

GI261 Cyclostratigraphy and Astrochronology

Faculty of Science

Autumn 2022

Extent and Intensity

1/1/0. 3 credit(s). Type of Completion: zk (examination).

Taught in person.

Teacher(s)

Jeffrey Over (lecturer), [Mgr. Tomáš Kumpan, Ph.D.](#) (deputy)

[Mgr. Tomáš Kumpan, Ph.D.](#) (alternate examiner)

Guaranteed by

[Mgr. Tomáš Kumpan, Ph.D.](#)

[Department of Geological Sciences - Earth Sciences Section - Faculty of Science](#)

Contact Person: [doc. Mgr. Martin Ivanov, Dr.](#)

Supplier department: [Department of Geological Sciences - Earth Sciences Section - Faculty of Science](#)

Prerequisites (in Czech)

G3061 Historická a stratigrafická geologie, G3021 Petrografie

Timetable

Thursday 13:00 - 15:00

Course Enrolment Limitations

The course is also offered to the students of the fields other than those the course is directly associated with.

The capacity limit for the course is 45 student(s).

Current registration and enrolment status: enrolled: **0**/45, only registered: **14**/45, only registered with preference (fields directly associated with the programme): **14**/45

fields of study / plans the course is directly associated with

there are 60 fields of study the course is directly associated with, [display](#)

Course objectives (in Czech)

Investigation of the principles and application of cyclostratigraphy and astrochronology in refinement of the geological time scale through presentations by students and faculty of current literature and research.

Learning outcomes (in Czech)

Upon successful completion of this course, students will have an understanding of the nature and scale of cyclostratigraphy and the applications to absolute time in the geological record.

Syllabus

Week 1	15 Sept	field classes
Week 2	22 Sept	Introduction to cyclostratigraphy and astrochronology
Week 3	29 Sept	no meeting
Week 4	06 Oct	research paper/student-faculty discussion

Week 5	13 Oct	research paper/student-faculty discussion
Week 6	20 Oct	research paper/student-faculty discussion; Dr. Kateřina Kloubová – Czech Republic Fulbright Commission
Week 7	27 Oct	research paper/student-faculty discussion Hyks / Duration of Lower Oxfordian Cordatum ammonite Zone;
Week 8	03 Nov	research paper/student-faculty discussion Hazmuka;
Week 9	10 Nov	research paper/student-faculty discussion Dubjelova;
Week 10	17 Nov holiday	no meeting
Week 11	24 Nov	research paper/student-faculty discussion Damborsky; Kozakova
Week 12	01 Dec	research paper/student-faculty discussion Sobek; Sotorrio Gonzalez
Week 13	08 Dec	research paper/student-faculty discussion Rajnoch; Khoshyar
Week 14	15 Dec	review and summary

Nečas, Fojt, Barchanek

Literature

Required literature

- Hinnov, L.A., Hilgen, F.J., 2012. Chapter 4. Cyclostratigraphy and Astrochronology. *In* Gradstein, F.M., Ogg, J., Schmitz, M., Ogg, G. (eds.), *The Geologic Time Scale 2012*, Elsevier. p. 63–83.
- Laskar, J., 2020. Astrochronology. *In* Gradstein, F.M., Ogg, J.G., Schmitz, M., Ogg, G. (eds.), *The Geologic Time Scale 2020*. Elsevier, Amsterdam, p. 139-158.
- Strasser, A., Hilgen, F.J., Heckel, P.H., 2006. Cyclostratigraphy - concepts, definitions, and applications. *Newsletter in Stratigraphy* 42:75–114.

Not specified

see below

Teaching methods (in Czech)

Theoretical lectures, assignments, group discussion and presentations

Assessment methods (in Czech)

Evaluation of presentation and discussion

Language of instruction

English

Further Comments

- The course can also be completed outside the examination period.
- The course is taught only once.
- The course is taught: every week.

Teaching methods

Group discussion and presentations

Assessment methods

Evaluation of presentation and discussion

Final grade will be S - satisfactory; F - unsatisfactory

Cyclostratigraphy and Astrochronology

- Bard, E., Raisbeck, G.M., Yiou, F., Jouzel, J., 1997. Solar modulation of cosmogenic nuclide production over the last millennium: comparison between ^{14}C and ^{10}Be records. *Earth and Planetary Science Letters* 150 (3-4):453–462.
- Berger, A., Loutre, M.F., and Laskar, J., 1992. Stability of the astronomical frequencies over the Earth's history for paleoclimate studies. *Science* 255, no. 5044:560–566, <https://doi.org/10.1126/science.255.5044.560>.
- Bray, J.R., 1968. Glaciation and solar activity since the fifth century B.C and the solar cycle. *Nature* 220:672–674.
- Da Silva A.C., Dekkers, M.J., De Vleeschouwer, D., Hladil, J., Chadimova, L., Slavik, L., and Hilgen, F.J., 2019. Millennial-scale climate changes manifest Milankovitch combination tones and Hallstatt solar cycles in the Devonian greenhouse world. *Geology* 47:19–22.
- De Vleeschouwer, D., Da Silva, A.-C., Sinnesael, M., Chen, D., Day, J.E., Whalen, M.T., Guo, Z., and Claeys, P., 2017. Timing and pacing of the Late Devonian mass extinction event regulated by eccentricity and obliquity. *Nature Communications* 8, no. 2268, <https://doi.org/10.1038/s41467-017-02407-1>.
- De Vleeschouwer, D., Parnell, A.C., 2014. Reducing time-scale uncertainty for the Devonian by integrating astrochronology and bayesian statistics. *Geology* 42:491–494.
- Franco, D.R., Hinnov, L.A., and Ernesto, M., 2012. Millennial-scale climate cycles in Permian–Carboniferous rhythmites: Permanent feature throughout geologic time? *Geology* 40:19–22.
- Hinnov, L.A., 2013. Cyclostratigraphy and its revolutionizing applications in the earth and planetary sciences. *Geological Society of America Bulletin* 125:1703–1734.
- Hinnov, L.A., Hilgen, F.J., 2012. Chapter 4. Cyclostratigraphy and Astrochronology. In Gradstein, F.M., Ogg, J., Schmitz, M., Ogg, G. (eds.), *The Geologic Time Scale 2012*, Elsevier. p. 63–83.
- Lakin, J., Marshall, J., Troth, I., Harding, I., 2016. Greenhouse to icehouse: a biostratigraphic review of latest Devonian–Mississippian glaciations and their global effects. In Becker, R.T., Königshof, P., Brett, C.E. (eds.), *Devonian Climate, Sea Level and Evolutionary Events*. 423. Geological Society, London, Special Publications, 439–464.
- Laskar, J., 2020. Astrochronology. In Gradstein, F.M., Ogg, J.G., Schmitz, M., Ogg, G. (eds.), *The Geologic Time Scale 2020*. Elsevier, Amsterdam, p. 139–158.
- Meyers, S.R., 2015. The evaluation of eccentricity-related amplitude modulation and bundling in paleoclimate data: an inverse approach for astrochronologic testing and time scale optimization. *Paleoceanography* 30:1625–1640.
- Meyers, S.R., 2019. Cyclostratigraphy and the problem of astrochronologic testing. *Earth Science Reviews* 190:190–223.
- Mörner, N.A., 2015. The approaching new grand solar minimum and little ice age climate conditions. *Nature Science Communications* 7:510–518.
- Pas, D., Hinnov, L., Day, J.E., Kodama, K., Sinnesael, M., Liu, W., 2018. Cyclostratigraphic calibration of the Famennian stage (Late Devonian, Illinois Basin, USA). *Earth and Planetary Science Letters* 488:102–114.
- Strasser, A., Hilgen, F.J., Heckel, P.H., 2006. Cyclostratigraphy - concepts, definitions, and applications. *Newsletter in Stratigraphy* 42:75–114.
- Usoskin, I.G., Gallet, Y., Lopes, F., Kovaltsov, G.A., Hulot, G., 2016. Solar activity during the Holocene: the Hallstatt cycle and its consequence for grand minima and maxima. *Astronomy and Astrophysics* 587, A150.