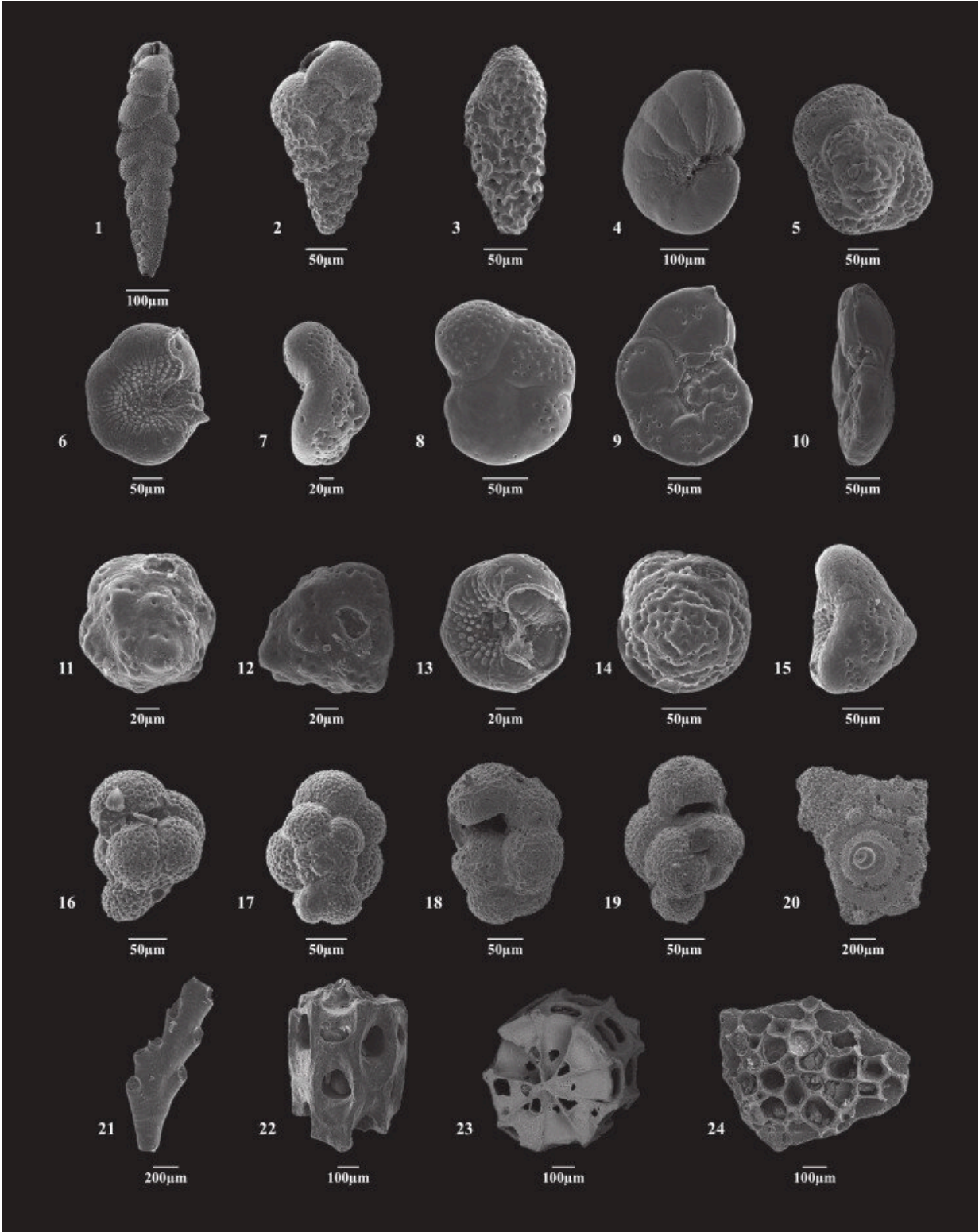


# **A micropaleontology manuscript written 'on the barricades'**

May 3 2023

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Example of Foraminifera found in the samples. Credit: The original article

In the course of the younger Tertiary, a sea spread over the territory of Europe up to the Black and Caspian seas, whose outcrop, the Eastern Paratethys, connected with the Indian Ocean approximately in the area of Iran. Together with the Mediterranean Sea, it formed an important link between the Indian Ocean and the Atlantic and, thanks to the flow of warm water masses in subtropical to equatorial regions, it ensured the maintenance of relatively high air temperatures over the continent.

"It is very interesting and important to study this sea, because the disruption of the mentioned connection, along with other factors, caused the gradual cooling of the Northern Hemisphere, leading to the Ice Ages," says Professor Katarína Holcová, describing the thematic setting of the study.

In Central and Western Europe, scientists have processed the available data regarding this sea thoroughly, but in Eastern Europe (Moldova, Ukraine, Russia, Georgia, and Kazakhstan) the situation is the opposite. Any samples from this area are therefore very interesting, and research should focus primarily on profiles in the Crimean region, which are the most important for paleontologists—the so-called type profiles.

"In the late 1980s, I had the opportunity to look at the type site. At that time, we spent fourteen days on the spot, but even then the Soviet colleagues did not allow us to take samples," recalls Professor Holcová about the unsuccessful expedition. After the annexation of Crimea in 2014, Russian scientists began working intensively in the area.



Photo of the site. Credit: Yuliia V. Vernyhorova

In 2017, Professor Holcová was contacted by Yuliia Vernyhorova from Kyiv (Department of stratigraphy and paleontology of Cenozoic deposits, Institute of Geological Sciences of National Academy of Sciences of Ukraine), a scientist working in paleontology and stratigraphy.

Until 2014, her scientific activity was focused on the study of the Neogene of the Kerch Peninsula, she also provided scientific support for the geological survey of the Kerch Peninsula and the eastern part of the

Crimean Peninsula from 2008 to 2014. Before 2014 she managed to take samples from the Crimean profile.

"Yuliia realizes the great importance of her scientific experiences and the importance of the materials obtained from this area. The whole situation surrounding the research of the Crimean profiles troubled her a lot," explains Professor Holcová.

Yuliia was able to come to Charles University Prague (and subsequently to Ludwig-Maximilians-Universität in Munich) and bring back valuable material in 2018.

"With sacred reverence, she brought such quite small samples," Professor Holcová describes the meeting with the Ukrainian scientist. "Together with other colleagues we agreed that we simply have to deal with such small samples and try to get as much data out of the material as possible."

Scientists from the Faculty of Science of Charles University processed micropaleontology and applied advanced geochemical methods to the samples.

The co-author from Munich (Prof. Dr. Bettina Reichenbacher, Department für Geo- und Umweltwissenschaften, Paläontologie & Geobiologie, Ludwig-Maximilians-Universität München, Germany) processed statoacoustic structures from the inner ear of fish (otoliths), which showed the authors what the water column of the studied sea looked like in the younger Tertiary period, and assisted with structuring the comprehensive manuscript data.

Other colleagues (Nela Doláková, Masaryk University, Brno) processed the pollen that remained in the sediment and based on them calculated temperatures, precipitation, and other data to reconstruct the landscape

on land.

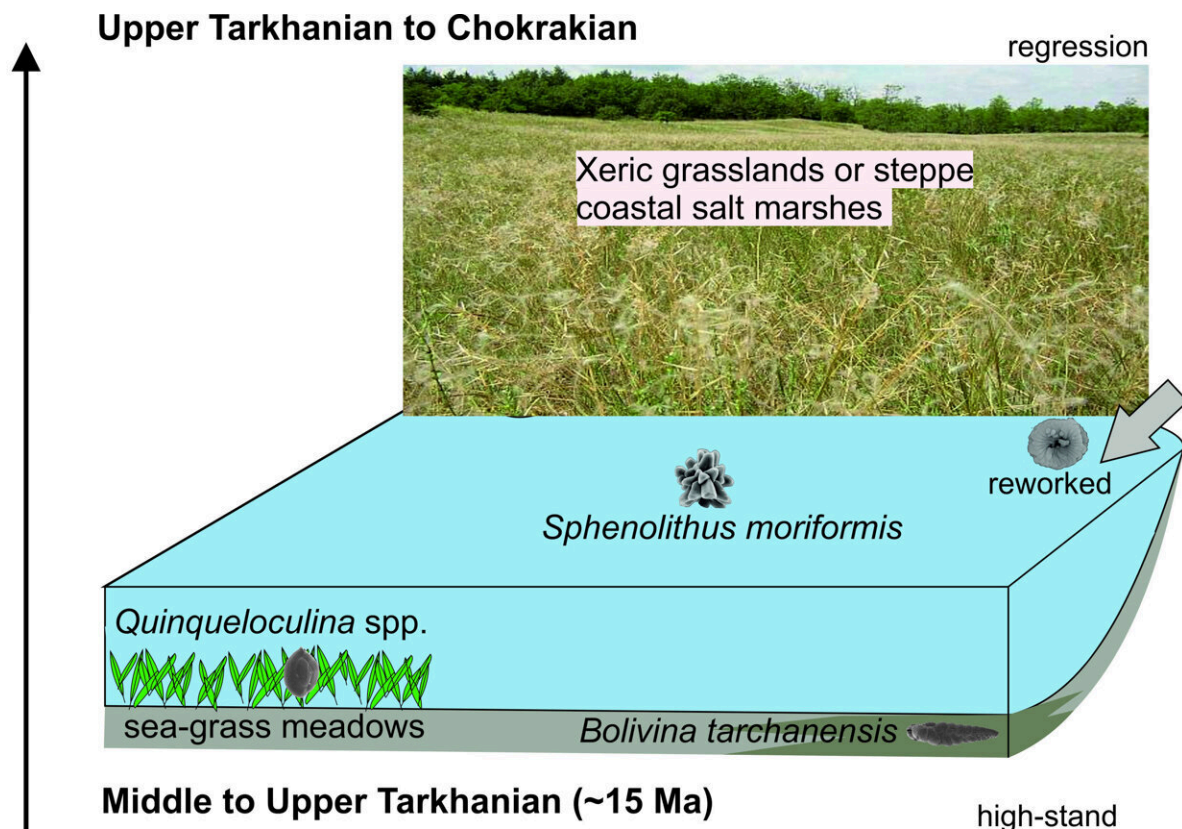
"The material that Yuliia brought had an important geopolitical aspect, but it was also very interesting scientifically. Until now, there has never been a reconstruction of what the landscape looked like on land from that region," explains Professor Holcová. At that time, Central Europe was enjoying the warmest period in the last 15 million years, with dense forests, palm trees, and relatively humid conditions.

It was, therefore, interesting to find out what the landscape on the edge of the vast continent looked like at that time and whether the differences between coastal and inland continental climates were already evident during the Tertiary period.

One of the most interesting results of the work is that there were steppes in the younger Tertiary period in the Crimean region. "We really didn't expect that, because the grassy biotopes are relatively young," comments Professor Holcová on the output of the study. "However, there was clearly steppe vegetation in this area already fourteen million years ago, when things looked completely different in central Europe."

Furthermore, it turned out that the Crimean region was not crucial for communication between the Indian and Atlantic Oceans, it was probably some kind of a bay.

"Direct communication between these bodies of water had to be somewhere else, and unfortunately the most interesting sediments are either not preserved at all, or we cannot find them, because they are in areas such as Iran, where we cannot get to them for political reasons. We often deal with territories where we touch the pain of humanity, and so we increasingly value what we have here," explains Professor Holcová.



Model of the site created by the authors of the article. Credit: The original article

In the article, Yuliia Vernyhorova also summarized the work that Ukrainian scientists have done since the country's independence, when they started publishing in Ukrainian. Therefore, the author tried to summarize the previous results of colleagues who also worked on the profile, but their studies are poorly accessible and little known to the rest of the world due to the language barrier. The research and the article itself are thus really complex and therefore took quite a long time to complete.

"It was completely iconic that we finished the text and style of the manuscript around February 20, 2022. The colleague from Brno did not follow the current news and on the morning of February 24 she sent

Yulia the final edits of the article," Professor Holcová describes the tense situation.

"In the meantime, one colleague had already written to me about what had happened and then we decided that we should react somehow because we had seen what we had sent the article to Yulia into. At that moment, we all really thought that the article was over because Yuliia would have other things to worry about."

But it turned out that the opposite was true, and the scientist started writing the article with perhaps even more vigor. She said she needed something else besides all the horror she experiences every day in the war-torn country. Working on the article meant a vision for her that the terrible situation would one day end and she would be doing science again.

"When she got online, Yuliia kept in touch with us. We were surprised that she was still working hard on the article," Professor Holcová says. "When financial support for Ukrainian scientists arrived, I immediately offered Yulia to come to Prague with her son."

But Yuliia wanted to stay in Ukraine. She decided she couldn't accept evacuation for herself and considered it necessary to stay in Kyiv and help her country win. "Me and my husband helped at the Kyiv barricades. Every day, seven days a week, we went to the humanitarian headquarters at the central Kyiv railway station and as volunteers received and sent humanitarian supplies, distributed ready-made food for refugees, wounded in hospitals, people in bomb shelters, and Ukrainian defenders on the outskirts of Kyiv," says Yuliia Vernyhorova.

At the end of spring 2023, after the liberation of the north of Ukraine, Yuliia and her husband continued their humanitarian mission. Together with active volunteers, they became part of the charitable fund



Renovate, and to this day, in parallel with their main work, they are engaged in humanitarian projects to help people affected by the Russian invasion and also help to provide Ukrainian defenders with the necessary things to bring Ukrainian victory closer.

The situation still did not change, but Yuliia Vernyhorova and her co-authors continued to work hard and gradually improved the article and successfully completed and published it. The editorial board of the journal also appreciated the circumstances of the creation of the manuscript and granted Yulia's article Open Access (the article is freely available on the Internet—editor's note). Just like the editors, the co-authors appreciate and highly praise the bravery that the author showed when she did not give up on the manuscript and finished the article.

The study is published in the journal *Marine Micropaleontology*.

**More information:** Yuliia V. Vernyhorova et al, 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* (2023). [DOI: 10.1016/j.marmicro.2023.102231](https://doi.org/10.1016/j.marmicro.2023.102231)

Provided by Charles University

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