Methods and Interpretation in Mineralogy
– COURSE SYLLABUS

1.	**Course title:**	
	Methods and Interpretation in Mineralogy	
2.	**Lecturers:**	
	Dr hab. Leonid Shumlyanskyy, dr Aneta Anczkiewicz, prof. dr hab. Arkadiusz Derkowski, dr Fabian Tramm, dr Igor Niezgodzki, dr Jérémie Soldner, dr hab. Marek Szczerba *dr hab. Marek Szczerba – course cooridnator*	
3.	**Field, type and level of studies, year of study:**	
	geology, geochemistry, mineralogy – full-time doctoral studies, all years	
4.	**Course character:**	
	compulsory lectures, seminars and discussions	
5.	**Teaching method:**	
	ONLINE *(interactive contact with lecturers in real time)* *The lecture will be held every Tuesday at 14:00, starting on 10 March 2026*	
6.	**Language:**	*English*
7.	**Course type and number of hours:**	
	Lecture with seminar elements (30h)	
8.	**Estimated load of student's independent work:**	**10 h**
9.	**Total workload and number of ECTS points:**	**2 ECTS**
10.	**Short description and main focus of the course:**	
	This lecture series synthesizes current research on geological time, mineral structures, and analytical methodologies, providing a comprehensive framework for understanding contemporary mineralogical research. *Block I - Geological Time and Context; Leonid Shumlyanskyy (3) and, Aneta Anczkiewicz (1). The first block will include perspectives on how novel geochronological (including fission tracks) and isotope geochemical methods applied to ancient materials, such as e.g. zircons from early Archean cratons, help address questions about the formation and evolution of the Earth's continental crust and the initiation of plate tectonics through Earth history.* *Block II - Clay Mineralogy and Structural Complexity, Arkadiusz Derkowski (4)* *The second block focuses on clay mineralogy and the structural complexity of layered materials. Lectures will cover all types of clay minerals, their structural disorder and how it affect their properties. Applications in industry, environmental science, and geotechnical engineering will also be discussed.* *Block III - Methods and Modelling; Fabian Tramm (1), Igor Niezgodzki (1), Jérémie Soldner (2), Marek Szczerba (1)*	

	The third block focuses on experimental, computational, and modelling approaches in Earth Sciences. Lectures will cover a wide range of topics, including Raman spectroscopy, transmission electron microscopy, numerical palaeoclimate simulations, use of Perple_X for phase equilibria modelling, and molecular simulations. Lectures will be supplemented by interactive seminars with contributions of all participating students.	
11.	**References:**	
	• *Harrison, T. M. (2009). The Hadean crust: evidence from> 4 Ga zircons. Annual Review of Earth and Planetary Sciences, 37(1), 479-505.* • *Moore, D. M., & Reynolds, R. C. (1997) X-Ray Diffraction and the Identification and Analysis of Clay Minerals. Oxford University Press.* • *Theng, B. K. G., & Lagaly, G. (2006). Handbook of clay science. B. K. Theng, G. Lagaly, & F. Bergaya (Eds.). Amsterdam: Elsevier.* • *Ferraro, J. R. (2003). Introductory raman spectroscopy. Elsevier.* • *Connolly, J. A. (2005). Computation of phase equilibria by linear programming: a tool for geodynamic modeling and its application to subduction zone decarbonation. Earth and Planetary Science Letters, 236(1-2), 524-541.* • *Cygan, R. T., Liang, J. J., & Kalinichev, A. G. (2004). Molecular models of hydroxide, oxyhydroxide, and clay phases and the development of a general force field. The Journal of Physical Chemistry B, 108(4), 1255-1266.*	
12.	**Prerequisites:**	
	Basic knowledge of geology or Earth sciences	
13.	**Educational outcomes:**	**PQF level 8 codes:**
	Knowledge: *The student has basic knowledge of Earth history, clay mineral structures, and modern analytical and modelling methods.*	*P8S_WG*
	Practical Skills: *This course introduces advanced mineralogical and geochemical methods, including: Raman spectroscopy, TEM, AFT and phase equilibria calculations. Students will develop skills in interpretation of multi-method analytical data, and the application of experimental and computational approaches to investigate phase equilibria, clay mineral structures, and processes related to crustal evolution, diagenesis, and low-temperature metamorphism.*	*P8S_UW, P8S_UU*
	Social Skills: *The student is able to evaluate the presented material critically, ask questions. They can apply the acquired knowledge in planning future research activities.*	*P8S_KK*
14.	**Evaluation of the educational outcomes:**	
	Student's commitment during the classes, discussions during lectures and seminars.	
15.	**Criteria to complete the course:**	
	Minimum 80% of attendance, final grade depends on the student's commitment during the	

	classes.
16.	**Contact with the course leader/lecturer:**
	dr hab. Marek Szczerba. e-mail: m.szczerba@ingpan.krakow.pl – course coordinator