EGU General Assembly 2020

The westernmost Late Miocene-Pliocene volcanic activity in the Vardar Zone (North Macedonia)

Geochronology, petrology and geochemistry of Pakoševo, Debrište and Šumovit Greben volcanic centers

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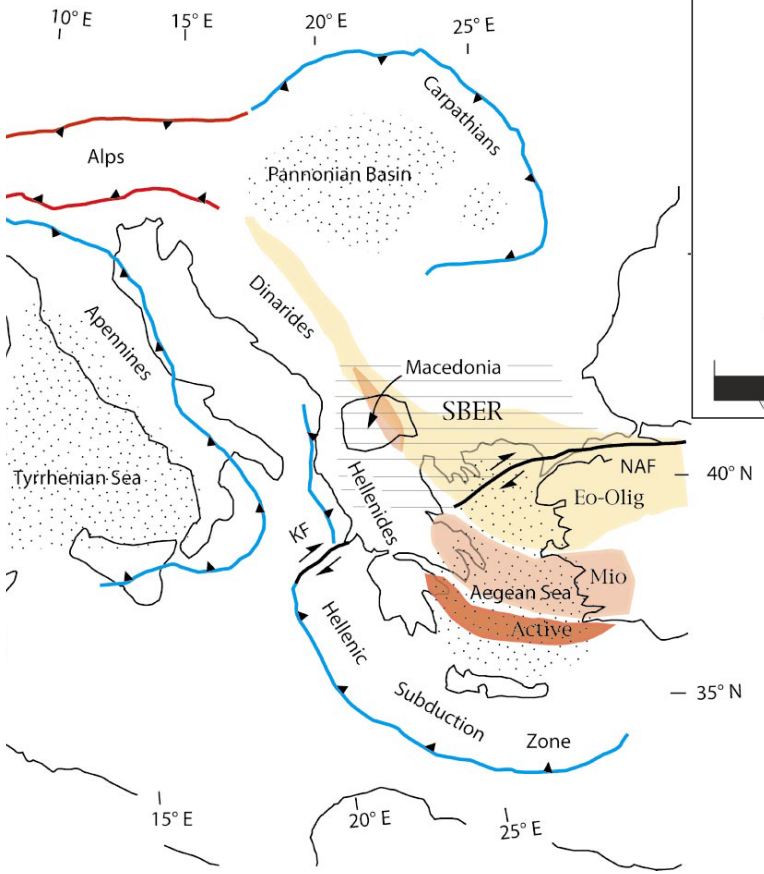
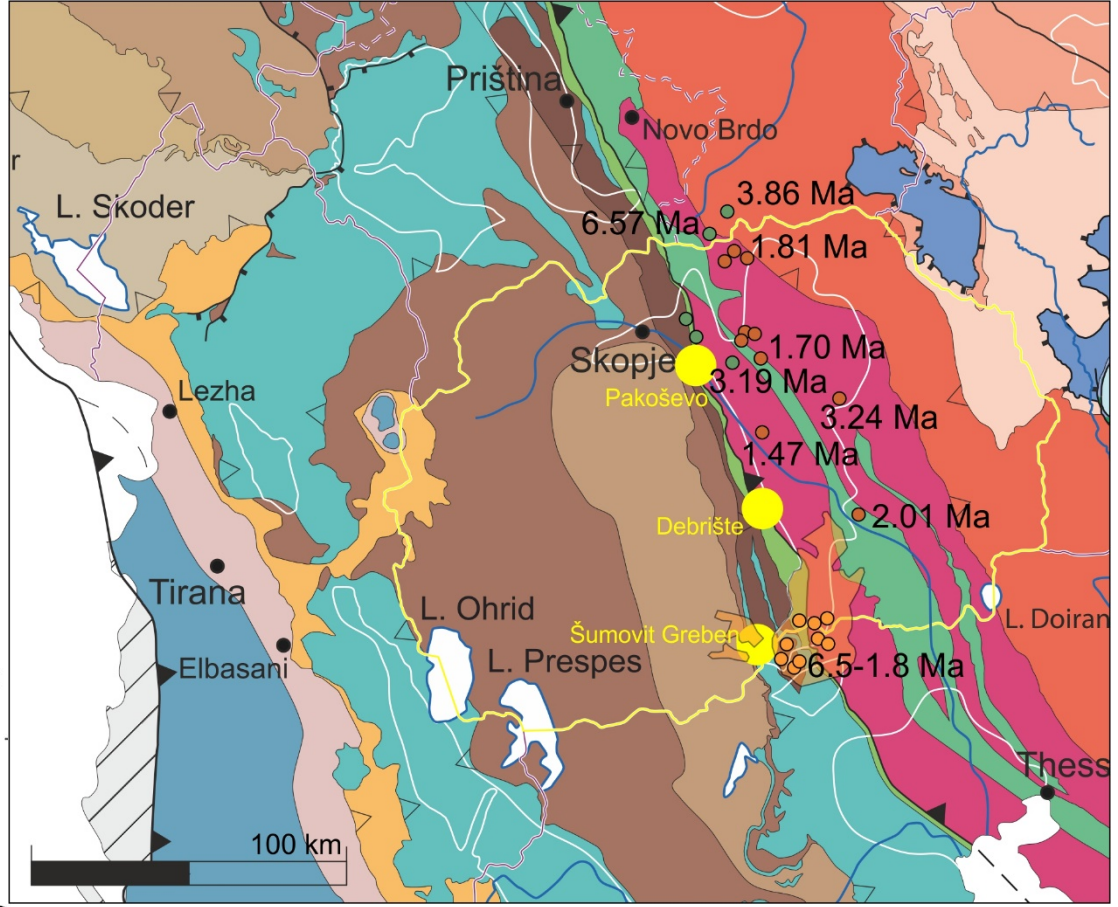
Geological settings of Macedonia

- part of the South Balkan Extension Regime
- contemporaneous volcanism with the Cenozoic extension





distribution of the <10 Ma volcanics

2.01 Ma age

- UK volcanics
- HMg-K volcanics
- LMg-K volcanics
- volcanoclastics
- sampling location

Maps and data from Dumurdzanov et al., 2005; Yanev et al., 2008 and Schmid et al., 2020

Ophiolites & suture zones (mostly ophiolite bearing)

Suture zones

- Sava-Izmir-Ankara-Erzincan suture zone

Obducted ophiolites

- Western Vardar ophiolitic unit (incl. Meliata-Maliac, Mirdita, Pindos & Almopias ophiolites)
- Transylvanian & Circum-Rhodope ophiolites) Eastern Vardar ophiolitic unit (incl. South Apuseni,

Rhodopes mega-unit (units of disputed origin)

- Rhodope upper unit (Kerdilion-Madan)
- Rhodope middle unit (Nestos suture zone)
- Pangaion-Pirin unit (SW Rhodopes)

Europe-derived allochthons in the Balkan Peninsula & Pontides

- Circum-Rhodope & Strandja units
- Dacia mega-unit: Subbucovinian, Bucovinian, Biharia, Supragetic, Serbo-Macedonian; Infrabucovinian, Getic, Sredna Gora, East Balkan
- Danubian, West Balkan, Struma

Adria-derived allochthons in the Dinarides, Hellenides & W-Turkey

- composite nappes, carrying obducted ophiolites: Bükk, Jadar-Kopaonik & Tavşanli units; Drina–Ivanjica, Korab, upper Pelagonian, Afyon–Ören units; East Bosnian-Durmitor, lower Pelagonian, Lycian nappes & Taurides
- Pre-Karst unit, Bosnian flysch & Beotian zone
- High Karst & Parnass units
- Budva-Cukali, Krasta, Pindos zones, Cycladic blueschists
- Dalmatian, Kruja, Gavrovo-Tripolitza zones, Menderes, Bey Dağları
- Ionian zone

Adriatic microplate

- S-Alpine, Apenninic & Dinaridic-Hellenic foreland

Major faults

- First order thrusts
- First order normal faults
- First order strike slip faults

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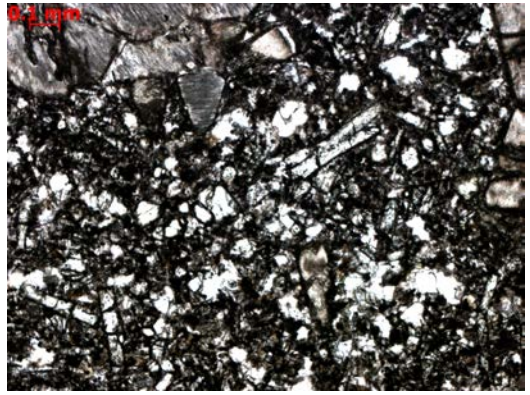
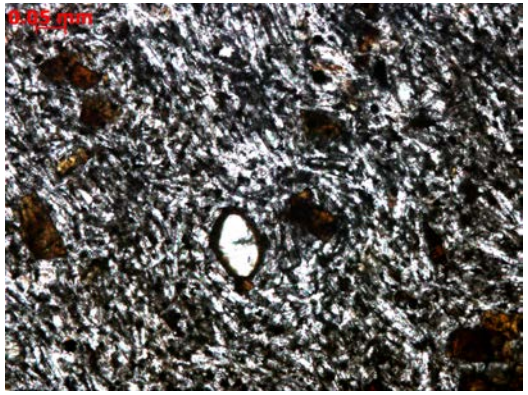
Pakoševo

Debrište

- remnant of a small-volume lava flow and, most likely, a phreatic eruption with diatreme breccia; covering Pliocene sediments at the SE edge of the Skopje basin
- few centers and remnants of lava flows along the Jurassic-Cretaceous limestone-serpentinite units at the W edge of the Tikveš basin



3.77 ± 0.09 Ma



7.98 ± 0.11 – 7.77 ± 0.11 Ma

(it was thought to be Pleistocene)

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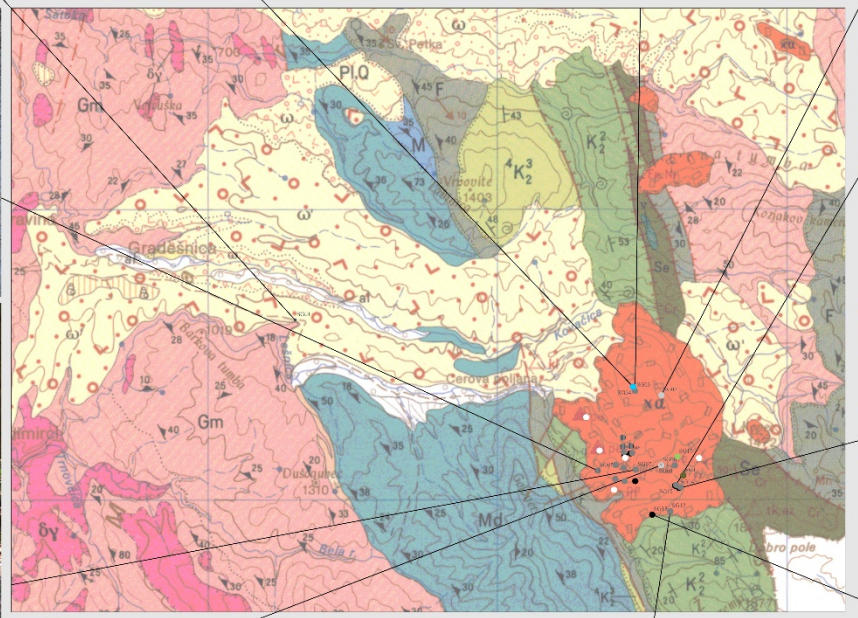
Šumovit Greben

2.89 ± 0.04 – 2.78 ± 0.04 Ma





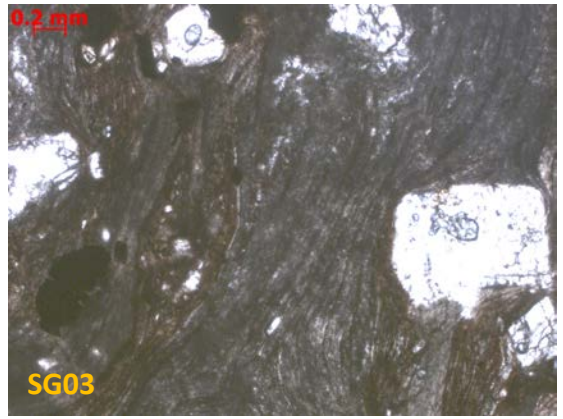



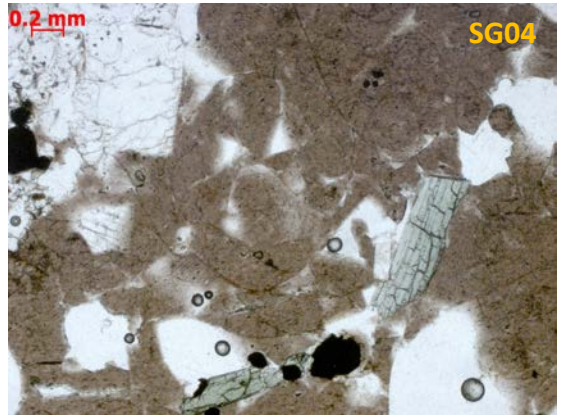


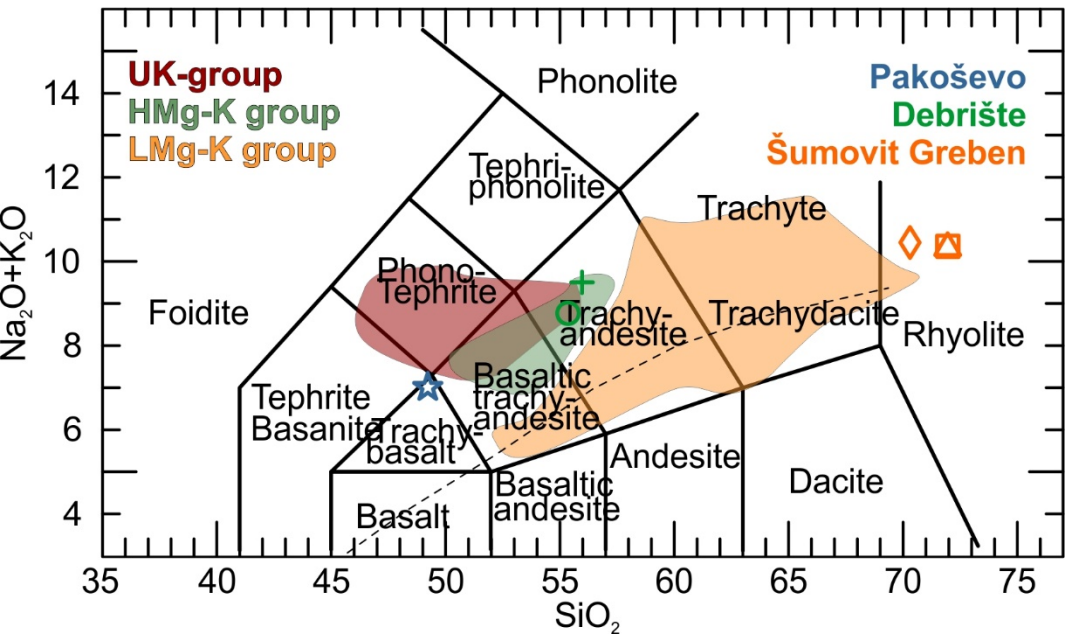


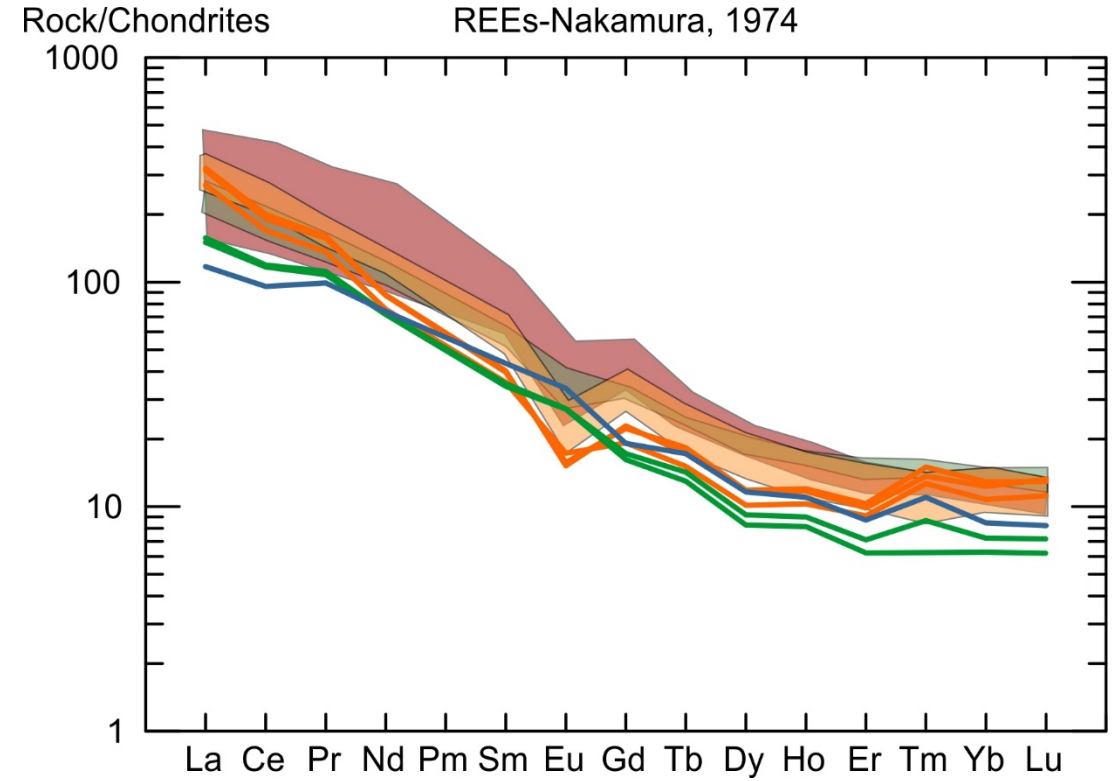

- sandstone
- serpentinite
- lower „obsidian"
- perlite
- darker greyish, with fluidal texture - SG03
- lighter greyish, no fluidal texture - SG02
- lighter greyish, containing darker greyish rounded clasts
- upper „obsidian" (no Q) - SG04
- darker greyish, with fluidal texture (vertical) - neck

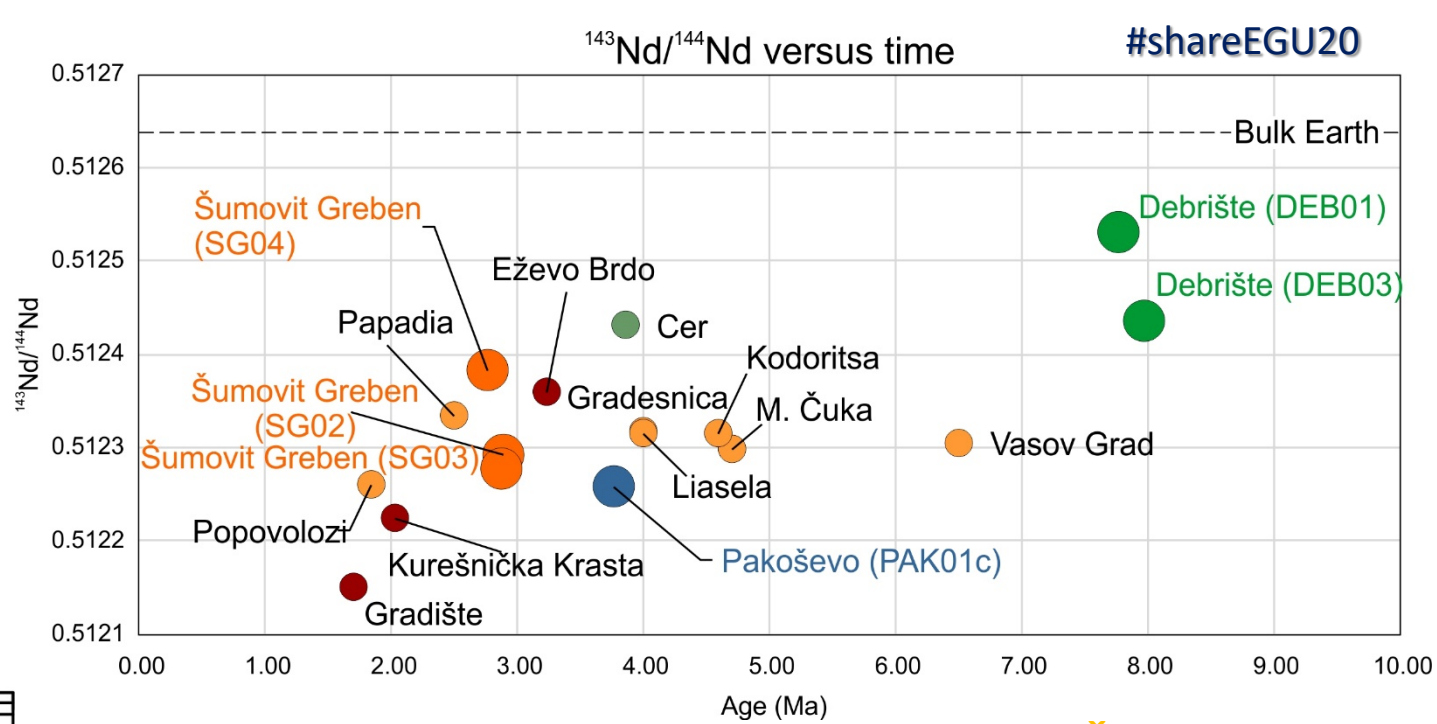
- composite (at least four units) rhyolitic volcanic structure at the SE edge of Mariovo basin, along the Cretaceous flysch and serpentinite units; a possible eruption center of the nearby ignimbrites











- **Pakoševo** is part of the HMg-K group, whereas **Šumovit Greben** is part of the LMg-K group of the Kozuf-Voras volcanic system; **Debrište** is also part of the LMg-K group but shows similarities to the HMg-K group based on the rare earth elements content
- $^{143}Nd/^{144}Nd$ isotopic composition is gradually decreasing with time, the least metasomatic composition is exhibited by the **Debrište** samples which are the oldest (within the <10 Ma volcanics) in the region

Total alkali silica diagram (LeBas et al., 1986), chondrite normalized rare earth element diagram (Nakamura, 1974) and $^{143}Nd/^{144}Nd$ versus time diagram based on whole rock data

Data for comparison from Kolios et al., 1980; Boev, 1988; Eleftheriadis et al., 2003; Cvetkovic et al., 2004 and Yanev et al., 2008; classification from Yanev et al., 2008

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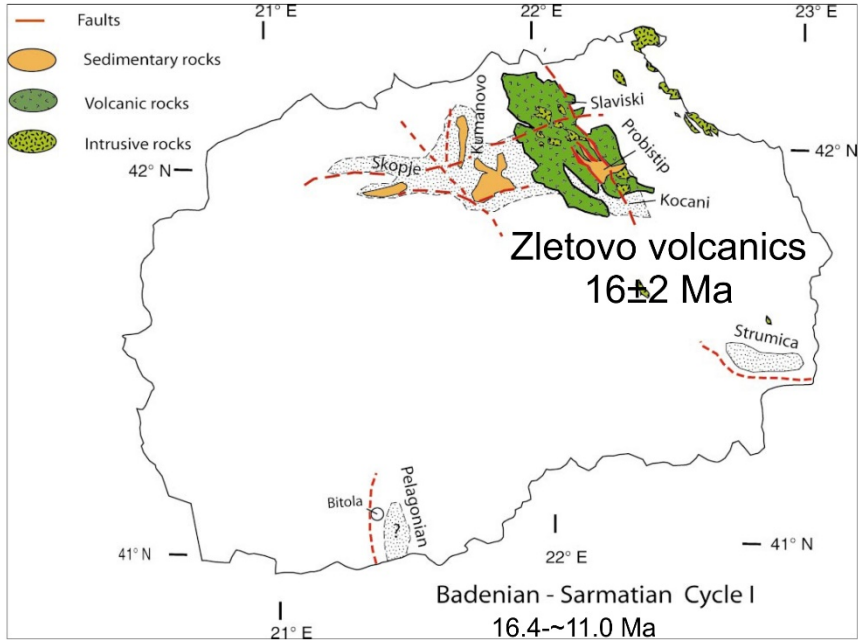
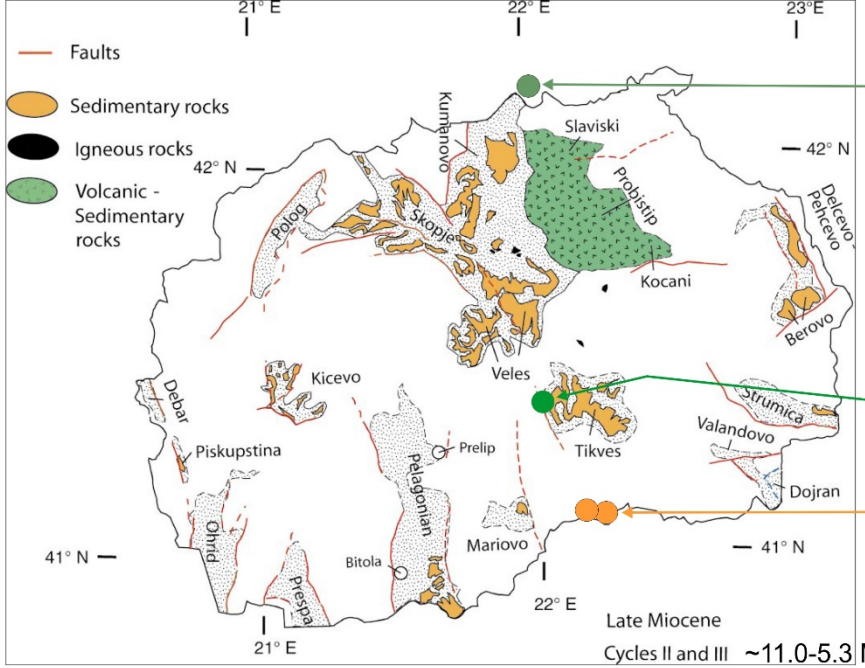
Spatial relation of the basin evolution and the volcanic activity during Neogene-recent extension





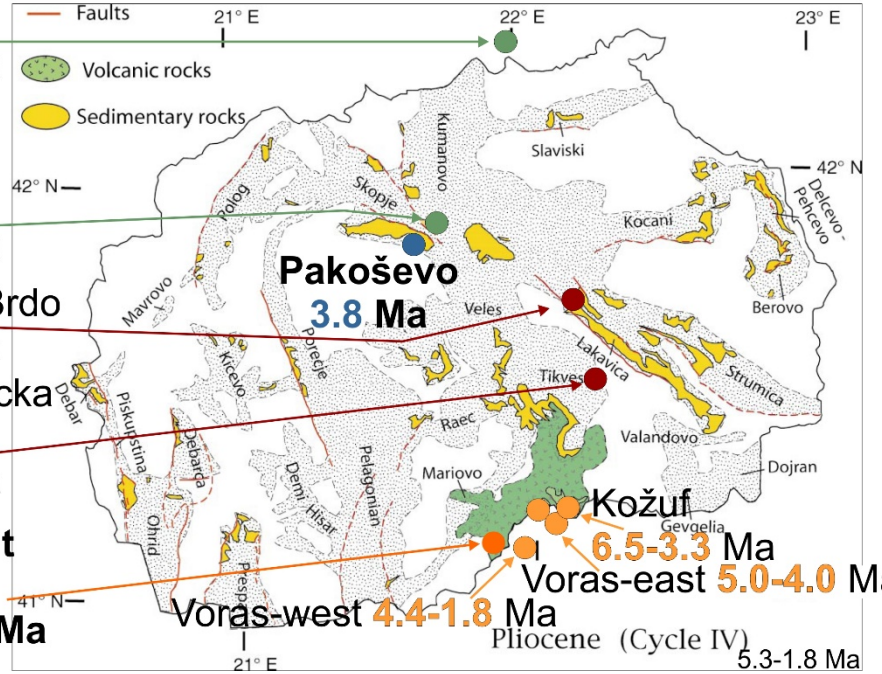
Cer
3.86 Ma

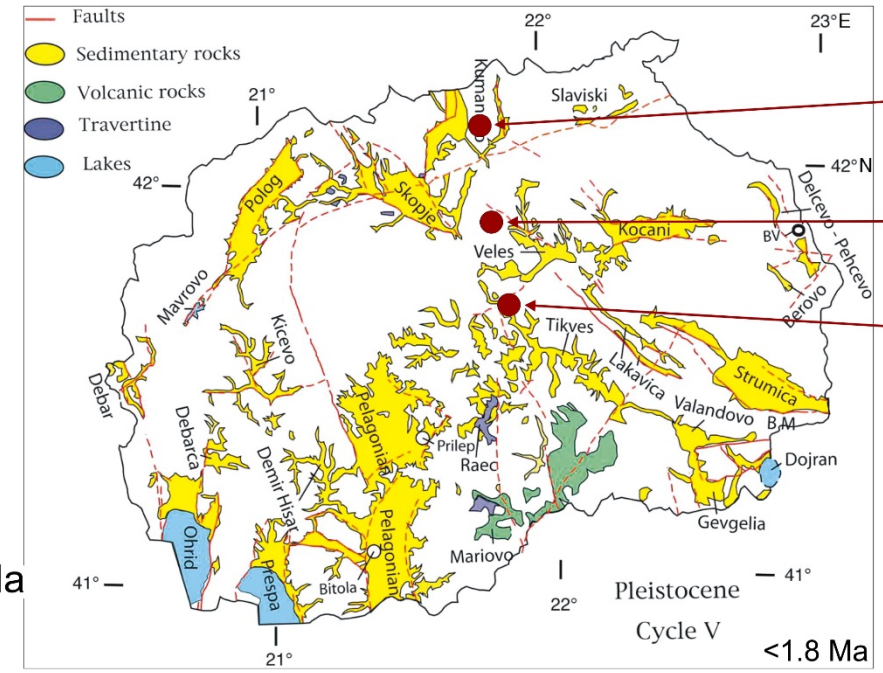
Djurište
3.19 Ma

Eževo Brdo
3.24 Ma

Kurešnicka Krasta
2.04 Ma

Šumovit Greben
2.9-2.8 Ma





Data from Kolios et al., 1980; Lippolt and Fuhrmann, 1986; Boev, 1988; Troesh and Frantz, 1992; Dumurdzanov et al., 2005; Yanev et al., 2008 and Neubauer et al., 2009

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