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UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	GEOKEMIJA SEDIMENTNIH KARBONATOV
Course title:	GEOCHEMISTRY OF SEDIMENTARY CARBONATES

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Okoljske in regionalne študije, doktorski študij 3. stopnje	Modul Modul Paleobiologija in sedimentarna geologija		
Environmental and Regional Studies, doctoral study 3rd level	Module Module Palaeobiology and Sedimentary geology		

Vrsta predmeta / Course type	Izbirni/Elective
Univerzitetna koda predmeta / University course code:	DIP07

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work		ECTS
30	10	20			120		6

Nosilec predmeta / Lecturer:	Doc. dr. Špela Goričan, izr. prof. dr. Aleksander Horvat (ostali izvajalci: doc. dr. Alenka Eva Črne)

Jeziki / Languages:	**Predavanja / Lectures:**	slovenščina, angleščina / Slovene, English
	Vaje / Tutorial:	slovenščina, angleščina / Slovene, English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisite:**
Vpis v 1. letnik.	Inscription to the 1st academic year.

Vsebina:	**Content (Syllabus outline):**
• Dolgoročni ogljikov cikel. • Mineralogija, kemija in reakcijska kinetika glavnih karbonatnih faz (kalcit, dolomit, aragonit). • Sistem CO_2-ogljikova kislina in kemija raztopin. • Interakcije med karbonatnimi minerali in raztopinami. • Koprecipitacija in trdne raztopine karbonatnih mineralov. • Biološko formirani in inducirani karbonatni minerali	• Long-term carbon cycle. • Mineralogy, chemistry and reaction kinetics of major carbonate phases (calcite, dolomite, aragonite). • The CO_2-carbonic acid system and solution chemistry. • Interactions between carbonate minerals and solutions. • Coprecipitation reactions and solid solutions of carbonate minerals. • Biologically formed and biologically induced carbonate precipitation.

● Karbonatni sistem v oceanih in akumulacija globokomorskih karbonatnih sedimentov. ● Sestava in izvor plitvovodnih karbonatnih sedimentov. ● Zgodnja diageneza. ● Vpliv podzemnih procesov in metamorfizma. ● $\delta^{13}C$, $\delta^{18}O$, $^{87}Sr/^{86}Sr$, sledne prvine in elementi redkih zemelj (REE): indikatorji paleo-okolja ali/in diageneze. ● Kratkoročni ogljikov cikel in vpliv človeka.	● The oceanic carbonate system and preservation of deep-sea carbonates. ● Composition and source of shallow-water carbonate sediments ● Early diagenesis. ● Burial and metamorphism. ● $\delta^{13}C$, $\delta^{18}O$, $^{87}Sr/^{86}Sr$, trace elements and REE incorporation: paleoenvironmental vs. diagenetic proxies. ● Short-term carbon cycle and human impact.

Temeljni literatura in viri / Readings:

Izbrana poglavja in članki/Selected chapters and papers:

- Morse JW, Mackenzie FT (1990) *Geochemistry of sedimentary carbonates*. Elsevier, Amsterdam.
- Holland H, Turekian K, eds. (2014) *Treatise on Geochemistry*, izbrana poglavja iz **Vol. 9**: Sediments, Diagenesis and Sedimentary Rocks, in **Vol. 7**: Surface and Groundwater, Weathering and Soils.
- Morse JW, Arvidson RS, Luttge A (2007) Calcium carbonate formation and dissolution. *Chemical Reviews* **107**: 342-381.
- Machel HG (2004) Concepts and models of dolomitization: a critical reappraisal. In: Braithwaite CJR, Rizzi G, Darke G (eds) The *Geometry and Petrogenesis of Dolomite Hydrocarbon Reservoirs*, Special Publication **235**. Geological Society, London, 7-63.

Cilji in kompetence:

Namen predmeta je poglobiti znanje o nastanku karbonatnih mineralov in sedimentov v različnih okoljih. Študent/ka bo spoznal in znal uporabiti osnovne fizikalno-kemične zakonitosti, ki vplivajo na nastanek karbonatnih mineralov in sedimentov. Študent/ka bo pridobil/a pregled nad aktualnimi geokemijskimi indikatorji paleokolja in diageneze. Znanje bo znal/a praktično uporabiti pri interpretaciji paleokolja in diageneze recentnih in starejših karbonatov in karbonatnih kamnin.

Objectives and competences:

The purpose of the course is to deepen the knowledge on the occurrence of carbonate minerals and sediments in different environments. Students will learn and know how to use the basic physico-chemical limitations and conditions which affect formation of carbonate minerals and sediments. The students will gain an overview of geochemical proxy indicators currently in use for the reconstruction of past environmental and diagenetic conditions. This knowledge enables interpretation of paleoenvironment and diagenesis of recent and older carbonates and carbonate rocks.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanje in razumevanje:	Knowledge and understanding:
Študent pozna vidike karbonatnih mineralov in njihovih interakcij z vodnimi raztopinami. Loči nastanek primarnih karbonatnih mineralov in sedimentov v različnih okoljih od kasnejših diagenetskih in metamorfnih mineralov. Za interpretacijo paleokolja nastanka karbonatnih kamnin in za ovrednotenje diageneze zna uporabiti številne geokemijske indikatorje. Pri interpretaciji (paleo)okolja in sprememb na Zemljini površini zna opredeliti vlogo globalnega kroženje ogljika.	The student knows the basic aspects of carbonate minerals, and their interaction with the aqueous solution. He/she differentiates between early carbonate precipitates in different surface environments from later diagenetic and metamorphic overprints. In order to interpret the paleoenvironment of carbonate rock formation and assess the diagenetic overprints, he/she is able to use a wide range of geochemical proxies. When interpreting the (paleo)environment and changes on the Earth's surface he/she is able to define the role of the global carbon cycle.

Metode poučevanja in učenja:	**Learning and teaching methods:**
● Predavanja ● e-učenje ● Seminarji ● Praktične vaje	● Lectures ● e-learning ● Seminars ● Practical training

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
● Pisni ali ustni izpit	60	● Written or oral exam
● Predstavitev izbrane teme	40	● Presentation of a chosen topic

Reference nosilca / Lecturer's references:

Doc. dr. Špela Goričan

1. Cifer, T., **Goričan, Š.**, Gawlick, H.-J., Auer, M. 2020: Pliensbachian, Early Jurassic radiolarians from Mount Rettenstein in the Northern Calcareous Alps, Austria. Acta Palaeontologica Polonica, 65/1, 167-207.
2. **Goričan, Š.**, O'dogherty, L., Baumgartner, P. O., Carter, E. S., Matsuoka, A. 2018: Mesozoic radiolarian biochronology : current status and future directions. Revue de micropaléontologie, 61/3-4, 165-189.
3. Jach, R., **Goričan, Š.**, Reháková, D., Uchman, A., Iwańczuk, J.2018: Comment on "Decadal to millennial variations in water column parameters in pelagic marine environments of the Western Tethys (Carpathian realm) during Middle-Late Jurassic : evidence from the radiolarian record" by M. Bąk, K. Bąk and M. Michalik : discussion. *Global and planetary change*. str. 1-6. DOI: 10.1016/j.gloplacha.2018.10.009
4. O'Dogherty, L., Aguado Merlo, R., Baumgartner, P. O., Bill, M., **Goričan, Š.**, Sandoval, J., Sequeiros, .2018: Carbon-isotope stratigraphy and pelagic biofacies of the Middle-Upper Jurassic transition in the Tethys-Central Atlantic connection. Palaeogeography, palaeoclimatology, palaeoecology. 507, 129-144.
5. Gawlick, H.-J., Missoni, S., Sudar, M., **Goričan, Š.,** Lein, R., Stanzel, A. I., Jovanović, D. 2017: Open-marine Hallstatt Limestones reworked in the Jurassic Zlatar Mélange (SW Serbia) : a contribution to understanding the orogenic evolution of the Inner Dinarides. Facies, 63/4 1-25.

Izr. prof. dr. Aleksander Horvat

1. Tulan E., Sachsenhofer, R. F., Tari, G., Witkowski, J., Tămaș, D. M. , **Horvat, A.**, Tămaș, A. 2020: Hydrocarbon source rock potential and paleoenvironment of lower Miocene diatomites in the Eastern Carpathians Bend Zone (Sibiciu de Sus, Romania). Geologica Carpathica, 71.
2. Goričan, Š., Žibret, L., Košir, A., Kukoč, D., **Horvat, A.** 2018: Stratigraphic correlation and structural position of Lower Cretaceous flysch-type deposits in the eastern Southern Alps (NW Slovenia). International journal of earth sciences, 107/8, 2933-2953.
3. Moro, A**., Horvat, A.**, Tomić, V., Sremac, J. Bermanec, V. 2018: Facies development and paleoecology of rudists and corals: : an example of Campanian transgressive sediments from northern Croatia, northeastern Slovenia, and northwestern Bosnia. Facies, 62/19, 18-25. DOI: 10.1007/s10347-016-0471-y.
4. Moro, A., Velić, I., Mikuž, V., **Horvat, A.** 2018: Microfacies characteristics of carbonate cobble from Campanian of Slovenj Gradec (Slovenia) : implications for determining the Fleuryana adriatica De Castro, Drobne and Gušić paleoniche and extending the biostratigraphic range in the Tethyan realm. Mining-Geology-Petroleum Engineering Bull.,42, 1-13. DOI: 10.17794/rgn.2018.4.1.
5. **Horvat, A**. 2016: Distephanopsis concavus Horvat : a revised silicoflagellate species from the Middle Miocene of the Central Paratethys. Geologija, 59/2, 233-241. DOI: 10.5474/geologija.2016.014.

Doc. dr. Alenka Eva Črne

1. Joosu, L., Lepland, A., Kirsimae, k., Romashkin, A.E., Roberts, N.M.W., Martin, A.P.& **Črne, A.E.** 2015. The REE-composition and petrography of apatite in 2Ga Zaonega Formation, Russia: The environmental setting for phosphogenesis. *Chemical Geology*, 395, 88-107.
2. **Črne, A.E.**, Melezhik, V.A., Lepland, A., Fallick, A.E., Prave, A.R. & Brasier, A.T. 2014. Petrography and geochemistry of carbonate rocks of the Zaonega Formation, Russia: documentation of ^{13}C-depleted non-primary calcite. *Precambrian Research*, 240, 79-93.
3. Qu, Y., **Črne, A.E.**, Lepland, A., van Zuilen, M. 2012. Methanotrophy in a Paleoproterozoic oil field ecosystem, Zaonega Formation, Karelia, Russia. – *Geobiology*, 10, 467-478.
4. Kump, L. R., Junium, C., Arthur, M. A., Brasier, A. T., Fallick, A. E., Melezhik, V. A., Lepland, A., **Črne, A.E.**, Luo, G. 2011. Isotopic evidence for massive oxidation of organic matter following the great oxidation event. – *Science*, 334 (6063), 1694-1696.
5. **Črne, A.E.,** Weissert, H.J., Goričan, Š., Bernasconi, S.M. 2011. A biocalcification crisis at the Triassic-Jurassic boundary recorded in the Budva Basin (Dinarides, Montenegro). – *Geol. Soc. Amer. Bull.*, 123 (1-2), 40-50.