

**Methods and Frontiers in Micropaleontology
- COURSE SYLLABUS**

1.	<p>Course title:</p> <p>Methods and Frontiers in Micropaleontology</p>
2.	<p>Lecturers:</p> <p><i>Prof. dr hab. Jarosław Tyszka – course leader (ING PAN)</i></p> <p><i>Invited lecturers:</i></p> <p><i>Dr Katarzyna Berent (Academic Centre for Materials and Nanotechnology, AGH)</i></p> <p><i>Dr hab. Przemysław Gedl (ING PAN)</i></p> <p><i>Dr Agata Jarzynka (ING PAN)</i></p> <p><i>Dr Michael Lintner (ING PAN)</i></p> <p><i>Dr Igor Niezgodzki (ING PAN)</i></p> <p><i>Dr hab. Joanna Pawłowska, Prof. of the Institute (IO PAN)</i></p> <p><i>Dr Wiesława Radmacher (ING PAN)</i></p> <p><i>Prof. dr hab. Marek Zajączkowski (IO PAN)</i></p>
3.	<p>Field, type and level of studies, year of study:</p> <p><i>geology, paleobiology, paleo/oceanography, biogeochemical methods – full-time doctoral studies</i></p>
4.	<p>Course character:</p> <p><i>compulsory lectures, seminars and discussions</i></p>
5.	<p>Teaching method:</p> <p>ONLINE (<i>interactive contact with lecturers in real time</i>)</p>
6.	<p>Language:</p> <p><i>English, Polish depending on the audience and the lecturer</i></p>
7.	<p>Course type and number of hours:</p> <p>Lecture with seminar elements (30h), Optional workshop (25h)</p>
8.	<p>Estimated load of student's independent work: 20 h</p>
9.	<p>Total workload and number of ECTS points: 50h, 2 ECTS</p> <p>Optional: voluntary movie production published on YouTube ING PAN channel and webpage GeoPlanet Doctoral School 25h, 1 ECTS</p>
10.	<p>Short description and main focus of the course:</p> <p><i>Main goal of this interdisciplinary course is to provide students with critical knowledge on</i></p>

main microfossil groups, their research methodology, and applications in the context of paleoenvironmental interpretation and environmental monitoring. The first part will be devoted to a basic overview of calcareous, siliceous and organic microfossils recorded in marine sediments presented against the geological time scale. The main focus will be given to understanding all aspects of microfossil proxies, stressing their advantages and limitations. We will explore an interface between organic and inorganic domains at sub/microscopic scale. An important part will present classical and the most modern tools and methods applied to micropaleontological studies. The course will further introduce main applications of microfossil proxies, as well as present research trends and frontiers. Most knowledge will be shared by experienced researchers who have dedicated their lives and passion to studying these fields of science.

Our lectures and seminars will include these subjects:

- i. Introduction to the course and micropaleontology [J. Tyszką]
- ii. Biomineralization frontiers: Foraminifera [J. Tyszką]
- iii. Biomineralization: Electron microscopy methods [K. Berent]
- iv. Overview of calcareous microproxies [J. Tyszką]
- v. Overview of siliceous microproxies [J. Tyszką]
- vi. Experimental micropaleontology: Spectroscopic analyses applied to pollution studies [M. Lintner]
- vii. Introduction to palynology (incl. preparation methods, palynomorphs, overview of Dinoflagellata) – [P. Gedl]
- viii. Applied palynology with palynofacies [W. Radmacher]
- ix. The use of spores, pollen, and plant macroremains in solving puzzles [A. Jarzynka]
- x. Molecular methods in micropaleontology [J. Pawłowska]
- xi. Micro-proxies: methods and challenges [M. Zajączkowski]
- xii. Micropaleontological proxies: Reconstruction of paleoenvironments [J. Tyszką]
- xiii. Earth System Models tested on micro/proxies [I. Niezgodzki]
- xiv. Seminar and course supplements [J. Tyszką]
- xv. Seminar and summary of the course [J. Tyszką]

Lectures will be supplemented by interactive seminars with contributions of all participating students. All presentations will be extensively illustrated by high quality graphic data.

As an optional activity, there is an option to produce a short (5-15 mins) popular science movie (documentary) on micropaleontology and/or methods used in this field. The movie can be directly related to doctoral student's own research and interest. The topic and scenario of the movie should be consulted with a lecturer and the course leader. Publication of the video on the ING PAN YouTube channel, as well as on the website of the GeoPlanet Doctoral School will become the basis for the award of ECTS.

11. References:

- Armstrong, H. and Brasier M., 2013. *Microfossils*. Wiley
- Caccianiga M. et al., 2021. Common and much less common scenarios in which botany is crucial for forensic pathologist and anthropologists: a series of eight case studies. *International Journal of Legal Medicine* 135:1067–1077, <https://doi.org/10.1007/s00414-020-02456-0>
- Dybova-Jachowicz S. and Sadowska A. (red.) 2003. *Palinologia*. Instytut Paleobotaniki PAN, Kraków [in Polish]
- Editorial 2006. *Forensic palynology: Why do it and how it works*. *Forensic Science International* 163 (2006) 163–172.
- Jenkins D. G., 1993. *Applied Micropalaeontology*. Kluwer Academic Publishers
- J. Jansonius and D.C. McGregor (eds) *Palynology: principles and applications* (eds, American Association of Stratigraphic Palynologists Foundation, Dallas, Texas.

	<p>Jungck, J.R. et al., 2019. <i>Art Forms in Nature: Radiolaria from Haeckel and Blaschka to 3D nanotomography, quantitative image analysis, evolution, and contemporary art. Theory in Biosciences</i>, 138, pp.159-187.</p> <p>Murray J.W., 2006. <i>Ecology and Applications of Benthic Foraminifera</i>. Cambridge University Press; doi: https://doi.org/10.1017/CBO9780511535529</p> <p>Ohtsuka S. et al., 2015. <i>Marine Protists. Diversity and Dynamics</i>, Springer, pp. 1-648.</p> <p>Saraswati, P.K, Srinivasan, M.S., 2016. <i>Micropaleontology</i>. Springer.</p> <p>Taberlet, P. et al., 2018. <i>Environmental DNA: For Biodiversity Research and Monitoring</i> Oxford Academic, 2018, doi: https://doi.org/10.1093/oso/9780198767220.001.0001</p> <p>Tyson, R.V., 1995. <i>Sedimentary Organic Matter</i>. Chapman & Hall, pp. 1-615.</p>	
12.	<p>Prerequisites:</p> <p><i>Knowledge of paleontology, general geology, sedimentology, ecology, oceanography at undergraduate level</i></p>	
13.	<p>Educational outcomes:</p> <p>Knowledge: <i>student knows basic features of main groups of microfossils recorded in the Paleozoic, Mesozoic and Cenozoic strata; knows tools and methods applied to micropaleontological and actualistic studies.</i></p> <p>Practical Skills: <i>student knows preparation methodology of calcareous, siliceous and organic microfossils; knows how to study and identify main groups of microfossils; is aware about paleo/ environmental context of presented microorganisms; knows how to use micropaleontological data in order to interpret biostratigraphy, to reconstruct paleoenvironment; understands biomineralization, taphonomic, and sedimentary processes.</i></p> <p>Social Skills: <i>student is able to critically apprehend presented material, ask questions, and to understand importance of team work in professional endeavors.</i></p>	<p>PQF level 8 codes:</p> <p>P8S_WG</p> <p>P8S_UW, P8S_UU</p> <p>P8S_KK</p>
14.	<p>Evaluation of the educational outcomes:</p> <p><i>Presentation, student's commitment during the classes, discussions during lecture and seminars</i></p>	
15.	<p>Criteria to complete the course:</p> <p><i>at least 90% attendance, final grade depends on the evaluation of the presentation and the student's commitment during the classes</i></p>	
16.	<p>Contact with the course leader/lecturer:</p> <p><i>ndtyszka@cyfronet.pl (no major time restrictions), meetings on Zoom/Messenger/Whatsapp or F2F in Kraków (Institute of Geological Sciences, Polish Academy of Sciences, Research Center in Kraków, ul. Senacka 1) are possible upon earlier agreements</i></p>	