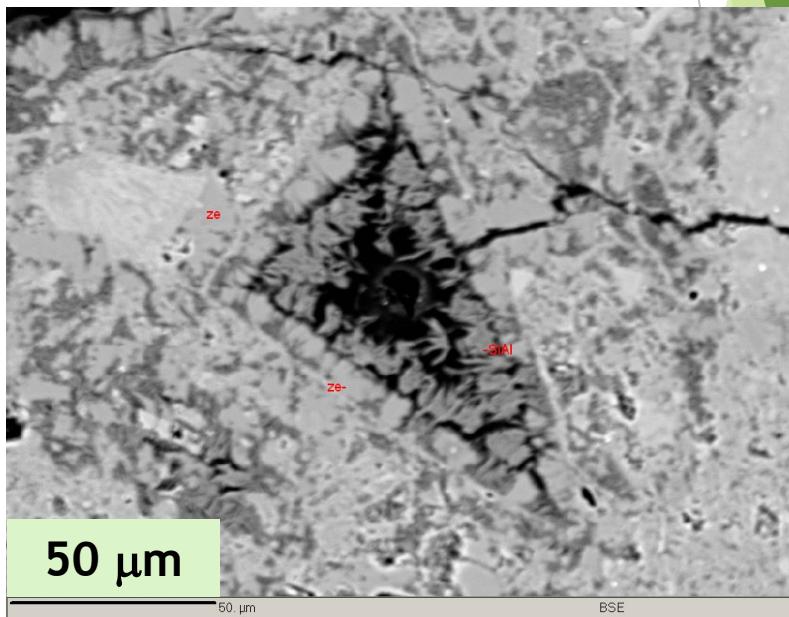
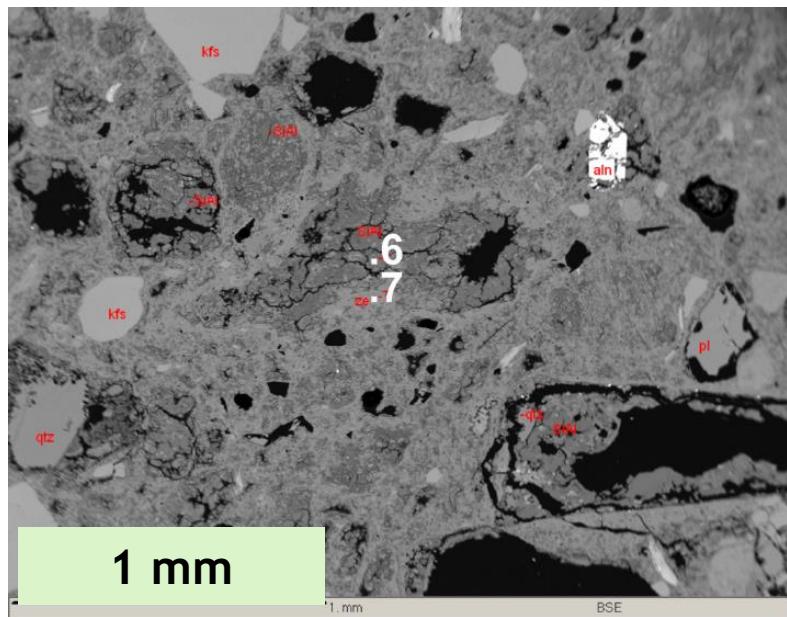
altered rhyolite tuff and tuff breccia, fluviolimnic facies



Mordenite + clinoptilolite 30-50 %

Reserves: 4,7 Mt (Hroncova, 1994)

Bartošova Lehôtka - Paseka



Bartošová Lehôtka - mineral composition

surface samples

	BL15 1	BL15 2	BL15 3	5BB*
Quartz	2.2	0.2		13
K-feldspar	20.9	16.5	14.7	1
Plagioclase		1.2	2.8	
Calcite	1.8			
Anatase	0.1	0.3	0.2	
Clinoptilolite	1.9	7.6	6.6	
Opal CT (+ volcanic glass)	6.6	36	43.2	35
Mordenite		6	2.8	35
Pyroxene	0.9			
Amphibole	0.5	0.7	0.3	
Kaolinite	2.4			
Montmorillonite	53.7	28.7	25.6	15
Illite	9	2.8	3.8	
Biotite				1

* Data from Zuberec et al., 2002

Bartošova Lehôtka - Paseka

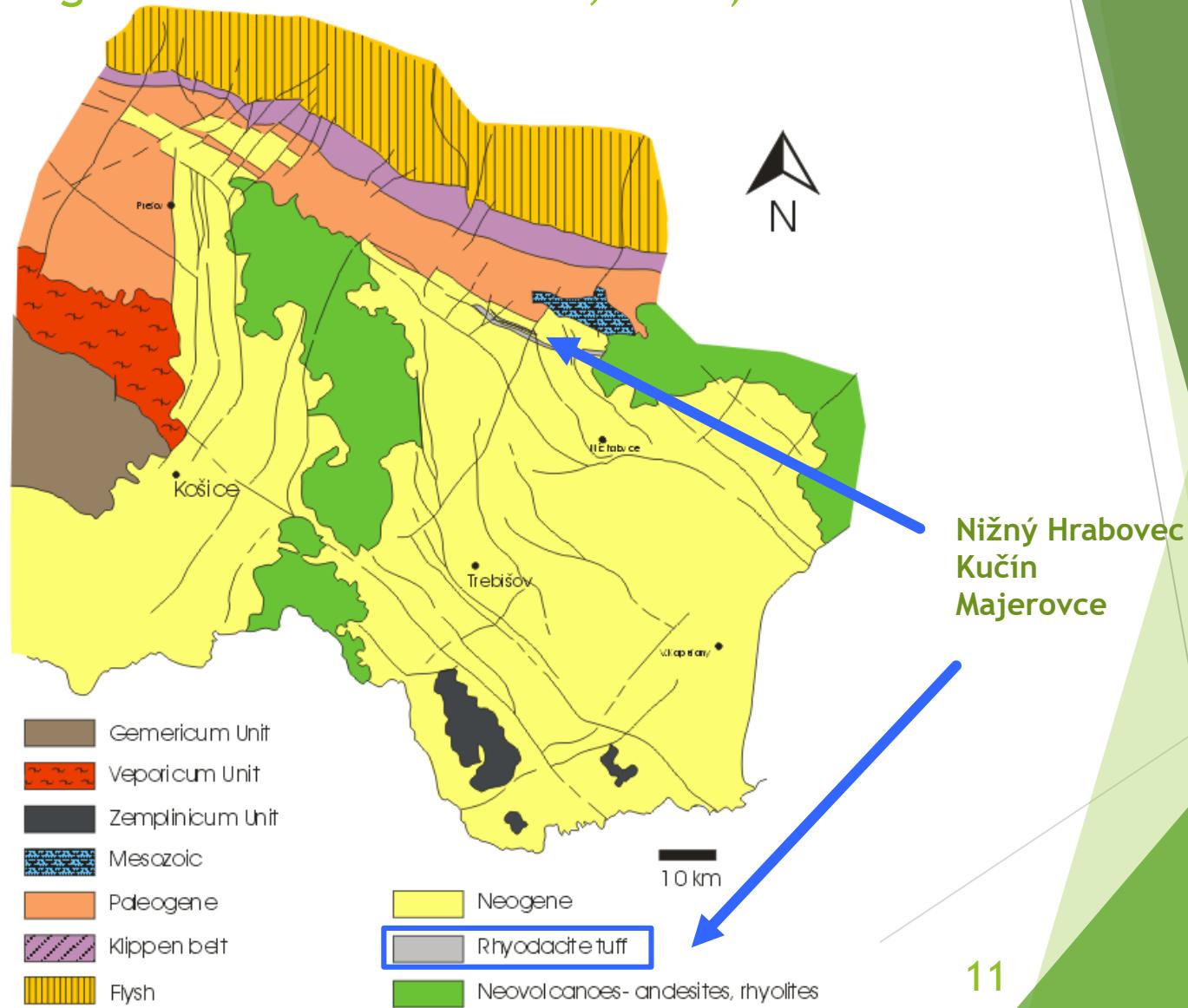
- ▶ zeolite deposit was opened by company Sedlecký kaolin - Slovensko s.r.o. in 2006.
- ▶ The deposit is randomly mined
- ▶ Natural zeolite is mainly processed by Sedlecký kaolin, a.s. in Czech Republic and is sold as pet litters (usually in mixture with bentonite)
- ▶ The main expected applications are in agriculture and environmental protection



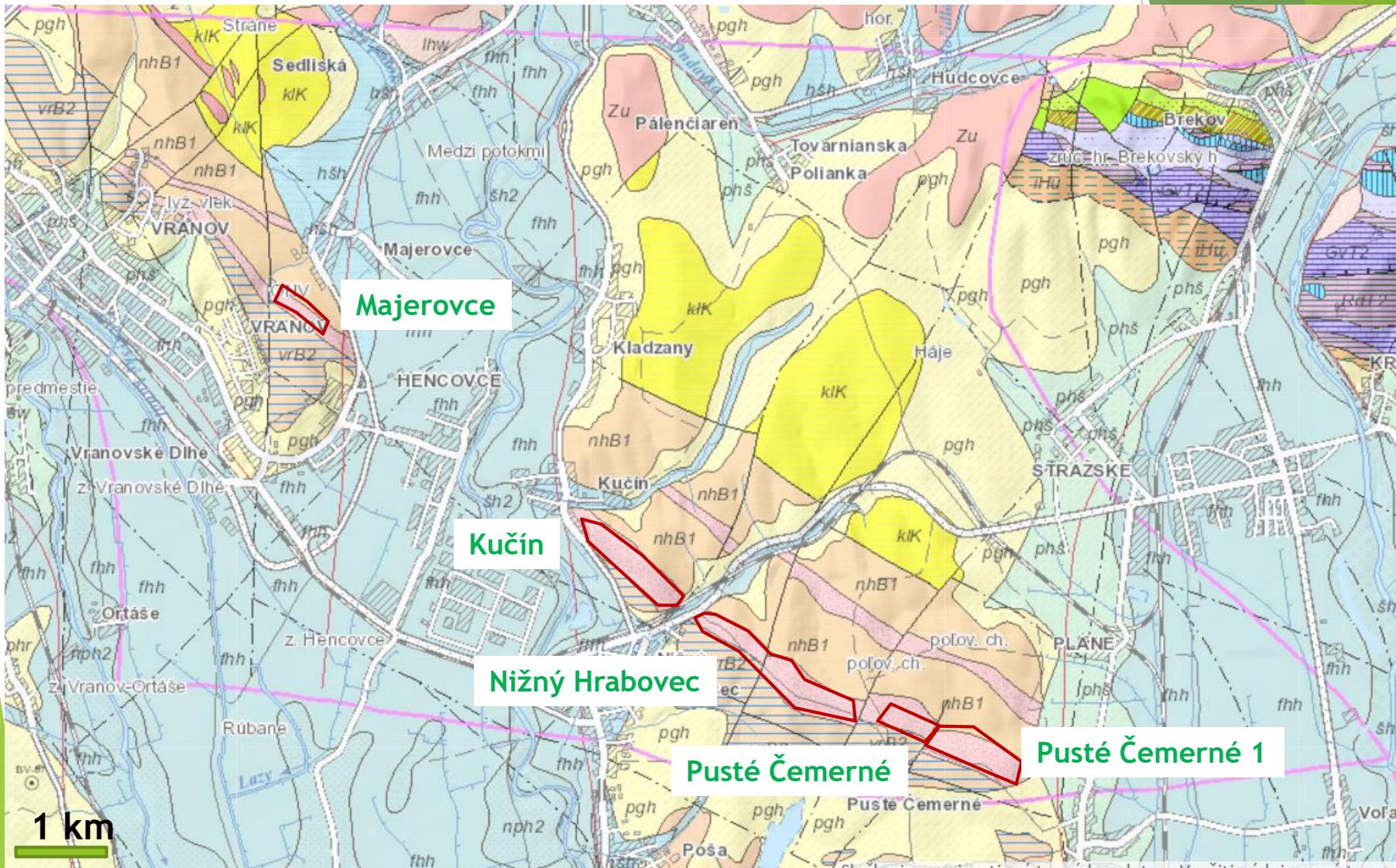
Source: Main Mining Office SR (MMO SR, Hlavný banský úrad SR)

East Slovak neogen basin

(according to Lexa and Kalinčiak, 2000)



Geological map - Hrabovec tuff

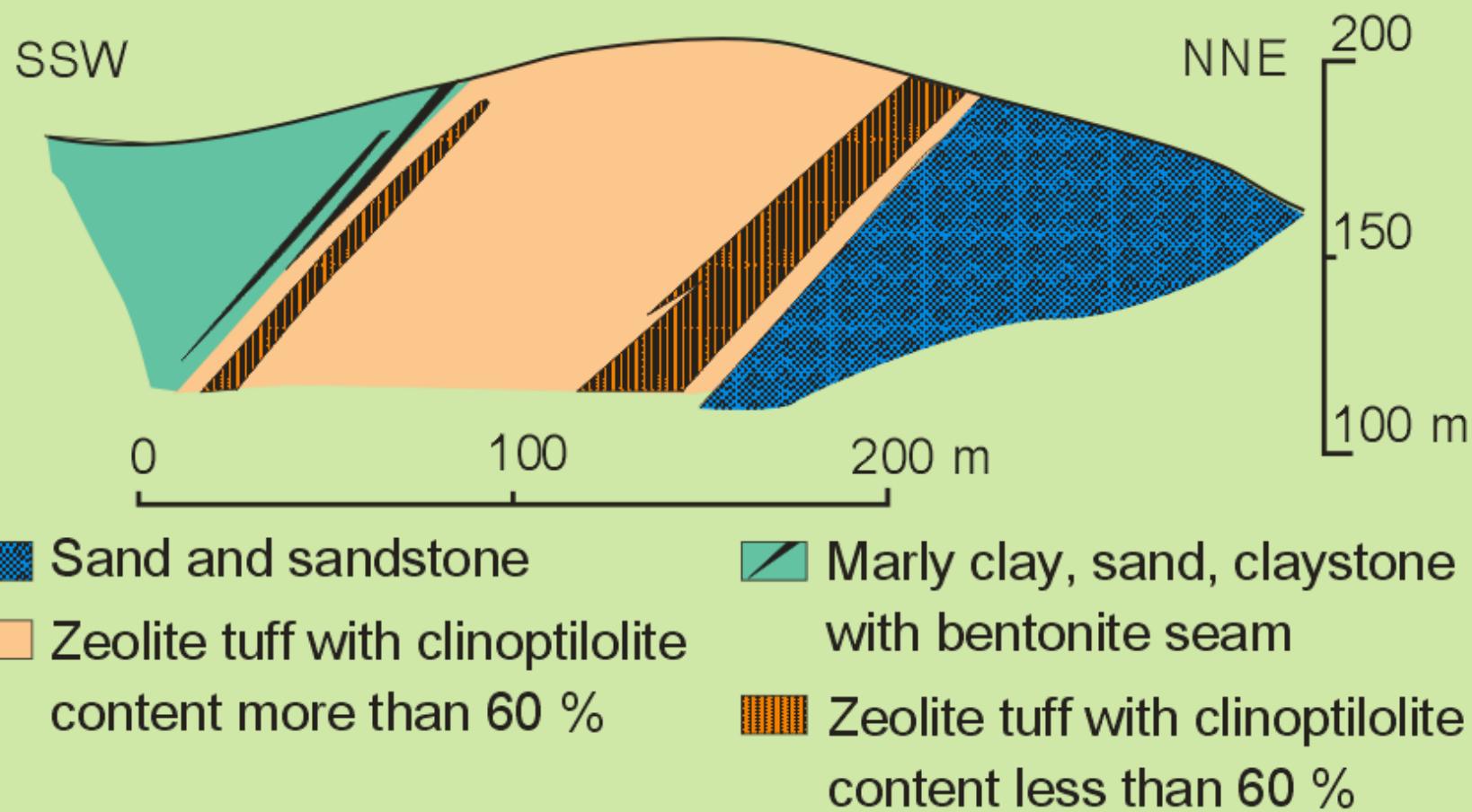


Hrabovec rhyodacite tuffs

mining area

www.geology.sk

Nižný Hrabovec (Varga, 1984)



rhyodacite volcanoclastic rocks (Hrabovec tuff) of
Lower to Middle Badenian age

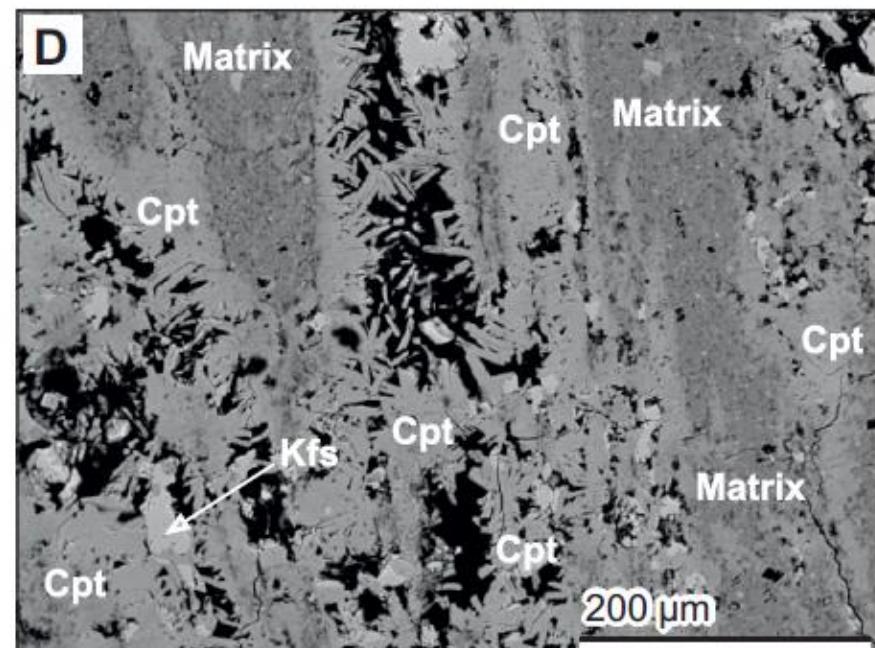
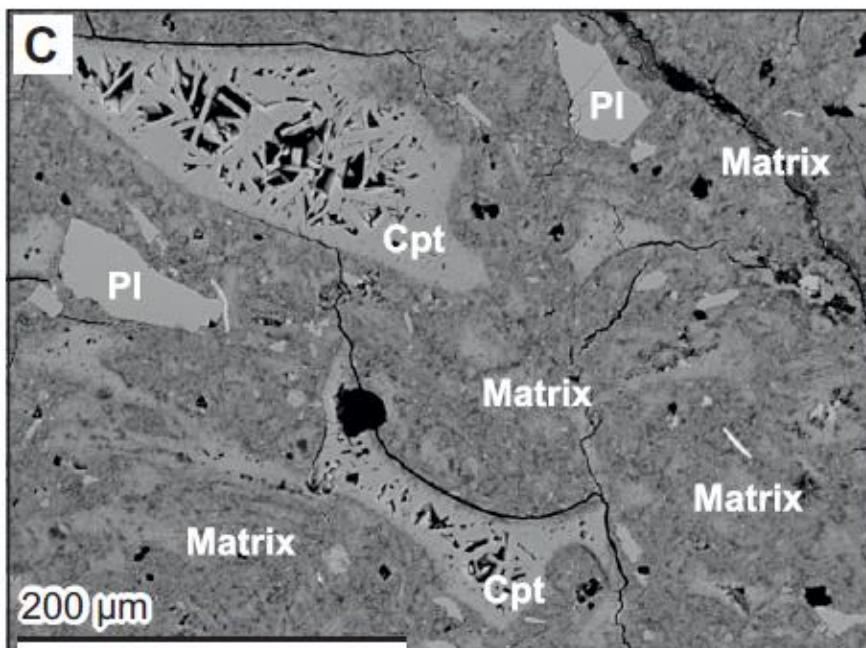
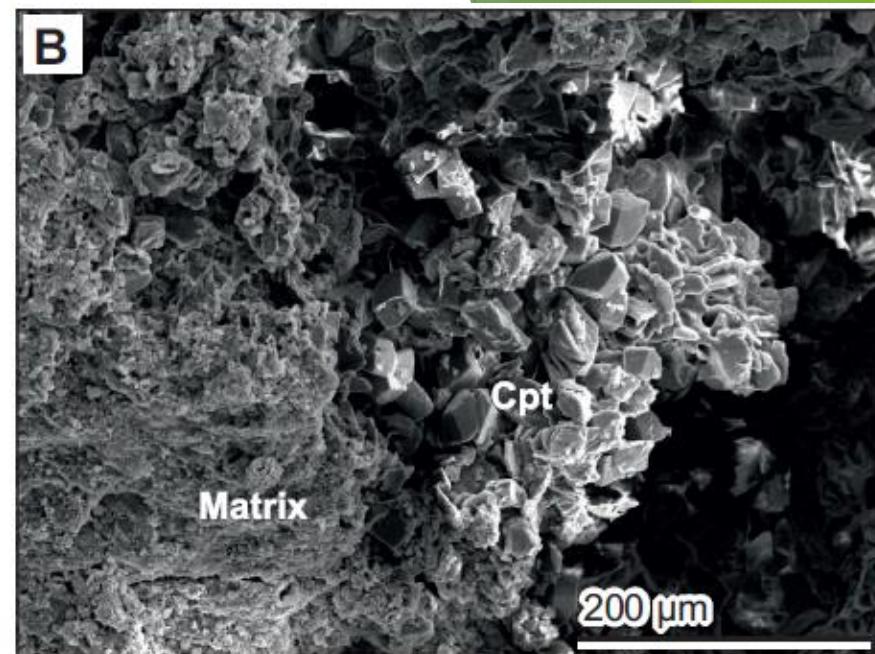
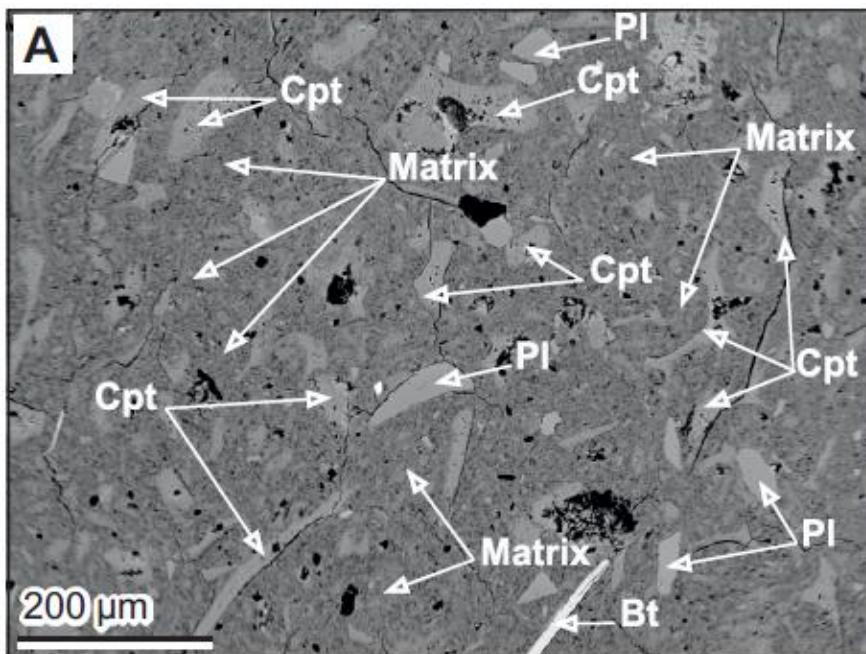
Nižný Hrabovec



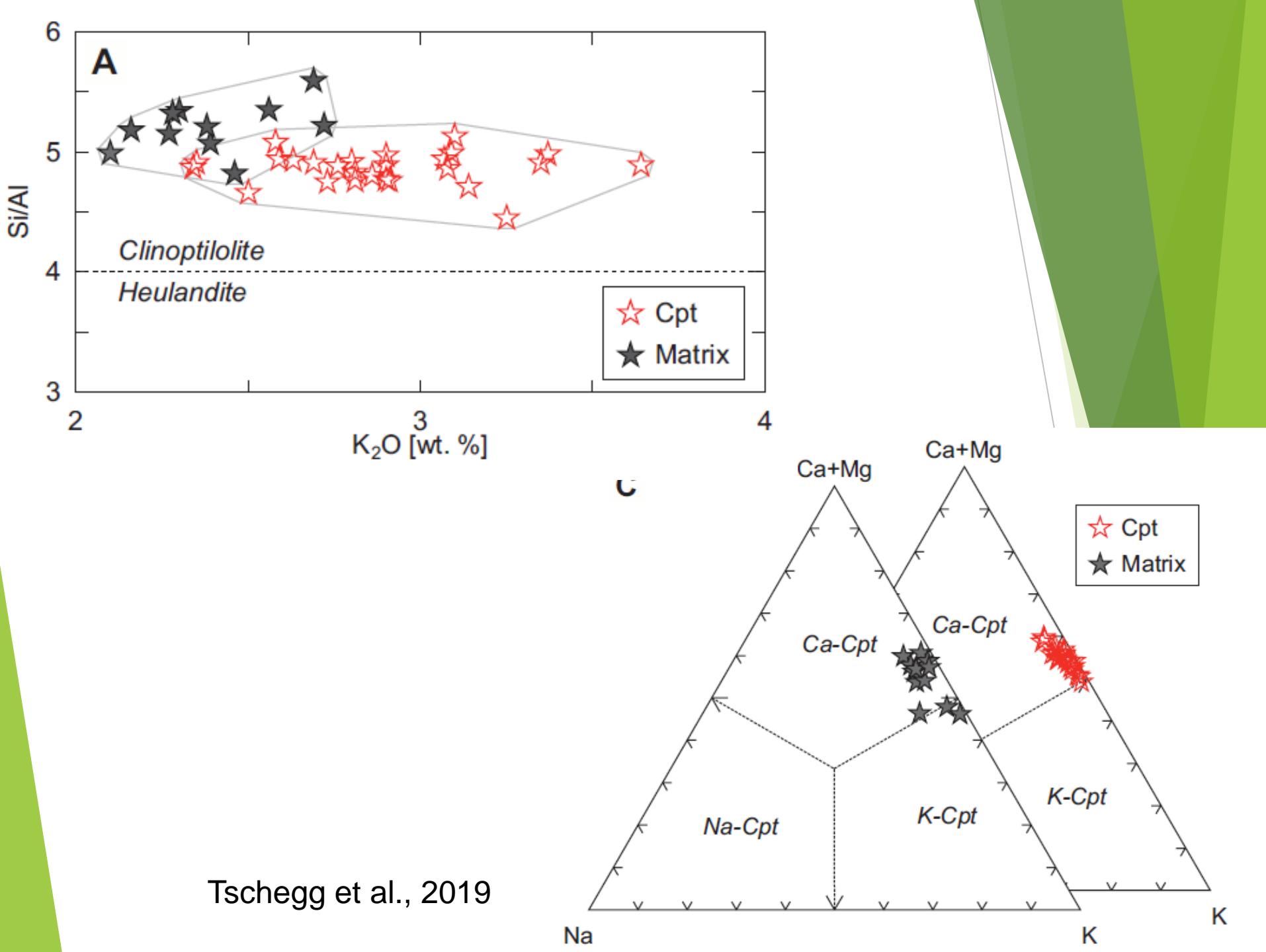
Nižný Hrabovec and Kučín zeolite

- ▶ a light-green and fine-grained, zeolitized tuff:
 - ▶ 70-80 % K-Ca clinoptilolite (Uhlík et al., submitted to AGEOS)
 - ▶ 82-84 % K-Ca clinoptilolite (VSK PRO-ZEO)
 - ▶ mostly up to 20 % opal-C(CT), cristobalite
 - ▶ mostly up to 5 % primary pyroclastic minerals
- ▶ CEC= 94 - 132 meq/100 g (Kozáč et al., 1982)

SiO ₂	73,42
Al ₂ O ₃	12,43
Fe ₂ O ₃	1,05
FeO	0,31
TiO ₂	0,12
CaO	2,94
MgO	0,85
MnO	0,042
P ₂ O ₅	0,04
Na ₂ O	0,24
K ₂ O	2,61
SO ₃ ⁻	0,03
S.ž.	2,79
H ₂ O ⁺	3,49
H ₂ O ⁻	5,12

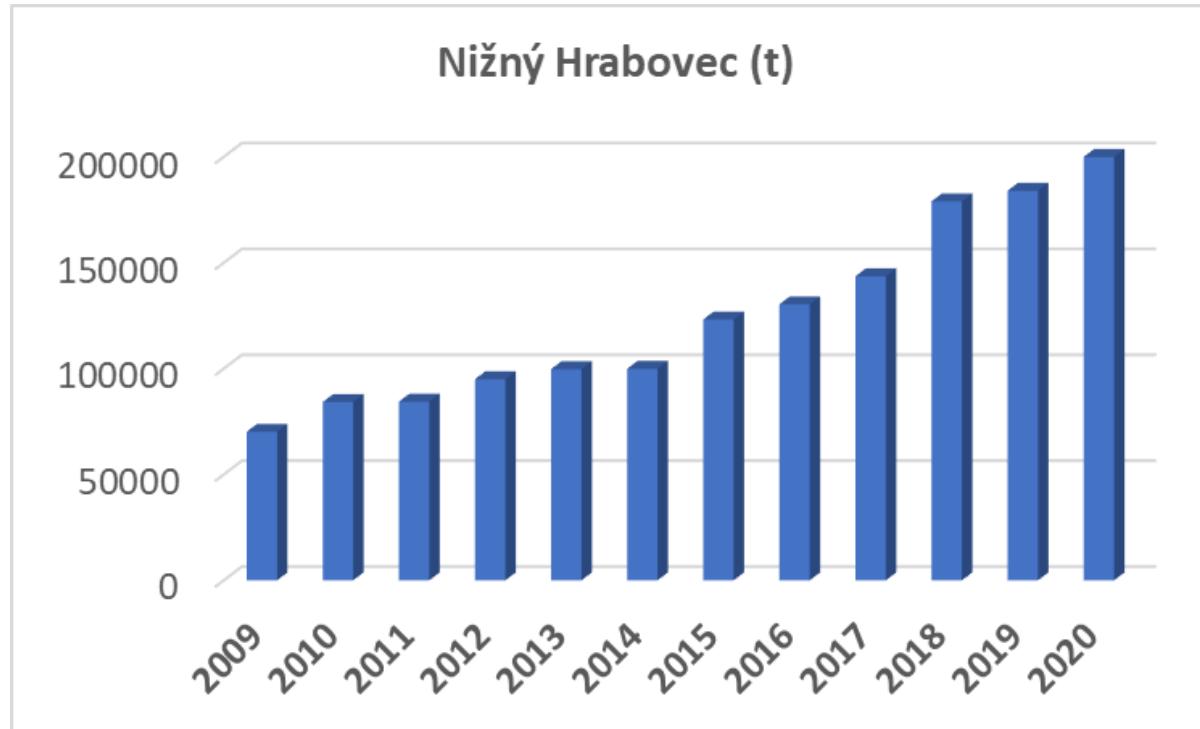


Bt = biotite, Cpt = clinoptilolite, Kfs = K-feldspar, Pl = plagioclase Tschegg et al., 2019



Nižný Hrabovec - ZEOCEM, a.s.

- ▶ is the largest zeolite quarry in Europe operated by the company Zeocem, a.s., Bystré,
- ▶ 38.7 Mt in the category of balance reserves Z-1 and Z-2



Source: Main Mining Office SR (MMO SR, Hlavný banský úrad SR)

Nižný Hrabovec - ZEOCEM, a.s.

- ▶ is certified company with own research and development of new products
- ▶ prepares “common” zeolite products which are based on different size fractions of zeolite
- ▶ also offer three commercial lines of special products
 - ▶ ZeoCem Micro
 - ▶ mixed products, based on zeolite and 7 other components with a certified miscible 1: 100,000
 - ▶ ZEOCEM GRANUL
- ▶ significant strengthening of promotional activities in the last 30 years is behind the success of the company.

Applications

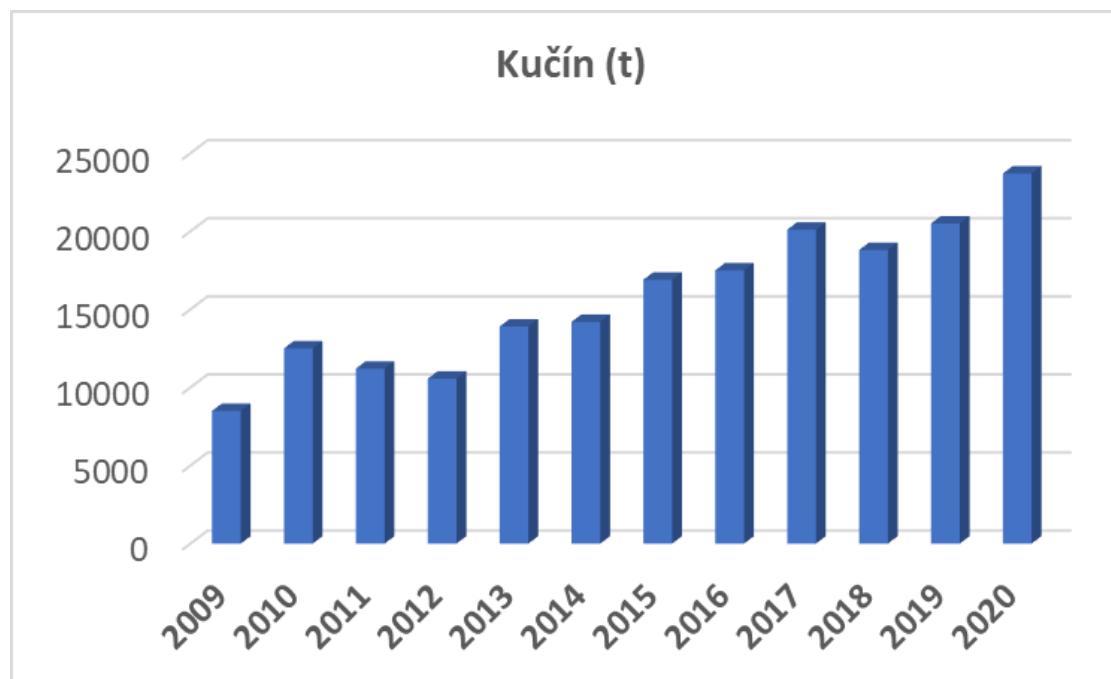
  ZEOLITE PRODUCTS COMPANY ZEOCEM BLOG CONTACTS  Search ... EN

 AGRO	 BUILDING	 ENVIRO	 INDUSTRY	 HOBBY
AGRO ANIMALS  ZeoFeed  ZeoBedding  ZeoGrit	PRODUCTS FOR CEMENTS  KlinoMix  KlinoStone CONCRETE PRODUCTS  ZeoBau READY-MIX CONCRETE  ZeoSlag  Zeo RMX ROAD SURFACES  AsphaClin	WATER TREATMENT  ZeoAqua - pools  ZeoAqua - drinking water  ZeoWater WINTER ROAD MAINTENANCE  ZeoTraction  ZeoTraction Ultra BIOGAS PRODUCTION  KlinoGas	MATERIAL FILLER  ZeoCem Micro GAS AND FLU-GAS TREATMENT  KlinoCarb  ZeoCem Eco - flue gas cleaning ENVIRONMENTAL ACCIDENTS  KlinoSorb	GARDEN  KlinoGrow Garden  FloraStone PETS AND AQUARIUMS  PussyCat  PussyCat Plus  PussyPet
 MIXED PRODUCTS	 MICRONIZED PRODUCTS	 GRANULATED PRODUCTS		

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Kučín - VSK PRO-ZEO s.r.o.

- ▶ was founded in 2004. VSK PRO-ZEO is a member of the international VSK MINING GROUP
- ▶ the second largest producer of zeolite in Slovakia
- ▶ the estimated in-place zeolite reserves are 23 Mt



Source: Main Mining Office SR (MMO SR, Hlavný banský úrad SR)

Kučín - VSK PRO-ZEO s.r.o.

- ▶ is certified company
- ▶ offers zeolite from Kučín deposit in several fractions after cleaning of zeolites from loam, crushing, grinding and sorting
- ▶ According to available data, the company VSK PRO-ZEO s.r.o. sells zeolite mainly to companies that incorporate the zeolite into their final products.
- ▶ the main application for zeolite from Kučín deposit is as a feed additive for animals

Applications



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Our Products

PRODUCTS FOR EVERY FIELD



Agriculture



Ecology



Industry



Home Usage

ProFeed
ProGravel
ProBedding
ProSand

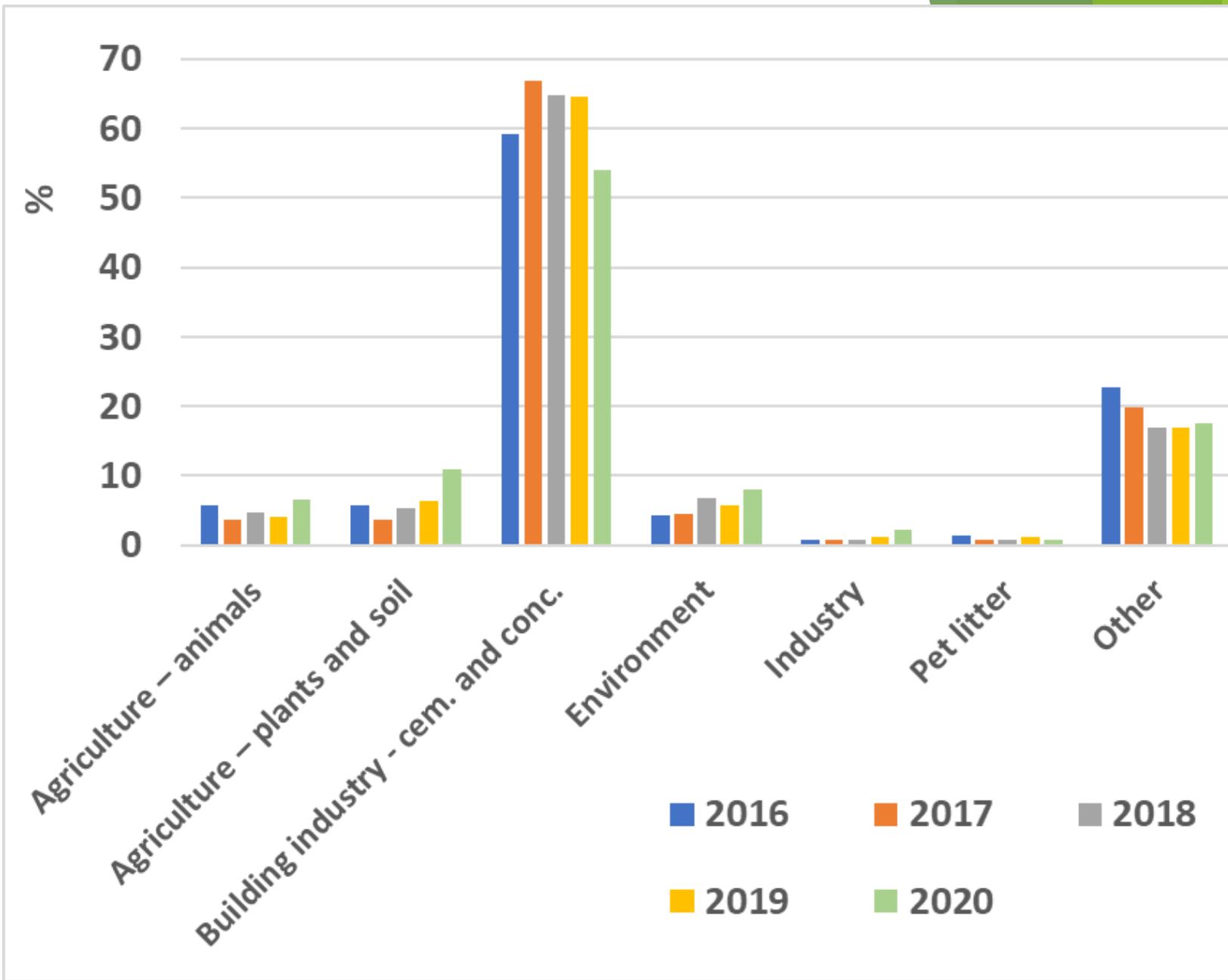
ProPool
ProWater
ProGrit
ProEcoGas

ProPowder
ProBuild
ProSorb
ProGas

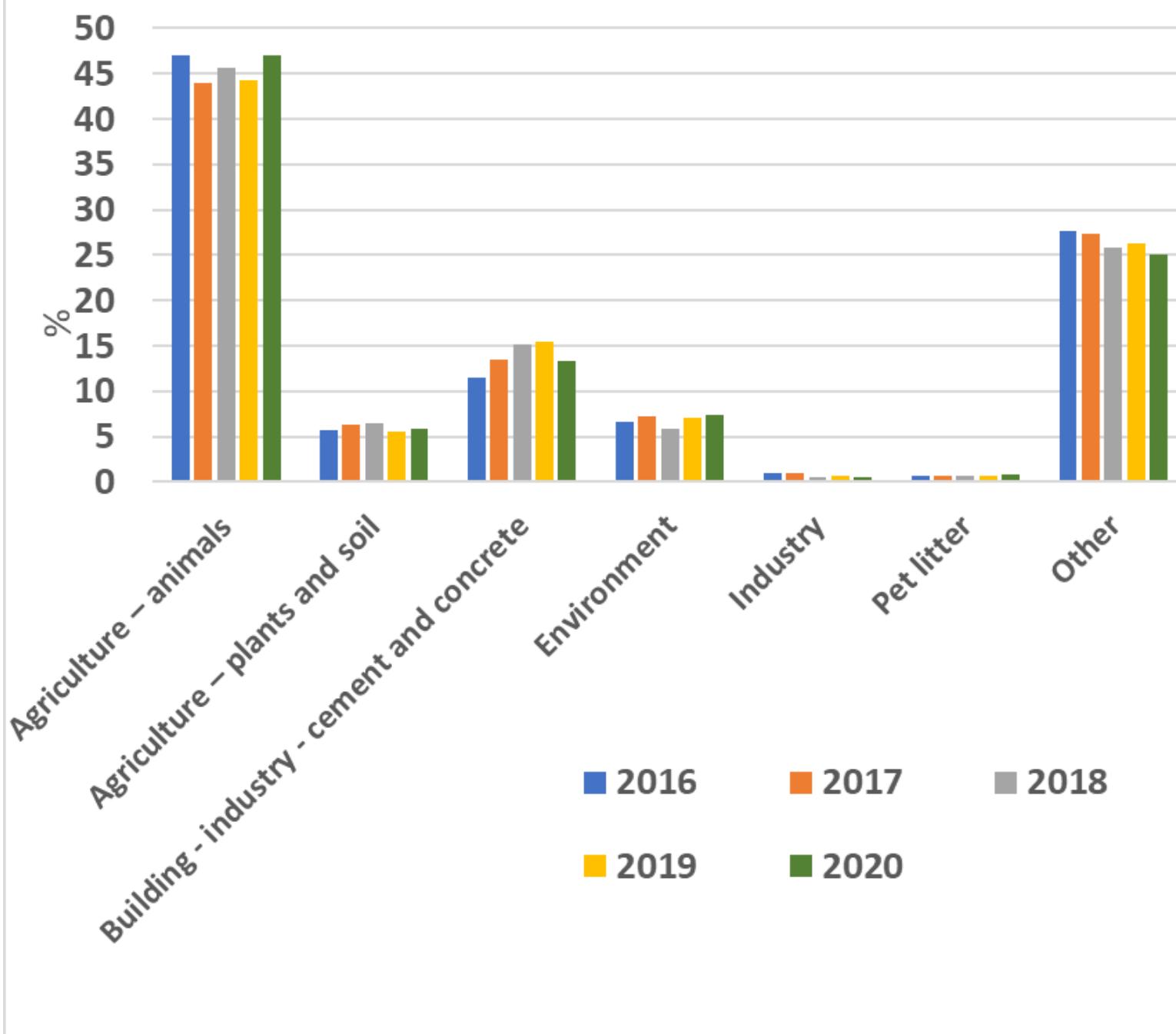
ProPet
ProGarden

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Share (%) of individual applications in the sale of Slovak natural zeolite to the Slovak market



*Share (%) of individual applications in the sale of
Slovak natural zeolite to the global market*



Acknowledgement

- ▶ financial support from the International Visegrad Funds (Grant no 22030212)
- ▶ to companies Sedlecký kaolin - Slovensko s.r.o., VSK PRO - ZEO s. r. o., ZEOCEM, a.s., for consultations
- ▶ to my colleague Marek Osacký

- ▶ to YOU for YOUR attention

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