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Reconstructing the evolution of Eocene ecosystems in southern Eurasia to better understand past mammalian dispersals

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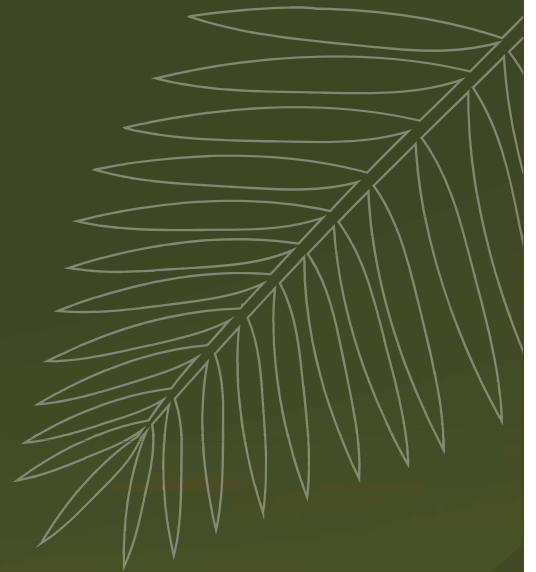
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**XV International
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Czech Republic**

**Abstract
Book**

character in Central Paratethys underwent significant changes due to the Alpine uplift of the western Alps and Carpathians, initiating altitudinal zonality. Differences mainly in quantitative representation of zonal elements between northern localities (Czechia and Slovakia) and southern parts of this are (Slovenia, Romania) indicates increasing of latitudinal zonality. In Eastern Paratethys, palynospectra indicated an earlier trend of gradual cooling and a notable shift towards more arid and continental climate conditions. This trend may be linked to the presence of the vast moderate Eurasian continent.

Doláková, N., Kováčová, M., Utescher, T. (2021): Vegetation and climate changes during the Miocene climatic optimum and Miocene climatic transition in the northwestern part of Central Paratethys. – *Geological Journal*.56, (2), 729–743.

Vernyhorova, Y.V., Holcová, K., Doláková, N., Reichenbacher, B., Scheiner, F., Ackerman, L., Rejšek, J., De Bortoli, L., Trubač, J., Utescher, T. (2023): The Miocene Climatic Optimum at the interface of epicontinental sea and large continent: A case study from the Middle Miocene of the Eastern Paratethys. - *Marine Micropaleontology* 181, 102231

Poster session T01 Challenges in studying Cenozoic vegetation history: In memoriam Zlatko Kvaček

P-064 - Reconstructing the evolution of Eocene ecosystems in southern Eurasia to better understand past mammalian dispersals

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During early and middle Eocene, the Balkans and Anatolia formed an endemic biogeographic province called Balkanatolia that was separated from mainland Eurasia. This isolation ended around 40 Ma when Asian ungulates dispersed into the province and endemic taxa declined. The paleoenvironments of this biogeographic province remain yet poorly known. The goal of this PhD project is to characterize the flora and the local climate of Balkanatolia (rainfall seasonality, aridity) to better understand what could have favoured these biogeographic changes. The work presented here is twofold. First, we will present an overview of the current knowledge about the Eocene flora of Balkanatolia. This review will include all kind of vegetal structure preserved in the fossil record (pollen, wood, seeds...). Second, we will present preliminary results on pollen assemblages and fossil wood specimens of different Eocene localities in Central Anatolia yielding endemic Balkanatolian taxa (Çamili, Çiçekdağı, Büyüktefek, Bultu-Zile, Yeni-Çeltek and Eski-Çeltek). Through a taxonomical identification, these palynological results will draw a first reconstruction of forested assemblages before the arrival of Asia-derived mammal fauna. These paleobotanical results will be compared and interpreted with contemporary geochemical proxies and paleontological data to highlight the environmental evolution through the development and demise of Balkanatolia.

Poster session T01 Challenges in studying Cenozoic vegetation history: In memoriam Zlatko Kvaček

P-065 - Plio-Pleistocene flora of the travertine mound of the Dreveník site in Slovakia

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Travertine is specific chemogenic sediment, which is known for an extraordinary fossilization potential, among other things. The Dreveník travertine mound site is located in the Eastern Slovakia. Based on biostratigraphy the age is estimated to late Neogene – early Pleistocene. These Slovak travertines contain a unique impressions of fossil flora, mainly leaves, seeds and conifer female cone. The floral composition is a combination of typically Tertiary (*Carya* sp., *Ginkgo adiantoides*, *Liquidambar* sp. etc.) and Quaternary (*Carpinus betulus*, *Parrotia persical* etc.) elements with many others taxa (*Ulmus cochii*, *Fagus* sp. etc.). The main aim of this study is to prepare a detailed systematic review based on the external plant morphology. The systematic review is necessary in order to get an exact depiction of the Slovak Plio-Pleistocene flora and vegetation. This knowledge will enable us to set this site in a broader context of the Plio-Pleistocene plant exchange. Comparison this study site with other Late Neogene localities

Reconstructing the evolution of Eocene ecosystems in southern Eurasia to better understand past mammalian dispersals

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Session T01: Challenges in studying Cenozoic vegetation history - In memoriam Zlatko Kvaček (1937-2020)

Introduction: Balkanatolia

- During Early-Middle Eocene, Balkans and Anatolia formed an endemic biogeographic province: Balkanatolia (Figure 1; Licht et al. 2022).
- This isolation ended around 40 Ma (arrival of Asian ungulates into Balkanatolia and endemic taxa extinction).
- The paleoenvironments of this biogeographic province remain yet poorly known.

Is this faunal turnover correlated to an environmental and climatic change?

- PhD goal: to characterize the flora and the local climate of Balkanatolia (rainfall seasonality, aridity).
- Hypothesis: opening and aridification since 40 Ma (appearance of Restionaceae?).

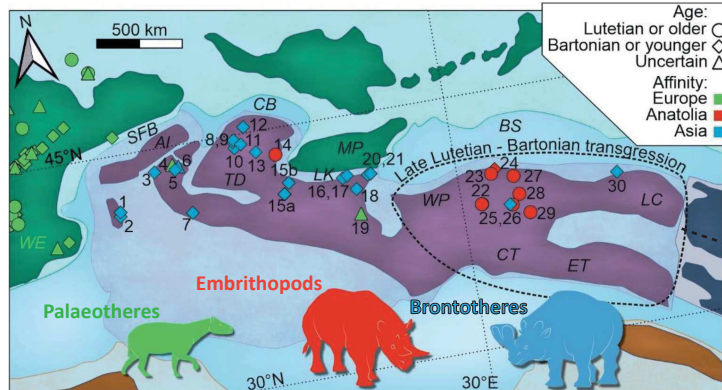


Figure 1. Synthetic paleogeographic map of Balkanatolia near the Bartonian-Priabonian Boundary, 38 million years ago. Purple: Balkanatolia; green: Eurasia; blue: Cimmerian blocks; orange: Afro-Arabia. Eocene fossil sites in circles (Ypresian-Lutetian), diamonds (Bartonian-Priabonian) or triangles (uncertain age); symbols colour

Focus on Turkey

- The Turkish Eocene floras are poorly known (few localities; Table 1; Figure 4; Collinson & Hooker 2003).

Table 1. List of Turkish Eocene localities with plant remains.

Map	Locality	Formation	Age	Material	References
A	Çorum-Bayat	Yoncaltı	Early Eocene	Palynomorphs	Akyol 1980; Kayseri-Özer 2013
B	Western part of Yozgat-Çiçekdağ and Sorgun	Yoncaltı	Early-Middle Eocene	Palynomorphs	Akgün et al. 2002; Kayseri-Özer 2013
C	Yozgat-Çiçekdağ (near the village of Arabanköy)	Yoncaltı	Early-Middle Eocene	Palynomorphs	Akgün et al. 2002; Kayseri-Özer 2013
D	Çeltek-Çiçekdağ	Manaca	Late Ypresian-Lutetian	Palynomorphs	Akkiraz et al. 2022
E	Ankar a-Cubuk-Susuzköy	Manaca	Middle Eocene	Phytoliths	Srromberg et al. 2007
F	Eastern part of Yozgat-Sorgun	Yoncaltı	Lutetian	Palynomorphs	Nakoman 1986; Kayseri-Özer 2013
G	Sarıaya	Celtek ek	Lutetian	Palm leaf & wood	Akkekik et al. 2023
H	Çarlık-Topkapı Basin	Bağcıme	Middle-Late Eocene	Palynomorphs	Akkiraz et al. 2008; Tokar et al. 2012; Kayseri-Özer 2013
I	Burdur region	Valsakıyayla	Middle-Late Eocene	Palynomorphs	Akkiraz 2008; Tokar et al. 2012; Kayseri-Özer 2013
J1	Çorum-Amasya	Celtek	Middle-Late Eocene	Palynomorphs	Akgün 2002; Kayseri-Özer 2013
J2	Çorum-Amasya	Armutlu	Middle-Late Eocene	Palynomorphs	Akgün 2002; Kayseri-Özer 2013
K	Zeyvepözü-Kabaklıtepe area	Kabaklıtepe	Late Eocene-Early Oligocene	Palynomorphs	Akgün et al. 2021
L	Sivas	Tuzhisar	Late Eocene-Early Oligocene	Palynomorphs	Göndogan et al. 2005; Kayseri-Özer 2011; 2013
M	Mersin-Mut	Yoncaltı	Late Eocene-Early Oligocene	Palynomorphs	Kayseri et al. 2006; Kayseri-Özer 2013
N	Çamili	Yoncaltı	Lutetian	Palynomorphs & wood	2023 Field campaign
O	Çiçekdağ	Yoncaltı	Lutetian	Palynomorphs	2023 Field campaign
P	Boydaklıfak	İnkik	Priabonian	Palynomorphs & wood	2023 Field campaign
Q	Bultu-Zile	İ	Lutetian	Palynomorphs & wood	2023 Field campaign
R	Eski-Çeltek	Celtek	Lutetian	Palynomorphs	2023 Field campaign
S	Yeni-Çeltek	Celtek	Lutetian	Palynomorphs	2023 Field campaign

- Late Eocene-Early Oligocene: transition from a humid, tropical climate to a more subtropical one.
- Presence of plant formations associated with colder (mid-altitude forest, upland), more open and dryer (steppe) environments (Table 2).

Table 2. List of environments characteristic taxa in Turkish Eocene localities.

Environment	Representative taxa	Present before 40 Ma	Present after 40 Ma
Mangrove	<i>Aucoumea</i> , <i>Nyssa palm</i> , <i>Peltociera</i>	Yes	Yes
Back-mangrove	<i>Acrostichum</i> , <i>Anemita</i> , <i>Ferns</i> , <i>Araceae</i> , <i>Araceae</i> (including <i>Mauritia palm</i>), <i>Ephedraceae</i> , <i>Myricaceae</i> , <i>Rubiaceae</i>	Yes	Yes
Freshwater swamps	<i>Chenopodiaceae</i> , <i>Cupressaceae</i> , <i>Cyathaceae</i> , <i>Cyrtillaceae</i> , <i>Engelhardtia</i> , <i>Gleicheniaceae</i> , <i>Ilex</i> , <i>Lygodiacae</i> , <i>Mastixiaceae</i> , <i>Myricaceae</i> , <i>Nymphaeaceae</i> , <i>Nyssa</i> , <i>Osmundaceae</i> , <i>Polypodiaceae</i> , <i>Pteris</i> , <i>Sapotaceae</i> , <i>Schizaceae</i> , <i>Belagilaceae</i> , <i>Sporangiaceae</i> , <i>Taxodiaceae</i> , <i>Typhaceae</i> , <i>Urticaceae</i>	Yes	Yes
Lowland-riparian	<i>Anacardiaceae</i> , <i>Araliaceae</i> , <i>Betulaceae</i> , <i>Carya</i> , <i>Celtis</i> , <i>Corylaceae</i> , <i>Cycadaceae</i> , <i>Cyrtillaceae</i> , <i>Eleagraceae</i> , <i>Engelhardtia</i> , <i>Fagaceae</i> , <i>Icacinaeaceae</i> , <i>Ilex</i> , <i>Juglandaceae</i> , <i>Myricaceae</i> , <i>Oleaceae</i> , <i>Pinus</i> , <i>Platanus</i> , <i>Podaceae</i> , <i>Pterocarpya</i> , <i>Rosaceae</i> , <i>Rutaceae</i> , <i>Salix</i> , <i>Sambucus</i> , <i>Sapotaceae</i> , <i>Smaroubaceae</i> , <i>Tilia</i> , <i>Ulmus</i> , <i>Vitaceae</i>	Yes	Yes
Montane	<i>Abies</i> , <i>Cathaya</i> , <i>Fagaceae</i> (including <i>Quercus</i> , <i>Castanea</i>), <i>Ficus</i> , <i>Pinus</i> , <i>Symplocaceae</i>	Yes	Yes
Steppe	<i>Artemisia</i> , <i>Ephedra</i>	No	Yes
Mid-altitude forest	<i>Cathaya</i> , <i>Cedrus</i> , <i>Pinus diploxylon</i>	No	Yes

- But no evident tipping point into MAT, CMT, WMT and MAP via coexistence approach data, from Kayseri-Özer (2013); Akgün et al. (2021); Akkiraz et al. (2022); (Figure 2). Even difficult to identify any trend.

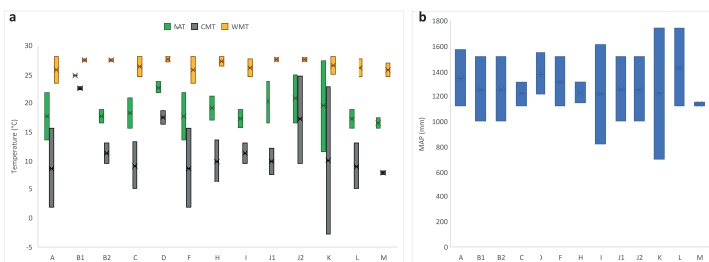


Figure 3. Graphical synthesis of coexistence approach data from Kayseri-Özer (2013); Akgün et al. (2021); Akkiraz et al. (2022). From left to right: oldest to youngest locality. a: MAT (Mean Annual Temperature), CMT (Coldest Month Temperature), WMT (Warmest Month Temperature), in °C. b: MAP (Mean Annual Precipitation) in mm. Letters: see Table 1.

- No evident environmental switchover around 40 Ma (few localities, mostly Early-Middle Eocene)?

New surveys (2023)

- New field campaign in September 2023: Eocene localities from Central Anatolia (Table 1, Figure 3, 4).

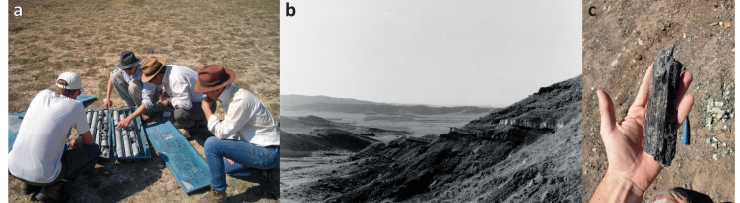


Figure 3. a: Field photo from Çamili (©Paul Botté); from left to right Leny Monthéil, Alexis Licht, Mehmet Serkan Akkiraz, Benjamin Raynaud. b: Field photo from Büyükteflek (©Paul Botté). c: Fossil wood from Bultu-Zile.

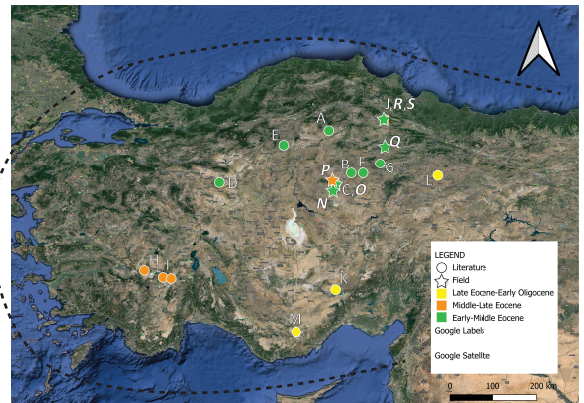


Figure 4. Map of the different Eocene Turkish localities mentioned in the literature (A-M, circles) and that were sampled in September 2023 (N-S, stars). Early-Middle Eocene in green, Middle-Late Eocene in orange, Late Eocene-Early Oligocene in yellow. Letters: see Table 1 and 3.

- Focus on one Bultu-Zile palynological sample (23BZ2.04B2). Lutetian lignite level.
- Wood remains from Büyükteflek are not well preserved: difficult to get a precise identification.
- Climate reconstructions, different methods, including coexistence approach (Mosbrugger & Utescher 1997).

Preliminary results

- Overview of palynomorph slide 23BZ2.04B2: 42 % of ferns, 54,7 % of conifers and 8,7 % of angiosperms (Figure 5). Three taxa respectively represented by e.g. *Leiotriletes*, *Cathayapollis* or *Plicatopollis*.

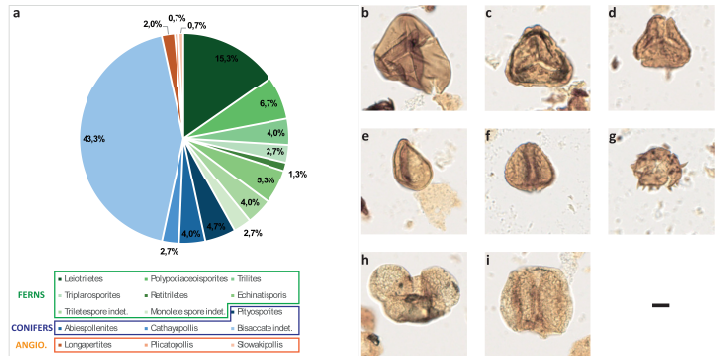


Figure 5. a: Pie-chart of the different great taxa represented in the slide 23BZ2.04B2, from Bultu-Zile. Ferns in green, conifers in blue, angiosperms in orange. Light microscope photographs of some palynomorphs from the Bultu-Zile slide 23BZ2.04B2. b: *Leiotriletes*; c: *Polyodiaceoisporites*; d: *Triletes*; e: *Triplanosporites*; f: *Retritriletes*; g: *Echinatisporis*; h: *Pityosporites*; i: *Cathayapollis*. Scale: 20 µm.

- Lutetian-congruent environment with freshwater (e.g. *Lygodiacae*), lowland-riparian (e.g. *Icacinaeaceae*) and montane (e.g. *Abies*) components.
- Unusual surrepresentation of conifers for Lutetian.

Conclusion & next steps

- Eocene Turkish flora are not much characterized (Collinson & Hooker 2003).
- Mostly Early-Middle Eocene localities in the literature.
- Bultu-Zile palynomorphs indicate freshwater, lowland-riparian and montane environments.
- Congruent with a tropical climate before 40 Ma. But unusually many conifers.
- Futur field campaign into younger localities (Priabonian-Rupelian) of Turkey and in other Balkanatolian countries.

References et al.



XV. International Palynological Congress (IPC)
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Prague, Czech Republic
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Session T01: Challenges in studying Cenozoic vegetation history - In memoriam Zlatko Kvaček (1937-2020)

Poster title: Reconstructing the evolution of Eocene ecosystems in southern Eurasia to better understand past mammalian dispersals

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Abstract:

During early and middle Eocene, the Balkans and Anatolia formed an endemic biogeographic province called Balkanatolia that was separated from mainland Eurasia. This isolation ended around 40 Ma when Asian ungulates dispersed into the province and endemic taxa declined. The paleoenvironments of this biogeographic province remain yet poorly known. The goal of this PhD project is to characterize the flora and the local climate of Balkanatolia (rainfall seasonality, aridity) to better understand what could have favoured these biogeographic changes. The work presented here is twofold. First, we will present an overview of the current knowledge about the Eocene flora of Balkanatolia. This review will include all kind of vegetal structure preserved in the fossil record (pollen, wood, seeds...). Second, we will present preliminary results on pollen assemblages and fossil wood specimens of different Eocene localities in Central Anatolia yielding endemic Balkanatolian taxa (Çamili, Çiçekdağı, Büyükteflek, Bultu-Zile, Yeni-Çeltek and Eski-Çeltek). Through a taxonomical identification, these palynological results will draw a first reconstruction of forested assemblages before the arrival of Asia-derived mammal fauna. These paleobotanical results will be compared and interpreted with contemporary geochemical proxies and paleontological data to highlight the environmental evolution through the development and demise of Balkanatolia.

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