UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Analiza sedimentacijskih okolij
Course title:	Sedimentary Environments
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0067733
Koda učne enote na članici/UL Member course code:	717

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
60	30	30	0	30	150	10

Nosilec predmeta/Lecturer:	Andrej Šmuc
Vrsta predmeta/Course type:	Obvezni / Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Osnovno znanje geologije, sedimentologije, strukturne geologije in tektonike in stratigrafije pridobljeno na dodiplomskem študiju. Obveznosti študenta: Študent mora redno obiskovati vaje, oddati vse zahtevane samostojne naloge ter opraviti preizkus teoretičnega in praktičnega znanja.	Basic knowledge of geology, sedimentology, structural geology and tectonics and stratigraphy acquired at the undergraduate level. The student must regularly attend excercises and submit all required tasks and pass the test of theoretical and practical knowledge.

Vsebina:	Content (Syllabus outline):
Sedimentna okolja; definicije, klasifikacija in osnovne značilnosti Vplivni faktorji na sedimentno zaporedje Mehanizmi nastanka različnih sedimentnih okolij Aluvialni sistemi Jezera Puščavska sedimentacijska okolja Klastične obale Plitva klastična morja Morski evaporiti Plitvovodna karbonatna okolja Globljemorsko okolje Glacialna okolja Vulkanska okolja Izdelava seminarske naloge	Sedimentary environment; definitions, classification and basic characteristics Influencing factors on the sedimentary sequence Mechanisms of origin of different sedimentary environments Alluvial Systems Lakes Deserta Clastic coasts Shallow marine clastic seas Marine evaporite environments Shallow water carbonate environments Deepwater environment Glacial environemts Volcanic environment Seminar work

Temeljna literatura in viri/Readings:

NICHOLS, G.,2009, Sedimentology and Stratigraphy, Wiley-Blackwell,419.
READING, H.G.,1996, Sedimentary Environments, Processes, Facies and Stratigraphy, Blackwell Science, 688.
EINSELE, G.,1991, Sedimentary Basins, Evolution, Facies and Sediment Budget, Springer,628.
PERRY, C., TAYLOR, K.,2007, Environmental Sedimentology, Blackwell, 441.
BENN, D.I, EVANS, D.J.A., 2010, Glaciers and Glaciation, Routledge, 802.
CAS, R.A.F., WRIGHT, J.V.,1995, Volcanic successions, Modern and Ancient. Chapman & Hall, 528.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Cilj predmeta je študente seznaniti z različnimi sedimentnimi okolji, procesi, ki se v njih odvijajo ter z dinamiko nastajanja sedimentov. Cilj predmeta je tako spoznavanje in interpretacija različnih sedimentnih zaporedij, značilnih za posamezna okolja ter spoznavnanje njihove odvisosti od lokalnih in globalnih tetkonskih procesov ter klimatskih in bioloških sprememb. KOMPETENCE: Sedimentne kamnine predstavljajo najpogostejše kamine, ki jih najdemo na zemljinem površju. V Sloveniji sedimente kamnine pokrivajo 90% površine, tako da se z njimi v svoji poklicni karieri sreča vsak geolog. Nekdanja sedimentacijska okolja, v katerih so omenjne kamine nastajale, rekonstruiramo najprej preko intepretacije procesa ali procesov, ki so povzročili nastanek določenega tipa sedimentov ter v naslednjem koraku preko interpretacije okolja v katerem so ti procesi potekali. Sedimentacijska okolja v katerih nastajajo kamine so izredno raznolika prav tako pa so raznoliki tudi faktorji, ki vplivajo na sedimentacijo. Sedimentacija v določenem okolju se namreč pojavi kot posledica interakcije med dotokom sedimenta, njegove predelave in modificiranje preko fizikalnih, kemilnih in bioloških procesov ter akomodacijskega prostora. Poznavanje recentnih in nekdanjih sedimentnih okolij, procesov, ki v njih delujejo ter sedimentnih zaporedij, ki so značilna za posamezna okolja je tako bistveno za vse geološke stroke.	OBJECTIVES: The aim of the course is to acquaint students with different sedimentary environments, processes that take place in them, and the dynamics of sedimentation. The aim of the course is understanding and interpretation of various sedimentary sequences specific to each environment and recognition of local and global tectonic processes and climatic and biological changes that took place in them. COMPETENCES: Sedimentary rocks represent the most common rocks which can be found on the Earth's surface. In Slovenia sediment rocks cover 90% of the surface. Former sedimentary environments in which these rocks were formed are reconstructed first in the view of processes that have led to the deposition of sediments, and in the next step over the interpretation of the environment in which these processes take place. Sedimentary environments are very diverse as well as factors affecting the sedimentation. Sedimentation in a particular environment does occur as a result of interaction between the incoming sediment, its processing and modification via physical, chemical and biological processes and accommodation space. Knowledge of recent and past sedimentary environments, processes that are active in them, and of sedimentary sequences, which are specific to each environment is essential for all geological profession.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent spozna različna sedimentacijska okolja in razume procese, ki delujejo v njih. Na podlagi sedimentnih zaporedij zna interpretirati okolja nastanka in dinamiko zapolnjevanja. S pomočjo poznavanja vzrokov sprememb v sedimentaciji razume spremembe regionalnih in lokalnih geoloških procesov in stanj.Zna izbrati in uporabiti ustrezne analitske tehnike ter ustrezno obdelavo podatkov.	Student learns different sedimentary environments and understand the processes operating in them. Based on the sedimentary sequences he or she can interpret environment origin and dynamics of sedimentation. With knowledge of the causes of changes in the sedimentation she or he understand changes in the regional and local geological processes. She can select and use appropriate analytical techniques and appropriate data processing.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z uporabo prezentacij. Izdelava seminarja na izbrano tematiko in njegova javna predstavitev Vaje potekajo kot vodene kabinetne vaje (30 ur) Terenske vaje obsegajo 3 dni dela na terenu.	Lectures by using the presentations. Creating a seminar on a selected topic and its public presentation Exercises will take place as a cabinet-guided exercises (30 hours) Field activities include three days of field work.

Načini ocenjevanja:	Delež/Weight	Assessment:
Izdelava in predstavitev seminarja	30,00 %	Preparation and presentation of seminar
Pisni in/ali ustni izpit	70,00 %	Written and/or oral exam
Za pozitivno oceno mora biti pravilno rešenih najmanj 50% teoretičnih vprašanj.		The positive assessment must be properly resolved, at least 50% of the theoretical issues.

Reference nosilca/Lecturer's references:

ŠMUC, Andrej, ROŽIČ, Boštjan. The Jurassic Prehodavci Formation of the Julian Alps: easternmost outcrops of Rosso Ammonitico in the Southern Alps (NW Slovenia). Swiss journal of geosciences, ISSN 1661-8726, 2010, vol.103, issue 2, str. 241-255, doi:10.1007/s00015-010-0015-3.
MURI, Gregor, ČERMELJ, Branko, JAĆIMOVIĆ, Radojko, SKABERNE, Dragomir, ŠMUC, Andrej, BURNIK ŠTURM, Martina, TURŠIČ, Janja, VREČA, Polona. Consequences of anthropogenic activity for two remote alpine lakes in NW Slovenia as tracked by sediment geochemistry. Journal of paleolimnology, ISSN 0921-2728, 2013, vol. 50, no. 4, str. 457-470, doi: 10.1007/s10933-013-9738-2.
ŠMUC, Andrej. Jurassic and cretaceous stratigraphy and sedimentary evolution of the Julian Alps, NW Slovenia. Ljubljana: Založba ZRC, ZRC SAZU, 2005. 98 str.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Antropogena in recentna sedimentacijska okolja
Course title:	Antropogene and Recent Sedimentary Environments
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562375
Koda učne enote na članici/UL Member course code:	747

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	15	0	0	30	75	5

Nosilec predmeta/Lecturer:	Andrej Šmuc, Nastja Rogan Šmuc
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Osnovno znanje kemije, geologije, sedimentologije in geokemije, pridobljeno na dodiplomskem študiju. Obveznosti študenta: Študent mora oddati vse zahtevane samostojne naloge ter opraviti preizkus teoretičnega in praktičnega znanja.	Basic knowledge of chemistry, geology, sedimentology and geochemistry, acquired at the undergraduate level. Methods: Students must submit all required separate tasks and pass the test of theoretical and practical knowledge.

Vsebina:	Content (Syllabus outline):
Urbana in recentna sedimentna okolja: definicije, klasifikacija in osnovne značilnosti Izvor urbanih sedimentov Transportni procesi Procesi nastajanja sedimentov v urbanih okoljih in njihove lastnosti Jezerska okolja Plitvomorska okolja Evaporitna okolja Jezovi in rezervoarji Poplavne ravnice Jamski sedimenti Onesnaženje sedimentov Upravljanje in načrtovanje urbanih in industrijskih sedimentnih okolij	Urban and recent sedimentary environment; definitions, classification and basic characteristics Sourcing of urban sediments Transport processes Processes of formation of sediments in urban environments and their properties Lake environments Shallow water environments Evaporite environments Dams and reservoirs Floodplains Cave sediments Contamination of sediments The management and planning of urban and industrial sedimentary environments

Temeljna literatura in viri/Readings:

POLETO, C. & CHARLESWORTH S., 2010, Sedimentology of Aqueous Systems, Wiley-Blackwell, 205
LOTTERMOSER, B.G., 2010, Mine Wastes: Characterization, Treatment and Environmental Impacts, Springer, 410pp.

BRINKMANN, R. & TOBIN, G.A., 2003, Urban sediment removal: the science, policy, and management of street sweeping. Kluwer, Dordrecht, 166 pp.
PERRY, C. & TAYLOR, K. G., 2006, Environmental Sedimentology. Wiley, 460 pp.
Urban sediments – A global prespective. 2009, J.Soils and Sediments, vol 9., Special edition.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Cilj predmeta je seznaniti slušatelje z različnimi urbanimi sedimentnimi okolji, procesi in dinamiko nastajanja sedimentov v njih, z lastnostmi omenjenih sedimentov in njihovo interakcijo z okoljem, kar je bistvenega pomena za razumevanje antropogenega onesnaženja. Izkušnje iz študija urbanih sedimentacijskih okoljih so tudi del planiranja pri načrtovanju novih industrijskih in urbanih sedimentacijskih okolij. KOMPETENCE: Urbana okolja so postala integriran del našega življenja, saj več kot 50% svetovne populacije živi v urbanih centrih. Urbani centri predstavljajo glavna prizorišča antropogenih fizikalnih in kemičnih sprememb, ki posredno vodijo v spremembe bioloških sistemov. Človek s svojim poseganjem v prostor ustvarja nova sedimentacijska okolja (cestne površine, kanalizacijski sistemi, jezovi, akumulacijska jezera, reke ipd.), kjer se kopičijo velike količine sedimentov. Družba s svojo dejavnostjo neposredno vpliva na sestavo sedimentov, ki so fizikalno in kemično močno aktivni ter reagirajo z okolno vodo in ekosistemi. Urbana sedimentacijska okolja tako predstavljajo osnovne sisteme za študije antropogenega vpliva okolja in omogočajo spremljanje časovne dinamike antropogenih vplivov na okolje.	OBJECTIVES: The aim of the course is to acquaint students with different urban and recent sedimentary environments, processes and dynamics of sediment in them and also with the properties of mentioned sediments and their interaction with the environment, which is essential for the understanding of anthropogenic pollution. The experience gained from the study of urban depositional environments are also part of the planning in the design of new industrial and urban depositional environments. COMPETENCES: Urban environments have become an integrated part of our lives, as more than 50% of the world's population lives in urban centers. Urban centers are the main venues of anthropogenic physical and chemical changes, which indirectly leads to changes in biological systems. Man with his interference in space creates new sedimentary environments (road surface, drainage systems, dams, reservoirs, rivers, etc.), that accumulate large amounts of sediment. The activities of modern society have a direct impact on the composition of the sediments, which are physically and chemically active and strongly react with the surrounding water and ecosystems. Urban sedimentary environments also represent the basic systems for studies of anthropogenic environmental impact and enable monitoring of temporal dynamics of anthropogenic impacts on the environment.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent pozna urbana sedimentacijska okolja in razume procese, ki delujejo v njih. S pomočjo pridobljenih podatkov zna interpretirati potencialna onesnaženja ter predlagati ustrezne rešitve. Zna izbrati in uporabiti ustrezne analitske tehnike ter ustrezno obdelavo podatkov. Razume fizikalne, kemične in biološke interakcije med urganimi sedimenti in okoljnimi ekosistemi.	Students get to know urban sedimentary environments and understand the processes operating in them. With the data collected on the field she can interpret potential contamination and to propose appropriate solutions. Knows how to select and use appropriate analytical techniques and appropriate data processing. Understand the physical, chemical and biological interactions between urban and recent sediments and adjacent ecosystems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z uporabo prezentacij. Izdelava seminarja na izbrano tematiko in njegova javna predstavitev Terenske vaje obsegajo 5 dni dela na terenu.	Lectures by using the presentations. Creating a seminar on a selected topic and its public presentation Field activities include five days of field work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Izdelava in predstavitev seminarja	80,00 %	Preparation and presentation of seminar
Pisni in/ali ustni izpit	20,00 %	Written and/or oral exam
Za pozitivno oceno mora biti pravilno rešenih najmanj 50% teoretičnih vprašanj.		The positive assessment must be properly resolved, at least 50% of the theoretical issues.

Reference nosilca/Lecturer's references:

GLAVAŠ, Neli, MOURELLE, Lourdes Maria, GÓMEZ, Carmen P., LEGIDO, José Luis, ROGAN ŠMUC, Nastja, DOLENEC, Matej, KOVAČ, Nives. The mineralogical, geochemical, and thermophysical characterization of healing saline mud for use in pelotherapy. Applied clay science, ISSN 0169-1317. [Print ed.], 2016, str. 1-10 [in press],

ROGAN ŠMUC, Nastja, SERAFIMOVSKI, Todor, DOLENEC, Tadej, DOLENEC, Matej, VRHOVNIK, Petra, VRABEC, Mirijam, JAĆIMOVIĆ, Radojko, LOGAR ZORN, Vesna, KOMAR, Darja. Mineralogical and geochemical study of Lake Dojran sediments (Republic of Macedonia). Journal of geochemical exploration, ISSN 0375-6742. [Print ed.], 2015, vol. 150, str. 73-83.

ROGAN ŠMUC, Nastja, DOLENEC, Tadej, SERAFIMOVSKI, Todor, TASEV, Goran, DOLENEC, Matej, VRHOVNIK, Petra. Heavy metal characteristics in Kočani Field plant system (Republic of Macedonia). Environmental geochemistry and health, 2012, vol. 34, iss. 4, str. 513-526.

MURI, Gregor, ČERMELJ, Branko, JAĆIMOVIĆ, Radojko, SKABERNE, Dragomir, ŠMUC, Andrej, BURNIK ŠTURM, Martina, TURŠIČ, Janja, VREČA, Polona. Consequences of anthropogenic activity for two remote alpine lakes in NW Slovenia as tracked by sediment geochemistry. Journal of paleolimnology, ISSN 0921-2728, 2013, vol. 50, no. 4, str. 457-470.

ROŽIČ, Boštjan, ŠMUC, Andrej. Gravity-flow deposits in the Toarcian Perbla formation (Slovenian basin, NW Slovenia). Riv. ital. paleontol. stratigr., 2011, vol. 117, no. 2, str. 283-294.

ROŽIČ, Boštjan, KOLAR-JURKOVŠEK, Tea, ŠMUC, Andrej. Late Triassic sedimentary evolution of Slovenian Basin (eastern Southern Alps): description and correlation of the Slatnik Formation. Facies, 2009, vol. 55, no. 1, str. 137-155, doi: 10.1007/s10347-008-0164-2.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Aplikativna inženirska geologija
Course title:	Applied Engineering Geology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0562384
Koda učne enote na članici/UL Member course code:	714

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	15	75	5

Nosilec predmeta/Lecturer:	Timotej Verbovšek
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
K izpitu lahko pristopi, kdor ima opravljen prvostopenjski študij geologije, gradbene ali podobne naravoslovne smeri.	Finished first-level (BSc) of geology, civil engineering or similar course.

Vsebina:	**Content (Syllabus outline):**
Predavanja: - Predpisi s področja gradbeništva in varovanja okolja. - Uporaba GIS tehnologije v inženirski geologiji. - Izračun geomehanskih parametrov na podlagi empiričnih enačb in klasifikacij - Analitične metode stabilnosti v predorogradnji - Analitične metode stabilnosti pri zemljinskih plazovih. - Numerične metode izračuna stabilnosti predora in brežin. - Določitev napetostno-deformacijskega polja pri posegih v teren. - Prepoznavanje različnih mehanizmov porušitve v zemljini in hribini. Vaje: - Računalniške in računske laboratorijske vaje. - Terenske vaje. - Popis vrtine.	Lectures: - Legislation from the construction field and environmental protection. - Usage of GIS technology in Engineering Geology. - Calculation of geomechanical parameters based on empirical equations and classifications. - Stability analysis methods in tunneling. - Stability analysis methods in landslides. - Numerical methods in stability calculations of tunnels and slopes. - Determination of stress-strain field in groundworks. - Recognition of slope failure mechanisms in soils and rock mass. Exercises: - Computational and computer exercises. - Field works. - Borehole logging.

Temeljna literatura in viri/Readings:

D. BEG, A. POGAČNIK, P. MOŽE (ur.) 2009. Priročnik za projektiranje gradbenih konstrukcij po Evrokod standardih. Inženirska zbornica Slovenije, Ljubljana
C.W.DUNCAN, 2004. Rock Slope Engineering and Civil Mining. Spon Press, London.

DUNCAN, J. M., WRIGHT, S. G., BRANDON, T. L., 2014. Soil Strength and Slope Stability, John Wiley and Sons, Hoboken, NJ, 317 str.
E.HOEK, E.T.BROWN, 1996. Underground Excavation in Rock. E& FN Spon, London.
J.P.HARRISON, J.A.HUDSON, 2000. Engineering Rock Mechanics. An Introduction to the principles. Pergamon, Amsterdam
CORTFORTH, D., 2005. Landslides in practice. John Wiley and Sons, Hoboken, NJ, 596 str.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Obvladanje aplikativnih inženirskih problemov. KOMPETENCE: Poznavanje analitičnih in numeričnih metod (stabilnostne analize).	OBJECTIVES: To obtain the knowledge of applied engineering problems. COMPETENCES: Ability to understand and solve the problems related to analysis and numerical methods (stability analyses).

Predvideni študijski rezultati:	**Intended learning outcomes:**
Poznavanje sestave tal in ocene stabilnosti terena. Sposobnost izračuna stabilnosti plazov. Sposobnost izračuna stabilnosti kamnitih brežin.	Recognition of ground composition and terrain stability estimation. Ability to calculate the landslide stability. Ability to calculate the rock slope stability.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (prezentacije, 30 ur), laboratorijske/kabinetne vaje (30 ur), terenske vaje (15 ur).	Lectures (presentations, 30 hours), laboratory/cabinet exercises (30 hours), field work (15 hours).

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit: teoretična vprašanja	60,00 %	Written and/or oral exam: theoretical questions
Vaje	40,00 %	Exercise: grade of submitted exercises
Pogoji za pristop k izpitu: udeležba na terenskih vajah, pozitivno opravljene oddane vaje, oddano poročilo terenskih vaj. Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Prerequisites for written exam: participation on field work, positively graded submitted exercises, submitted field report. Grades: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10), according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

PUCKO, Tatjana, VERBOVŠEK, Timotej. Comparison of hydraulic conductivities by grain-size analysis, pumping, and slug tests in Quaternary gravels, NE Slovenia. Open geosciences, 2015, vol. 7, iss. 1, str. 308-317, doi: 10.1515/geo-2015-0032.
VERBOVŠEK, Timotej (Mentor znanstvenega magisterija): BROŽIČ, Dušanka. Inženirsko geološka analiza stabilnosti konglomeratne brežine na avtocestnem odseku pri Tržiški Bistrici : magistrsko delo = geological engineering analysis of stability for conglomerate embankment on higway section near river Tržiška Bistrica : master's thesis. Ljubljana: [D. Brožič], 2016. XII, 99 str., pril., ilustr.
VERBOVŠEK, Timotej, KOČEVAR, Marko, BENKO, Igor, MAČEK, Matej, PETKOVŠEK, Ana. Monitoring of the Stogovce landslide slope movements with GEASENSE GNSS probes, SW Slovenia. V: MIKOŠ, Matjaž (ur.), et al. Advancing culture of living with landslides. Vol. 3, Advances in landslide technology. Cham: Springer. cop. 2017, str. 311-316, doi: 10.1007/978-3-319-53487-9_35.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Digitalno kartiranje
Course title:	Digital Mapping
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0596364
Koda učne enote na članici/UL Member course code:	11413

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	15	75	5

Nosilec predmeta/Lecturer:	Marko Vrabec
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
UVOD: koordinatni sistemi, geodetski datum, referenčni sestav. GEOPOZICIONIRANJE IN IZMERA: GNSS sistemi, GNSS navigacija v geološki praksi, metode GNSS izmere, obdelava GNSS meritev, polarna izmera. ZAJEM IN OBDELAVA DIGITALNIH PODATKOV: fotogrametrija, lasersko skeniranje, multispektralno in hiperspektralno snemanje, oblaki točk, digitalni modeli površja, multi- in hiperspektralne podobe. DIGITALNO GEOLOŠKO KARTIRANJE: oprema in platforme, programske aplikacije za kartiranje, tipi podatkov pri kartiranju, ontologija, merjenje in predstavljanje orientacij. DIGITALNA ORODJA ZA ANALIZO IN INTERPRETACIJO PODATKOV: uvažanje in integracija različnih vrst podatkov, grafična analiza podatkov, projiciranje podatkov na profile in ploskve, izdelovanje interpretativnih kart, profilov in 3D modelov, modeliranje 3D ploskev in volumnov iz različnih vrst podatkov, metode vizualizacije, izvažanje podatkov in modelov.	INTRODUCTION: coordinate systems, geodetic datum, coordinate reference systems. GEOPOSITIONING AND SURVEYING: GNSS systems, GNSS navigation in geological fieldwork, techniques of GNSS surveying, processing of GNSS data, polar surveys. ACQUISITION AND PROCESSING OF DIGITAL DATA: photogrammetry, laser scanning, multispectral and hyperspectral scanning, point clouds, digital elevation models, multi- and hyperspectral imagery. DIGITAL GEOLOGICAL MAPPING: equipment and platforms, mapping software, types of mapping data, onthology, measuring and representing orientation data. DIGITAL TOOLS FOR DATA ANALYSIS AND INTERPRETATION: importing and integration of various types of data, graphical data analysis, projecting data to sections and surfaces, creation of maps, cross-section and 3D models, modeling 3D surfaces and volumes from various data, visualization methods, export of data and models.

Temeljna literatura in viri/Readings:

Barnes, J., 1995, Basic Geological Mapping, Geological Society of London Handbook Series, John Wiley and Sons Ltd., 132pp. Izbor relevantnih strokovnih in znanstvenih člankov, ki ga vzdržuje in dopolnuje nosilec predmeta. [A selection of relevant professional and scientific papers, curated by the Lecturer.]

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študent se seznani z različnimi metodami digitalnega zajema, obdelave in interpretacije geoloških podatkov, s poudarkom na metodah ki se uporabljajo v regionalni geologiji. Seznani se s programskimi orodji za interpretacijo in modeliranje 2D in 3D geološke zgradbe iz terenskih podatkov. KOMPETENCE: sposobnost digitalnega zajema georeferenciranih geoloških podatkov na terenu; obvladovanje izbranih metod bližinskega in daljinskega zaznavanja za kartiranje geoloških objektov v različnih merilih; poznavanje in obvladovanje računalniških orodij za interpretacijo terenskih podatkov in modeliranje 2D in 3D geološke zgradbe; sposobnost izdelovanja digitalnih geoloških kart, profilov, 3D modelov.	OBJECTIVES: Students will be acquainted with various techniques of digital acquisition, processing and interpretation of geological field data, with special emphasis on techniques commonly used in regional geology. They will become familiar with software tools for interpretation and modeling of 2D and 3D geological structure from field data. COMPETENCES: capability to digitally acquire georeferenced geological field data; mastering of selected techniques of proximal and remote sensing for mapping of geological objects in various scales; knowledge and mastering of software tools for interpretation of field data and modeling of 2D and 3D geological structure; ability to create digital geological maps, cross-sections, and 3D models.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študenti poznajo moderne metode digitalnega terenskega kartiranja. Znajo izbrati problemu ustrezne metode digitalnega kartiranja in načrtovati njihovo izvedbo. Zbrane digitalne podatke znajo obdelovati in interpretirati z namenskimi programskimi orodji. Rezultate kartiranja znajo pripraviti in predstaviti v različnih oblikah, primernih za uporabnike geoloških podatkov.	Students are acquainted with modern techniques of digital field mapping. They are able to select digital mapping methods appropriate to the task and to plan their implementation. They can use specialized software to process and interpret acquired digital data. They are able to deliver and present the results of mapping to various end users of geological data.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, kabinetne vaje, seminarske vaje, projektno delo, terenske demonstracijske vaje.	Lectures, lab clases and tutorials, project work, field demonstrations.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni ali ustni izpit	50,00 %	Written or oral examination
Zaključni projekt	50,00 %	Final project

Reference nosilca/Lecturer's references:

VRABEC, Marko. Image analysis as a tool in geometrical description and structural analysis of outcrops. RMZ-mater. geoenviron., 1999, vol. 46, no. 3, str. 613-622.
STOPAR, Bojan, STERLE, Oskar, WEBER, John C., VRABEC, Marko. The role and importance of GNSS for Geodynamics. V: BAŠIĆ, Tomislav (ur.). 2. CROPOS konferencija, Zagreb, srpanj 2011. Zbornik radova, (CROPOS konferencija). Zagreb: Državna geodetska uprava: Sveučilište u Zagrebu. Geodetski fakultet: Hrvatska komora ovlaštenih inženjera geodezije: Hrvatsko geodetsko društvo, 2011, str. 39-42.
ŽIVEC, Tina, VEZOČNIK, Rok, ŽIBRET, Lea, VRABEC, Marko, VERBOVŠEK, Timotej. Primerjava zajema diskontinutet z bližnjeslikovno fotogrametrijo, terestičnim laserskim skeniranjem (TLS) in ročnimi meritvami v kamnolomu Žalostna gora. V: ROŽIČ, Boštjan (ur.). 21. posvetovanje slovenskih geologov, (Geološki zbornik, 22). Ljubljana: Univ. v Ljubljani, Naravoslovnotehniška fak., Oddelek za geologijo, 2013, str. 186.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Dinamika toka podzemne vode
Course title:	Groundwater Flow Dynamics
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0562385
Koda učne enote na članici/UL Member course code:	715

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	30	0	0	0	75	5

Nosilec predmeta/Lecturer:	Mihael Brenčič
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Zaključena dodiplomska (prva) stopnja. Pogoj za pristop k izpitu so opravljeni izpiti iz Matematike 1, Matematike 2 in Fizike iz obsega 1. stopenjskega študija geologije.	Bachelor degree. To take an exam, completed exams in Mathematics 1, Mathematics 2, and Physics included in the curriculum of BcS in Geology are mandatory.

Vsebina:	**Content (Syllabus outline):**
Predavanja: Prikaz osnovnih matematičnih orodij kvantitativne hidrogeologije. Osnovne enačbe toka podzemne vode v medzrnskem poroznem mediju (zaprt vodonosnik, odprt vodonosnik in polzaprt vodonosnik). Analitične rešitve enačb toka podzemne vode v medzrnskem poroznem mediju (stacionarni in nestacionarni sistemi). Tok podzemne vode v razpoklinskem poroznem mediju. Tok podzemne vode v dvojni poroznosti. Tok podzemne vode v nezasičenem poroznem medzrnskem mediju. Hidravlika vodnjakov v zaprtih, polzaprtih in odprtih vodonosnikih. Hidravlika vodnjakov v razpoklinskih vodonosnikh in vodonosnikih z dvojno poroznostjo. Poglobiti razumevanje širjenja onesnaževal v podzemni vodi in vodonosnikih Razumevanje konceptov masnega toka v različnih poroznih medijih v geološkem okolju. Vaje: Seminarske vaje (računske vaje iz dinamike podzemne	Lectures: Illustration of basic mathematical tools applied in quantitative hydrogeology. Basic equations of groundwater flow in intergranular porous media (confined aquifer, unconfined aquifer, leaky aquifer). Analytical solutions of groundwater flow equations in intergranular porous media (stationary and non stationary systems). Flow of groundwater in fissured porous media. Flow of groundwater in double porosity media. Flow of groundwater in unsaturated porous media. Well hydraulics in confined, leaky and unconfined aquifers. Well hydraulics in fissured aquifers and aquifers with double porosity. Concepts of pollutant spreading in groundwater and aquifers. Concepts of mass transport in various porous media in the geological environment. Exercises: Seminar exercises (mathematical exercises in the groundwater dynamics)

vode) Laboratorijske vaje (uporaba matematičnih modelov za modeliranje toka podzemne vode).	Laboratory exercises (application of mathematical models in modelling groundwater flow).

Temeljna literatura in viri/Readings:

Posamezna poglavja iz / Chapters from:
RUSHTON, K.K., 2005: Groundwater Hydrology. Wiley.
LEBBE, L.C., 1999: Hydraulic Parameter Identification. Springer.
BATU, V., 1998: Aquifer Hydraulic. Wiley.
BRENČIČ, M., 2009: Dinamika podzemne vode. NTF študijsko gradivo
FETTER, C.W., 1999: Contaminant hydrogeology. Prentice Hall.
KEHEW, A. E., 2001: Applied Chemical Hydrogeology. Prentice Hall.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Poglobiti razumevanje toka podzemne vode in njene porazdelitve v geološkem poroznem mediju. Razumevanje konceptov različnih poroznih medijev v geološkem okolju. Podati teoretične osnove dinamike toka podzemne vode v različnih vodonosnikih in poroznih medijih z namenom uporabe znanj pri praktičnih primerih izkoriščanja podzemne vode za oskrbo prebivalstva s pitno vodo in zaščite vodnih virov. KOMPETENCE: Sposobnost izbire primernega modela ter kalibracije in validacije izbranega modela za posamezne primere toka podzemne vode.	OBJECTIVES: To deepen the understanding of groundwater flow and its distribution in the geological porous media. Understanding the concepts of various porous media in the geological environment. Toillustrate the theoretical basis of the dynamics of groundwater flow in different aquifers and porous media with a emphasis on the application of knowledge to practical cases of exploitation of underground water for supplying the population with drinking water and protection of water resources. COMPETENCES: The ability to choose an appropriate model, and calibration and validation of the model chosen for individual cases of groundwater flow.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobljeno poglobljeno znanje iz hidravlike podzemne vode. Poglobljeno znanje o toku podzemne vode v sedimentih in razpoklinskih kamninah ter v kamninah z dvojno poroznostjo. Hidrogeoloških podatkov in njihova analiza, kvantifikacija toka podzemne vode v različnih poroznih medijih. Sposobnost hidrogeološkega obravnavanja geoloških problemov. Interpretacija hidrogeoloških podatkov. Sinteza geoloških, fizikalnih in tehničnih podatkov ter rezultatov raziskav. Razumevanje osnovnih fizikalnih zakonov toka vode v poroznem mediju. Sposobnost uporabe kompleksne programske opreme. Sposobnost uporabe matematičnih orodij.	The acquired in-depth knowledge of hydraulics of groundwater. In-depth knowledge about the flow of groundwater in sediments and fractured rocks and in rock with dual porosity. Hydrogeological data and their analysis, quantification of groundwater flow in different porous media. Ability to treat hydrogeological problems in geological contects. Interpretation of hydrogeological data. Synthesis of geological, physical and technical information and research results. Understanding the basic physical laws of water flow in porous media. The ability to use complex software. The ability to use mathematical tools.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, laboratorijske vaje, seminar.	Lectures, laboratory practices, seminar.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
snov predavanj	70,00 %	knowledge from the lectures
snov vaj	30,00 %	knowledge from exercises
Ocene: 6-10 (pozitivno) ob upoštevanju Statuta UL in fakultetnih pravil.		Marks: 6-10 (positive) according to the UL Statute and faculty rules.

Reference nosilca/Lecturer's references:

BRENČIČ, Mihael, VREČA, Polona, 2006: Identification of sources and production processes of bottled waters by stable hydrogen and oxygen isotope ratios. Rapid communication in mass spectrometry, 20/21, 3205-3212.

VREČA, Polona, BRENČIČ, Mihael, LEIS, Albrecht, 2007: Comparison of monthly and daily isotopic composition of precipitation in the coastal area of Slovenia. Isotopes in environtal and health studies 43, 307-321.
BRENČIČ, Mihael, DAWSON, Andrew, FOLKESON, Lennart, FRANÇOIS, Denis, LEITǍO, Teresa E., 2008: Pollution mitigation. In: DAWSON, Andrew (ed.). Water in road structures : movement, drainage & effects. Springer, pp. 283-297.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Ekonomska geologija
Course title:	Economic Geology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562405
Koda učne enote na članici/UL Member course code:	729

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	10	20	0	0	60	4

Nosilec predmeta/Lecturer:	Nastja Rogan Šmuc
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Zaključen prvostopenjski bolonjski študij naravoslovne smeri.	Completed the first-level of Bologna natural sciences study.

Vsebina:	Content (Syllabus outline):
Predavanja: 1. Aktualno svetovno stanje in potreba po naravnih ter energetskih virih, svetovne razmere. Pomen geologije v luči svetovnih razmer. 2. Trajnostni razvoj: sedanjost in prihodnost. 3. Ekonomika, zakon ponudbe in povpraševanja, cikli, cene. Svetovne borze (LME, NYMEX, ...) in tržne razmere. 4. Neobnovljivi viri energije (nafta, premog, zemeljski plin, mineralne surovine). Uporaba, prednosti in slabosti. 5. Obnovljivi in alternativni viri energije. Geotermalna, vodna, nuklearna, sončna, vetrna in ostale energije. Uporaba, prednosti in slabosti. 6. Dostopnost do mineralnih virov. Zakon o mineralnih surovinah in problemi lastništva zemljišč. 7. V iskanju rudnega nahajališča. Geološke raziskave. 8. Razvoj in vrednotenje rudnega nahajališča. 9. Ekonomski izračuni. Izračuni, dodatno načrtovanje in statistične ter dinamične metode. 10. Nafta, premog in plin. Raziskave, vrednotenje in ocene zalog. 11. Kako ohraniti mineralne vire. Priložnosti za raziskave in razvoj.	**Lectures:** 1. The current world situation and the need for natural and energy resources, the global situation. The importance of geology in the light of global conditions. 2. Sustainable development: present and future. 3. Economics, law of supply and demand, cycles, prices. World Stock Exchange (LME, NYMEX ...) and market conditions. 4. Non-renewable energy sources (oil, coal, natural gas and mineral materials). Uses, advantages and disadvantages. 5. Renewable and alternative energy sources. Geothermal, aquatic, nuclear, solar, wind and other energies. Uses, advantages and disadvantages. 6. Access to mineral resources. Mineral Resources Law and Land Ownership Problems. 7. In search of ore deposit. Geological research. 8. Development and evaluation of ore deposit. 9. Economic calculations. Calculations, additional design and statistical and dynamic methods. 10. Oil, coal and gas. Research, evaluation and inventory estimates. 11. How to conserve mineral resources. Opportunities for research and development.

12. Odgovorno rudarjenje. Nano in molekularna raven. 13. EU strateški načrt izvajanja evropskega partnerstva za inovacije v zvezi s surovinami. 14. Aktualni svetovni primeri in problemi. 15. Novi materiali, novi izzivi. **Seminar:** Seminarska naloga. **Računske in računalniške vaje:** izračuni zalog, izračuni donosa talilnice rudnika, življenjska doba rudnika, izračun stroškovnih podatkov, LCA, pregled stanja naravnih in obnovljivih virov, ekonomika in okoljski podatki, ...).	12. Responsible mining. Nano and molecular level. 13. EU Strategic Plan for implementing the European Raw Materials Innovation Partnership. 14. Current world examples and problems. 15. New materials, new challenges. **Seminar:** Seminar work. **Computational and computer exercises:** stock calculations, mine smelter yield calculations, mine lifetime, cost data calculation, LCA, natural and renewable resources survey, economics and environmental data ...).

Temeljna literatura in viri/Readings:

Izbrana poglavja iz knjig / Selected chapters from books:

Craig, J. R. et al., 1996, Resources of the Earth. Origin, Use, and Environmental Impact. Prentice-Hall, Inc, 520 str.
Field, B. C., 2008, Natural Resource Economics. 2nd ed., Waveland Press, Inc, 480 str.
Gluyas, J. in Swarbrick, R., 2015, Petroleum Geoscience. Blackwell Publishing, 359 str.
Pohl, W. L., 2016, Economic Geology. Principles and Practice. 2nd ed., Wiley Blackwell, 663 str.
Smil, V., 2005, Energy at the crossroads: Global perspectives and Uncertatinties. MIT Press, Cambridge, 443 str.
Periodika, znanstvene in strokovne revije / periodicals, scientific and professional journals.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Osvojiti koncept upravljanja z naravnimi viri ter spoznati njihovo uporabo, prednosti in slabosti posameznih virov ter vpliv njihovega izkoriščanja na okolje. Spoznati primarno vlogo geologije v luči aktualnega svetovnega povpraševanja po obnovljivih in alternativnih energetskih virih. Razumeti osnove ekonomike rudnika, trga ter zakona ponudbe in povpraševanja. Obvladati širšo geološko zakonodajo in njeno uporabo. Samostojno reševati probleme s področja naravnih virov. KOMPETENCE: Sposobnost upravljanja z naravnimi viri, poznavanje zakonodaje in standardov, ekonomike in uporabe različnih naravnih virov ter predvidevanje okoljskih posledic pri njihovem izkoriščanju.	OBJECTIVES: To conquer the concept of natural resource management and to learn about their use, the advantages and disadvantages of individual sources and the impact of their exploitation on the environment. To learn about the primary role of geology in the light of the current global demand for renewable and alternative energy sources. Understand the basics of economics of mine, the market and the law of supply and demand. To master wider geological legislation and its application. Independently solve problems in the field of natural resources. COMPETENCES: Ability to manage natural resources, knowledge of legislation and standards, economics and the use of various natural resources and anticipate the environmental consequences of their exploitation.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študentje poznajo koncept upravljanja z naravnimi viri. Poznajo njihovo uporabo, razumejo prednosti in slabosti posameznih virov. Ukvarjajo se z aktualno tematiko vpliva izkoriščanja teh virov na okolje. Razumejo primarno vlogo geologije v luči aktualnega svetovnega povpraševanja po obnovljivih in alternativnih energetskih virih. Obvladajo osnove ekonomike ter širše geološke zakonodaje.	Students know the concept of managing natural resources. They know how to use them, understand the strengths and weaknesses of individual resources. They deal with the current theme of the impact of exploiting these resources on the environment. They understand the primary role of geology in the light of the current global demand for renewable and alternative energy sources. They master the basics of economics and wider geological legislation.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarske in laboratorijske vaje.	Lectures, seminar and laboratory work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	70,00 %	Written and/or oral exam

Praktični del	20,00 %	Practical exam
Seminar	10,00 %	Seminar work
Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Evaluation scale: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) having regard to the Statute of UL and faculty rules.

Reference nosilca/Lecturer's references:

TASEV, Goran, SERAFIMOVSKI, Todor, DOLENEC, Matej, **ROGAN ŠMUC, Nastja**. Contribution to understanding of ore fluids in the Zletovo mine based on fluid inclusion data. RMZ - Materials and geoenvironment: periodical for mining, metallurgy and geology, ISSN 1408-7073. [Tiskana izd.], 2019, str., doi: 10.2478/rmzmag-2019-0008.
KRAMAR, Sabina, TRATNIK, Vesna, HROVATIN, Ivan Marija, MLADENOVIČ, Ana, PRISTACZ, Helmut, **ROGAN ŠMUC, Nastja**. Mineralogical and chemical characterization of Roman slag from the archaeological site of Castra (Ajdovščina, Slovenia). Archaeometry, ISSN 0003-813X. [Tiskana izd.], 2015, vol. 57, iss. 4, str. 704-719, doi: 10.1111/arcm.12116.
DOLENEC, Tadej, SERAFIMOVSKI, Todor, TASEV, Goran, DOBNIKAR, Meta, DOLENEC, Matej, **ROGAN, Nastja**. Major and trace elements in paddy soil contaminated by Pb-ZN mining: a case study of Kočani field, Macedonia. Environmental geochemistry and health, ISSN 0269-4042, 2007, vol. 29, no. 1, str. 21-32.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geofizikalne metode raziskav
Course title:	Geophysical Research Methods
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0596432
Koda učne enote na članici/UL Member course code:	11411

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	15	0	0	45	3

Nosilec predmeta/Lecturer:	Andrej Gosar
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Vpis v 1. letnik študija.	Entering the 1st year of program.

Vsebina:	Content (Syllabus outline):
Uvod v geofizikalne meritve v vrtinah, elementi karotažnih sistemov, klasifikacija karotažnih meritev. Okolje geofizikalnih meritev v vrtinah, izplaka, izplačni kolač in filtrat, globinski doseg in ločljivost meritev. Meritve temperature, vrste termometrov, temperaturno ravnovesje, formacijska temperatura. Meritve premera vrtine (kaliper) in odklona vrtine od navpičnice. Karotaža lastnega potenciala, difuzijski potencial, potencial glinovca, tipični odzivi in uporaba. Upornostna karotaža, empirične relacije med poroznostjo in električno upornostjo kamnin, Archijeva formula, kratka in dolga normalna upornostna karotaža, laterolog, mikrolog, fokusirana tokovna karotaža, indukcijska karotaža. Gama karotaža, naravna radioaktivnost kamnin in glavni izotopi (U, Th, K), Comptonovo sipanje, scintilacijski števec in fotopomnoževalka, spektralna gama karotaža, API enote, delež glinovca, odziv na pesek in glino. Akustična karotaža, intervalna seizmična hitrost, princip kompenziranega merjenja, akustična impedanca, sintetični seizmogrami, korelacija z refleksijskimi seizmičnimi podatki. Gostotna ali gama-gama karotaža, odziv kamnine na obstreljevanje z gama žarki, gostota in poroznost,	Introduction to geophysical well logging, logging equipment, classification of well logs. The well logging environment, drilling mud, mud cake and filtrate, depth penetration and resolution of measurements. Temperature measurements, thermometer types, temperature equilibrium, formation temperature. Borehole calliper and measurements of the deviation of borehole from vertical. Self-potential well logging, diffusion potential, shale potential, typical response and applications. Electrical resistivity logging, empirical relations between porosity and electrical resistivity, Archie equation, short and long normal logging, laterolog, microlog, focused current log, induction logging. Gamma ray logging, natural radioactivity of rocks and main isotopes ((U, Th, K), Compton scattering, scintillation counter and photomultiplier, spectral gamma ray logging, API units, shale volume, response to sand and clay. Sonic or acoustic logging, interval seismic velocity, principle of compensated measurements, acoustic impedance, synthetic seismograms, correlation with seismic reflection data.

karotaža fotoelektričnega faktorja ali litološko-gostotna karotaža. Nevtronska karotaža, kvantitativno določevanje poroznosti kamnine, elastično in neelastično sipanje nevtronov, hitri, epitermični in termični nevtroni. Dipmeter, določevanje vpada plasti z meritvami mikroupornosti, korelacijske metode, uporaba v sedimentologiji in strukturni geologiji. Slikovne karotaže, akustična slikovna karotaža, električna slikovna karotaža, interpretacija razpok in sedimentnih značilnosti. Sistematični pregled uporabe karotažnih meritev, kvantitativne določitve, semi-kvantitativne in kvalitativne določitve, korelacije karotažnih diagramov.	Density or gamma-gamma logging, the response of rock to bombardment with gamma rays, density and porosity, photoelectric factor or litho-density logging. Neutron porosity logging, qualitative determination of formation porosity, elastic and inelastic scattering of neutrons, fast, epithermic and thermic neutrons. Dipmeter, determination of strata dip using microresistivity measurements, correlation methods, applications in sedimentology and structural geology. Imaging logs, acoustic imaging, electric imaging, interpretation of fractures and sedimentary features. Systematic overview of applications of well logging, quantitative, semi-quantitative and qualitative determinations, correlations of well logs.

Temeljna literatura in viri/Readings:

1) Gosar, A. 2010: Geofizikalna karotaža – skripta. Naravoslovnotehniška fakulteta, 47 str.
2) Gosar, A., Ravnik, D. 2007: Uporabna geofizika. Naravoslovnotehniška fakulteta, 218 str.
3) Rider, M. 1996: The geological interpretation of well logs. Whittles Publishing, 280 str.

Cilji in kompetence:	**Objectives and competences:**
CILJI: • poznavanje najpomembnejših geofizikalnih metod, • poznavanje osnov geofizikalnih karotažnih meritev v vrtinah, • uporaba in načrtovanje geofizikalnih metod pri različnih geoloških raziskavah, • zmožnost osnovne obdelave in interpretacije geofizikalnih podatkov. KOMPETENCE: • sposobnost uporabe geofizikalnih podatkov, • sposobnost vključevanja geofizike v geološke raziskave, • sposobnost izvajanja geofizikalnih meritev.	OBJECTIVES: • knowledge of most important geophysical methods, • knowledge of geophysical well logging methods in boreholes, • application and planning of geophysical methods in different geological investigations, • capability of basic geophysical data processing and interpretation. COMPETENCES: • capability to apply geophysical data, • capability to include geophysics in geological investigations, • capability to perform geophysical measurements.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: • razumevanje principa delovanja geofizikalnih metod raziskav, • načrtovanja geofizikalnih raziskav za reševanje različnih geoloških problemov, • izvedba geofizikalnih meritev, • razumevanje osnovnih fizikalnih zakonov na primeru geologije, • razumevanje principa delovanja posameznih, geofizikalnih metod na praktičnih primerih, • sposobnost fizikalnega obravnavanja geoloških problemov, • sposobnost sinteze geofizikalnih in geoloških podatkov.	Knowledge and understanding: • understanding principles of geophysical research methods, • planning of geophysical investigations for solving different geological problems, • to perform geophysical investigations, • understanding basic physical principles related to the geology, • understanding principles of different geophysical methods on practical examples, • capability of physical approach to geological problems, • capability of synthesis of geophysical and geological data.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z uporabo prezentacij. Vodeno in samostojno reševanje praktičnih vaj in problemov. Računalniške vaje.	Lectures using presentations. Assisted and individual practical tutorials and problem solving. Computer tutorials.

Načini ocenjevanja:	Delež/Weight	Assessment:
Izpit iz snovi vaj	40,00 %	Tutorials examination
Izpit is snovi predavanj	60,00 %	Lectures examination
Izpit iz snovi vaj vključuje tudi predhodno pozitivno ocenjene oddane vaje. Izpit iz snovi predavanj je praviloma pisni, lahko pa je tudi ustni. Ocenjevalna lestvica je določena v vlogi za pridobitev soglasja k pričujočemu študijskemu programu.		Tutorials exam follows positively marked solved problems. Theory Lectures examination is usually written, but can be also oral. Marks are defined in the study program application.

Reference nosilca/Lecturer's references:

GOSAR, A. 1998: Seismic-reflection surveys of the Krško basin structure: Implications for earthquake hazard at the Krško nuclear power plant, southeast Slovenia. Journal of Applied Geophysics, 39/3, 131-153.
GOSAR, A. 2008: Gravity modelling along seismic reflection profiles in the Krško basin (SE Slovenia). Geologica Carpathica, 59/2, 147-158.
GOSAR, A. 2010: Site effects and soil-structure resonance study in the Kobarid basin (NW Slovenia) using microtremors. Nat. hazards earth syst. sci., 10/4, 761-772.
GOSAR, A. 2012: Analysis of the capabilities of low frequency ground penetrating radar for cavities detection in rough terrain conditions: the case of Divača cave, Slov. Acta carsologica, 41/1, 77-88.
GOSAR, A., ČERU, T. 2016: Search for an artificially buried karst cave entrance using ground penetrating radar: a successful case of locating the S-19 Cave in the Mt. Kanin massif (NW Slovenia). International Journal of Speleology, 45/2, 125-147.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geohazard in varstvo pred naravnimi nesrečami
Course title:	Geohazard and Protection from Natural Disasters
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562396
Koda učne enote na članici/UL Member course code:	719

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	45	0	0	0	75	5

Nosilec predmeta/Lecturer:	Barbara Čenčur Curk
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Znanje osnov geologije, geologija okolja, hidrologije, hidrogeologije, inženirske geologije in geofizike.	Knowledge of Basics of Geology, Hydrology, Hydrogeology, Engineering Geology and Geophysics.

Vsebina:	Content (Syllabus outline):
Uvod v geookolje Odnos človeka do narave Pregled evropske in slovenske okoljske zakonodaje ter zakonodaje s področja varstva pred naravnimi nesrečami Hidrometeorološki hazard (suša, poplave, toča, tornado...) Geofizikalni hazard (potresi, vulkani, plazovi in podori, posedanje, kraške udornice, preperevanje, hidrogeokemijski vpliv na podzemne objekte in temelje, obalna erozija) Karte geohazarda Upravljanje geohazarda in tveganja (možnost oz. nevarnost pred dogodkom, dogodek in postopki sancije, ki nastopijo med ali po dogodku) Monitoring (tehnike, načrtovanje)	Introcuction to geoenvironment Relationship between humankind and nature Review of the European and Slovenian environmental legislation and legislation in the field of protection against natural disasters Hydrometeorological hazard (drought, floods, hail, tornadoes ...) Geophysical hazard (earthquakes, volcanoes, landslides and rock falls, subsidence, karst sinkholes, weathering, hydrogeochemical impact on underground structures and foundations, coastal erosion) Geohazard maps Management of geohazard and risk (possibility or danger before the event, event and remediation procedures that occur during or after the event) Monitoring (techniques and design)

Temeljna literatura in viri/Readings:

HYNDMAN, D., HYNDMAN, D., 2014, Natural Hazards & Disasters, Brooks/Cole Cengage Learning, 555p.
ALCÁNTARA-AYALA, I., GOUDIE, A., 2010, Geomorphological hazards and disaster prevention, Cambridge University Press, 291p.
BRYANT, E., 2007, Natural hazards, Cambridge University Press, 312p.
BOBROVSKY, P. T., 2013, Encyclopedia of Natural Hazards, Springer, 1116p.

Cilji in kompetence:	Objectives and competences:
CILJI: Študent se seznani z odnosom človeka do narave, tipi geohazarda, upravljanjem, preprečevanjem, sanacijo in monitoringom geohazarda ter z zakonodajo na tem področju KOMPETENCE: Poznavanje geoloških mehanizmov, ki povzročajo različne tipe geohazarda, ter mehanizmov njihovega razširjanja v prostoru. Poznavanje postopkov raziskav in obdelav s katerimi se določijo možna nevarna območja in sanirajo že aktivna območja. Poznavanje sistemov za monitoring in obveščanje. Preventivni ukrepi in zakonodaja, izdelava kart geohazarda.	OBJECTIVES: Students get acquainted with the relationship between humankind and nature, geohazard types, management, prevention, rehabilitation and monitoring of geohazard, as well as legislation in this area. COMPETENCES: Knowing the geological mechanisms that cause different types of geohazard and the mechanisms of their distribution in space. Knowledge of research procedures and processes which determine the possible danger areas and remediation of already active areas. Knowledge of systems for monitoring and warning. Preventive measures and legislation, elaboration of geohazard map.

Predvideni študijski rezultati:	Intended learning outcomes:
Sposobnost napovedovanja, preprečevanja, preiskovanja in zmanjševanja posledic naravnih nesreč.	Capacity of forecasting, prevention and research of natural disasters and reducing the impact of natural disasters.

Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja (30 ur) z uporabo prezentacij. Vaje potekajo kot vodene seminarske vaje (30 ur) in kot vodene kabinetne vaje (15 ur).	Lectures (30 hours) by using presentations. Rehearsals will take place as tutorials (30 hours) and as a cabinet-guided exercises (15 hours).

Načini ocenjevanja:	Delež/Weight	Assessment:
Pisni in/ali ustni izpit: teoretična vprašanja	45,00 %	Written and/or oral exam: theoretical questions
Seminarji (2): 25% + 25%	50,00 %	Seminar work (2): 25% + 25%
Prisotnost na predavanjih in vajah	5,00 %	The presence at lectures and tutorials
Pogoji za pristop k izpitu: vsaj 75% prisotnost na predavanjih in 100 % prisotnost na vajah, pozitivno opravljene vaje in seminarji (predstavitev, naloga) in seminarske vaje. Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Conditions for the exam: at least 75% attendance at lectures and 100 % attendance at tutorials, successfully done tutorials and seminars (presentation and paper) and tutorials. Grading scale: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) according to the Statute of UL and faculty rules.

Reference nosilca/Lecturer's references:

ČENČUR CURK, Barbara. Impact of fertilization on water resources in karst, example of research field site Sinji Vrh. Acta agriculturae Slovenica, 2014, vol. 103/2, str. 203-211, doi: 10.14720/aas.2014.103.2.5.
SOUVENT, Petra, VIŽINTIN, Goran, CELARC, Sašo, ČENČUR CURK, Barbara. Ekspertni sistem za podporo odločanju na aluvialnih telesih podzemnih voda Slovenije = An expert system as a support to the decision making process for groundwater management of alluvial groundwater bodies in Slovenia. Geologija, 2014, vol. 57/2, str. 245-250, doi: 10.5474/geologija.2014.021.
LESJAK, Polonca, ČENČUR CURK, Barbara. Threats to local drinking water in the municipality of Ljubljana. Sanitarno inženirstvo, 2012, vol. 6/1, str. 58-77.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geologija Alpskega orogena
Course title:	Geology of the Alpine orogen
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0596370
Koda učne enote na članici/UL Member course code:	850

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	0	0	45	75	5

Nosilec predmeta/Lecturer:	Boštjan Rožič, Marko Vrabec
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Vpis v 2. letnik študija.	Entering the 2nd year of program.

Vsebina:	Content (Syllabus outline):
• Osnovne geodinamske značilnosti ozemlja: struktura skorje in litosfere, toplotni tok, seizmičnost, napetostno stanje, aktivni geodinamski procesi. • Paleogeografski razvoj ozemlja: rekonstrukcija širših paleogeografskih razmer, geodinamski razvoj in zaton regionalnih paleogeografskih enot. • Tektonski razvoj ozemlja: tektonika plošč in palinspastične rekonstrukcije, pred-alpidske tektonske faze, subdukcija in kolizija v alpskem prostoru, narivna tektonika, ekshumacija, dviganje in erozija orogena, orogenski kolaps in ekstruzija, sinorogena in postorogena ekstenzija, aktivni geološki procesi v Alpskem orogenu. • Metamorfizem in njegova geodinamska interpretacija. • Sinorogeni in postorogeni magmatizem in njegovi produkti. • Stratigrafski razvoj: odraz posameznih tektonskih faz v stratigrafskem zapisu paleogeografskih enot, dinamika pred- in postkolizijskih bazenov.	• Fundamental geodynamic characteristics of the region: crustal and lithospheric structure, heat flow, seismicity, stress field, active geodynamic processes. • Paleogeographic evolution of the region: reconstruction of the paleogeographic setting, geodynamic evolution and the decline of paleogeographic units. • Tectonic evolution of the region: plate tectonics and palinspastic reconstructions, preAlpine tectonic phases, subduction and collision in the Alpine domain, thrust tectonics, exhumation, uplift and erosion of the orogen, orogenic collapse and extrusion, syn- and post-orogenic extension, active tectonic processes in the Alpine orogen. • Metamorphism and its geodynamic interpretation. • Syn and post-orogenic magmatism and its products. • Stratigraphic evolution: reflection of tectonic phases in the stratigraphic record of paleogeographic units, dynamics of pre- and post-collisional basins.

Temeljna literatura in viri/Readings:

- Pfiffner O. A.: Geology of the Alps. Wiley-Blackwell, London, 2014, 375 str.

- Vozár, J. & et al. (Eds): Variscan and Alpine terranes of the Circum-Pannonian Region. *Slovak Academy of Sciences, Geological Institute*, Bratislava, 2014, 204 str.
- McCann T.(ur.): The Geology of Central Europe, Volume 2 – Mesozoic and Cenozoic. Geological Society of London, 2008, 752 str.
- Cavazza W., Roure F., Spakman W., Stampfli G.M., Ziegler P.A. (ur.): The TRANSMED Atlas. The Mediterranean Region from Crust to Mantle. Springer, 2004, 141 str.
- Izbor relevantnih člankov iz znanstvene periodike, ki ga vzdržuje in dopolnuje nosilec predmeta.
- [A selection of relevant scientific papers which is maintained by the Lecturer.]

Cilji in kompetence:	**Objectives and competences:**
CILJI: Evropske Alpe so najbolje preučen orogenski sistem na svetu. Dobra razgaljenost terena omogoča izjemen vpogled v terenske dokaze za moderne teorije o kontinentalni koliziji, nastanku in razvoju orogenov, ter o spremljajočih tektonskih, magmatskih, metamorfnih in sedimentarnih procesih. Predmet je organiziran v obliki predavanj in terenske ekskurzije preko klasičnih lokacij alpske geologije. Študenti se s študijem terenskih primerov na izdankih in v regionalnih prerezih seznanijo z geodinamskim razvojem orogena, interakcijo med tektonskimi, metamorfnimi, magmatskimi in sedimentnimi procesi, ter s pred-, sin- in postkolizijsko dinamiko celotnega orogenskega sistema. KOMPETENCE: Študenti so sposobni razumeti geološko zgradbo in nastanek Alpskega orogenskega sistema. Razlikovati morejo sestavne enote in cone orogena in jih interpretirati v kontekstu tektonike plošč. Svoje poznavanje geološkega razvoja slovenskega ozemlja znajo vključiti v regionalno celoto alpskega prostora.	OBJECTIVES: Euroean Alps are the best studied orogenic system in the World. Good terrain exposure facilitates excellent insight into field evidence for modern theories of continental collision, of orogen origin and evolution, and of accompanying tectonic, magmatic,metamorphic and sedimentary processes. Course is organized in the form of lectures and accompanying field excursion visiting the classical localities of Alpine geology. By examining field examples in outcrops and regional transects, the students get familiar with the geodynamical evolution of the orogen, interaction between tectonic, magmatic, metamorphic and sedimentary processes, and with pre-, syn- and post-collisional dynamics of the entire orogenic system. COMPETENCES: Students are able to understand the construction and formation of the Alpine orogenic system. They are able to distinguish the individual units and components of the orogen and interpret them in plate tectonic framework. They can integrate their knowledge of the geological evolution of the Slovenian territory into the Alpine regional framework.

Predvideni študijski rezultati:	**Intended learning outcomes:**
• Študenti poznajo glavne geološke in strukturne enote Alpskega orogena. • Razumejo kompleksen geološki razvoj orogenskih sistemov. • Znajo interpretirati strukturne in stratigrafske enote v kontekstu časovnega in geodinamskega razvoja orogena.	• Students are familiar with the major geological and structural units of the Alpine orogen. • They understand the complex geological evolution of orogenic systems. • They can interpret structural and stratigraphic units in the context of temporal and geodynamical evolution of the orogen.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja. Terenske vaje obsegajo 5 dnevno ekskurzijo.	Lectures. Course includes a 5 day field trip.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	100,00 %	Written and/or oral examination

Reference nosilca/Lecturer's references:

ROŽIČ, Boštjan, POPIT, Tomislav, GALE, Luka, VERBOVŠEK, Timotej, VIDMAR, Ines, DOLENEC, Matej, ŽVAB ROŽIČ, Petra. Origin of the Jezero v Ledvicah lake : a depression in a gutter-shaped karstic aquifer (Julian Alps, NW Slovenia) = Nastanek Jezera v Ledvicah - globel v žlebu podobnem kraškem vodonosniku (Julijske Alpe, SZ Slovenija). *Acta carsologica*. [Tiskana izd.]. 2019, letn. 48, št. 3, str. 265-282.

GALE, Luka, SKABERNE, Dragomir, PEYBERNES, Camille, MARTINI, Rossana, ČAR, Jože, ROŽIČ, Boštjan. Carnian reefal blocks in the Slovenian Basin, eastern Southern Alps. *Facies*, ISSN 0172-9179. [Print ed.], 2016, vol. 62, iss. 4, str. 1-15, doi:10.1007/s10347-016-0474-8.
ROŽIČ, Boštjan, GORIČAN, Špela, ŠVARA, Astrid, ŠMUC, Andrej. The Middle Jurassic to Lower Cretaceous succession of the Ponikve klippe: the Southernmost outcrops of the Slovenian Basin in Western Slovenia. Rivista italiana di paleontologia e stratigrafia, ISSN 0035-6883, 2014, vol. 120, no. 1, str. 83-102.
VRABEC, Marko, FODOR, László. Late Cenozoic tectonics of Slovenia: structural styles at the Northeastern corner of the Adriatic microplate. V: PINTER, Nicholas, GRENERCZY, Gyula, WEBER, John, STEIN, Seth, MEDAK, Damir. The Adria microplate: GPS geodesy, tectonics and hazards, (NATO Science Series, IV, Earth and Environmental Sciences, vol. 61). Dordrecht: Springer, 2006, str. 151-168.
FODOR, László, GERDES, Axel, DUNKL, István, KOROKNAI, Balázs, PÉCSKAY, Zoltan, TRAJANOVA, Mirka, HORVÁTH, Peter, VRABEC, Marko, JELEN, Bogomir, BALOGH, Kadosa, FRISCH, Wolfgang. Miocene emplacement and rapid cooling of the Pohorje pluton at the Alpine-Pannonian-Dinaridic junction, Slovenia. Swiss Journal of Geosciences, 2008, suppl.1, vol. 101, str. S255-S271.
KASTELIC, Vanja, VRABEC, Marko, CUNNINGHAM, Dickson, GOSAR, Andrej. Neo - Alpine structural evolution and present day tectonic activity of the eastern Southern Alps: the case of the Ravne Fault, NW Slovenia. J. Struct. Geol., 2008, vol. 30, str. 963-975.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geologija krasa 2
Course title:	Karst Geology 2
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562391
Koda učne enote na članici/UL Member course code:	845

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	30	0	0	15	75	5

Nosilec predmeta/Lecturer:	Timotej Verbovšek
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
K izpitu lahko pristopi, kdor ima opravljen prvostopenjski študij geologije ali podobne naravoslovne smeri.	Finished first-level (BSc) of geology or similar course.

Vsebina:	**Content (Syllabus outline):**
Predavanja: Struktura kraških kamnin. Litološke, geokemične, hidrogeološke in sedimentološke lastnosti, pomembne za zakrasevanje in nastanek kraških pojavov. Lezike, prelomi, razpoke v kamninah, detekcije teh elementov. Geokemični procesi. Raztapljanje kamnin, kinetika, ravnotežni in neravnotežni kemični procesi. Speleogeneza, zakrasevanje, hitrost zakrasevanja (kinetika), začetni procesi zakrasevanja (začetje oz. speleoinception). Modeliranje kraških in geokemičnih procesov, ranljivost voda v kraških in razpoklinskih kamninah. Hidrogeologija krasa. Temeljne razlike med kamninami z medzrnsko, razpoklinsko in kraško poroznostjo. Koncept dvojne in trojne poroznosti. Poroznost v karbonatih. Dinamika podzemne vode v kraških in razpoklinskih kamninah. Tok skozi eno razpoko in skozi sistem razpok. Epikras. Tok in prenos snovi v kraških kamninah. Konceptualni in računalniški modeli. Črpalni in sledilni poizkusi v kraških in razpoklinskih kamninah, računalniški programi za obdelavo poizkusov. Onesnaženja v kraških in razpoklinskih vodonosnikih. Speleološke značilnosti. Nastanek in razvoj jamskih kanalov, jamske oblike, sedimenti v jamah, oblike jam.	Lectures: Structure of karstic rocks. Lithological, geochemical, hydrogeological and sedimentological properties, crucial for karstification and evolution of karstic features. Bedding planes, faults, fractures and their detection. Geochemical processes. Dissolution of rocks, kinetics, equilibrium and non-equilibrium chemical processes. Speleogenesis, karstification, dissolution velocity (kinetics), inception horizon hypothesis. Modeling of karstic and geochemical processes, vulnerability of waters in karstic and fractured aquifers. Karst hydrogeology. Major differences between rocks with intergranular, fractured and karstic porosity. Concept of double and triple porosity. Porosity in carbonates. Dynamics of ground water in karstic and fractured rocks. Flow through a single fracture and multiple fractures. Epikarst. Flow and transport in aquifers. Conceptual and computer models. Pumping and tracer tests in karstic and fractured rocks. Pollution in these rocks. Speleological properties. Creation and evolution of karstic channels, sediments, cave morphology, cave forms. Determination of flow velocity. Age dating of sediments.

Določanje hitrosti podzemnega toka. Datiranje jamskih sedimentov. Procesna geomorfologija krasa. Vplivi in procesi na oblikovanje kraškega površja. Kemično in mehansko preperevanje. Površinsko raztapljanje površja (denudacija). Jamske oblike v humidni, aridni ter ostalih klimah. Mikrooblike in makrooblike, ostale oblike in pojavi. Vaje: Računalniške in računske laboratorijske vaje. Terenske vaje. Strukturno kartiranje, kraške oblike in jame na izbrani lokaciji. Seminarska naloga.	Process geomorphology of karst. Influences and processes on karstic surface development. Chemical and physical weathering. Surface dissolution (denudation). Cave forms in humid, arid and other climates. Micro- and macrofeatures, other features. Exercises: Computational and computer exercises. Field work. Structural karst mapping, karst and cave features in selected location. Seminar work.

Temeljna literatura in viri/Readings:

Izbrana poglavja iz knjig:
GAMS: Kras (Založba ZRC SAZU, 2003, 516 str.);
APPELO, C.A.J. and POSTMA, D., 1993. Geochemistry, groundwater and pollution. A.A. Balkema, Rotterdam; Brookfield, VT, xvi, 536 pp;
GILLIESON: Caves: processes, development and management (Blackwell 1996, 324 str.);
FORD & WILLIAMS: Karst geomorphology and hydrology (Wiley, 2007, 601 str.);
KLIMCHOUK, A. B.: Speleogenesis, Evolution of Karst Aquifers (National speleological society, 2000, 527 str.);
WHITE: Geomorphology and hydrogeology of karst terrains (Oxford University press, 1988, 464 str.)
BEAR, J., TSANG, C.-F., de MARSILY, G., 1993: Flow and Contaminant Transport in Fractured Rocks. Editors. San Diego: Academic Press.
National Research Council Rock Fractures and Fluid Flow, 560 str.. Contemporary Understanding and Applications. Washington: National Academy Press, 1996, 568 str.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Kvantitativno opredeliti kraške procese. Osvojiti koncept razumevanja toka in prenosa snovi v kraških in razpoklinskih kamninah, razumeti procese zakrasevanja in razvoja krasa ter širši spekter raziskovalnih metod. Poznati in modelirati geomorfološke procese v krasu. Uporabljati konceptualne in računalniške modele toka. KOMPETENCE: Sposobnost razumevanja in reševanja težav s področja geokemične, hidrogeološke, geomorfološke in geomorfološke tematike v kraških in kraško-razpoklinskih kamninah.	OBJECTIVES: To obtain the knowledge of karstic processes and gain the understanding of flow and transport in karstic and fractured rocks, karstification and karst evolution and geomorphological processes. To use the conceptual and numerical models. COMPETENCES: Ability to understand and solve the problems related to geochemical, hydrogeological, geomorphological topics in karstic and fractured rocks.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študentje znajo kvantitativno opredeliti procese kraških in razpoklinskih kamninah. Razumejo procese zakrasevanja in razvoja krasa, razumejo koncept toka in prenosa snovi v teh kamninah ter znajo opredeliti oz. modelirati geokemične, hidrogeološke in geomorfološke procese v krasu.	Student gain the knowledge to quantitatively define the processes in karstic and fractured rocks, understand the concept of flow and transport in these aquifers and know hoW to model the geochemical, hydrogeological and geomorphological processes.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (prezentacije 30 ur), seminarske vaje (15 ur), kabinetne vaje (15 ur), terenske vaje (15 ur).	Lectures (presentations 30 ur), seminar exercises (15 hours), cabinet exercises (15 hours), field work (15 hours).

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit: teoretična vprašanja	60,00 %	Written and/or oral exam: theoretical questions

Vaje: ocena oddane seminarske naloge, ki vključuje poročilo s terena	40,00 %	Exercise: seminar work grade, which includes the field report
Pogoji za pristop k izpitu: udeležba na terenskih vajah in pozitivno opravljena seminarska naloga, ki vključuje poročilo s terena. Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Prerequisites for written exam: participation on field work and positively graded seminar work, which includes the field report. Grades: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10), according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

VERBOVŠEK, Timotej. Influences of aquifer properties on flow dimensions in dolomites. Ground water, 2009, issue 5, vol. 47, str. 660-668, doi: 10.1111/j.1745-6584.2009.00577.x.
VERBOVŠEK, Timotej, KANDUČ, Tjaša. Isotope geochemistry of groundwater from fractured dolomite aquifers in Central Slovenia. Aquatic geochemistry, 2016, vol. 22, no. 2, str. 131-151, doi: 10.1007/s10498-015-9281-z
ZEGA, Mojca, ROŽIČ, Boštjan, GABERŠEK, Martin, KANDUČ, Tjaša, ŽVAB ROŽIČ, Petra, VERBOVŠEK, Timotej. Mineralogical, hydrogeochemical and isotopic characteristics of the Žveplenica sulphide karstic spring (Trebuša Valley, NW Slovenia). Environmental earth sciences, 2015, vol. 74, issue 4, str. 3287-3300, doi: 10.1007/s12665-015-4357-z.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geologija v šoli
Course title:	Geology in School
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0597248
Koda učne enote na članici/UL Member course code:	11423

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	15	30	0	0	75	5

Nosilec predmeta/Lecturer:	Petra Žvab Rožič
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Ni pogojev.	No prerequisites.

Vsebina:	Content (Syllabus outline):
• Osnovni pojmi didaktične teorije, dejavniki pouka, poučevanje in učenje • Metode poučevanja v geologiji; metodološki vidik učnega procesa in pouka • Učila in učni pripomočki v geologiji; osnove, primeri, kako ustrezno izbrati in uporabljati • Geologija in učni načrti; uvod, pregled, učni cilji • Ocenjevanje; pristopi ocenjevanja, samoevalvacija, refleksija • Geološke vsebine v učnem sistemu; pomen strokovnega znanja in potrebe šolskega kurikuluma, cilji in vsebine • Interpretacija strokovnih geoloških vsebin za določene ciljne skupine • Načrtovanje, priprava in izvedba učne ure	• Basic concepts of didactic theory, factors of teaching and learning • Teaching methods in geology; methodological aspect of learning process and teaching • Teaching and teaching aids in geology; basics, examples of how to properly select and use them • Geology and curriculum; introduction, review, learning objectives • Evaluation; assessment approaches, self-evaluation, reflection • Geological content in learning system; the importance of the expertise and needs of the school curriculum, goals and content • Interpretation of professional geological content for specific target groups • Design, preparation and implementation of the lesson

Temeljna literatura in viri/Readings:

Bligh, D.A., 1971. What'sthe Use of Lectures. Devon: Briar House Exeter.

Martin-Kniep, G. O. in Picone-Zocchia, J. *Changing the way you teach, improving the way students learn*. Alexandria, Va: Association for Supervision and Curriculum Development, 2009.

D. Kennedy, *Writing and using learning outcomes: a practical guide*. University College Cork, 2006.

Marentič Požarnik, B., Lavrič, A., 2011. Predavanje kot komunikacija - Kako motivirati in aktivirati študente. Center za pedagoško izobraževanje Filozofske fakultete, Ljubljana, 143 str.
Puklek Levpušček, M., Marentič Požarnik, B., 2005. Skupinsko delo za aktiven študij, Center za pedagoško izobraževanje Filozofske faklutete, Ljubljana, 136 str.
Marentič Požarnik, Barica; Peklaj, Cirila: Preverjanje in ocenjevanje za uspešnejši študij, Univerza v Ljubljani, Center za pedagoško izobraževanje Filozofske fakultete, Ljubljana 2002.
Trenutno veljavni učni načrti za osnovne in srednje šole (MIZŠ; http://www.mizs.gov.si/delovna_podrocja/direkto-rat_za_predsolsko_vzgojo_in_osnovno_sol-stvo/osnovno_solstvo/ucni_nacrti/)

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študent/ka pridobi znanje na področju didaktičnih pristopov, pri interpretaciji specifičnih geoloških vsebin, izkušnje pri izbiri pravih metod in učnih pripomočkov ter vpogled v obstoječe stanje na področju izobraževanja v Sloveniji. Nauči se kritične presoje strokovne literature in veščin interpretacij strokovnih geoloških tekstov za potrebe določenih ciljnih skupin. Spozna, izbere in pravilno uporablja različne metode poučevanja ter jih uspešno predstavi tudi v praksi. Pridobi sposobnost samoevalvacije in ocenjevanja drugih. KOMPETENCE: Študenti/ke bodo obogatili znanje strokovno geoloških vsebin, kot tudi pridobili veščine osnovnih didaktičnih pristopov za interpretacijo le teh. Sposobni bodo kritično presojati obstoječe strokovne geološke vsebine, jih razumeti in pravilno predstaviti. Pri tem bodo pomemben poudarek posvetili tudi metodološkim pristopom in uporabi učnih pripomočkov. Sposobni bodo samostojne priprave in izvedbe učne ure z geološko vsebino.	OBJECTIVES: Student receives knowledge in the field of didactic approaches, in interpretation of specific geological contents, experience in choosing the right methods and teaching aids, and insight into the current state of education in Slovenia. They learn the critical judgments of the professional literature and the skills of interpreting professional geological texts for the needs of specific target groups. They learn about, choose and correctly use different teaching methods and successfully introduces them in practice. They gain the ability to self-evaluate and evaluate others. COMPETENCES: Students will enrich knowledge of geological content, as well as acquire basic didactic approaches to interpreting them. They will be able to critically evaluate existing professional geological content, understand it and present it properly. In doing so, significant emphasis will be placed on methodological approaches and the use of teaching aids. They will be able to independently prepare and carry out lessons with geological content.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študenti/ke se nauči pravilne interpretacije strokovnih geoloških vsebin in pri tem poglobi njihovo osnovno razumevanje. Pridobi tudi vsa potrebna znanja za pravilno in, po aktualnih standardih, uspešno predstavitev geoloških vsebin. S tem se dvigne geološko in didaktično znanje potencialnih učiteljev geologije.	Students learn about correct interpretation of professional geological content and better understand some of their basic understanding. They also acquire all the necessary knowledge for the correct and, by current standards, successful presentation of geological contents. This raises the geological and didactic knowledge of potential geology teachers.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z demonstracijami, seminarsko delo (zasnova, priprava in predstavitev)	Lectures with demonstrations, seminar work (design, preparation and presentation)

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
pisni in/ali ustno izpit	50,00 %	written and/or oral exam
seminarsko delo	50,00 %	seminar work

Reference nosilca/Lecturer's references:

BRAJKOVIĆ, Rok, BEDJANIČ, Mojca, MALENŠEK ANDOLŠEK, Neža, RMAN, Nina, NOVAK, Matevž, ŠUŠMELJ, Kaja, ŽVAB ROŽIČ, Petra. Sistematičen pregled geoloških učnih ciljev in učbeniških vsebin v osnovnih šolah in v splošnih gimnazijah = Systematic overview of geological learning objectives and textbook contents for primary schools and gymnasiums. *Geologija*. [Tiskana izd.]. 2018, 61, št. 2, str. 239-252, ilustr. ISSN 0016-7789. DOI: 10.5474/geologija.2018.017.

BRAJKOVIĆ, Rok, VALAND, Nina, KADIVEC, Katarina, BOŽIČ, Dominik, ŽVAB ROŽIČ, Petra. KamenCheck - učni pripomoček za prepoznavanje in razvrščanje kamnin. *Proteus : ilustriran časopis za poljudno prirodoznanstvo*. [Tiskana izd.]. feb. 2019, letn. 81, [št.] 6, str. 243, 270-278, ilustr. ISSN 0033-1805.

ŽVAB ROŽIČ, Petra, BEDJANIČ, Mojca, BRAČIČ-ŽELEZNIK, Branka, BRAJKOVIĆ, Rok, FUCHS, Katarina, KARNIČNIK, Barbara, KOMAR, Darja, KOREN, Katja, KRIŽNAR, Matija, MAKOVAC, Samanta, MALENŠEK ANDOLŠEK, Neža, NOVAK, Matevž, PRAPROTNIK KASTELIC, Jerca, RMAN, Nina, ZUPANČIČ, Lan. Geology every day! - an example of educational workshop to teach the geology. V: *European Geosciences Union, General Assembly 2019, Vienna, Austria, 7-12 April 2019*. München: European Geosciences Union, 2019. Str. 15072. Geophysical research abstracts, Vol. 21. ISSN 1607-7962.

ŽVAB ROŽIČ, Petra, GABRIJELČIČ TOMC, Helena, GUNA, Jože, FON, Žiga, BRAJKOVIĆ, Rok, BOŽIČ, Dominik, KADIVEC, Katarina, VALAND, Nina, KNIFIC KOŠIR, Aja, ŠKERJANC, Anja, ABRAM, Tadej, VOZLIČ, Sašo, BABUDER, Klemen. *KamenCheck : "Kamen na Kamen palača"*. http://kamencheck.digied.si/.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geološki izbirni predmet
Course title:	Geology elective
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik	2. semester
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik	2. semester
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0111903
Koda učne enote na članici/UL Member course code:	822

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	45	0	0	75	5

Nosilec predmeta/Lecturer:

Vrsta predmeta/Course type:

Jeziki/Languages:		
	Predavanja/Lectures:	
	Vaje/Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**

Vsebina:	**Content (Syllabus outline):**

Temeljna literatura in viri/Readings:

Cilji in kompetence:	**Objectives and competences:**

Predvideni študijski rezultati:	**Intended learning outcomes:**

Metode poučevanja in učenja:	**Learning and teaching methods:**

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**

Reference nosilca/Lecturer's references:

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geološki izbirni predmet
Course title:	Geology elective
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0564729
Koda učne enote na članici/UL Member course code:	11424

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	45	0	0	75	5

Nosilec predmeta/Lecturer:	
Vrsta predmeta/Course type:	

Jeziki/Languages:	Predavanja/Lectures:	
	Vaje/Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**

Vsebina:	**Content (Syllabus outline):**

Temeljna literatura in viri/Readings:

Cilji in kompetence:	**Objectives and competences:**

Predvideni študijski rezultati:	**Intended learning outcomes:**

Metode poučevanja in učenja:	**Learning and teaching methods:**

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**

Reference nosilca/Lecturer's references:

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geomodeliranje
Course title:	Geomodeling
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik, 2. letnik	1. semester
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562376
Koda učne enote na članici/UL Member course code:	721

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	30	0	0	0	75	5

Nosilec predmeta/Lecturer:	Marko Vrabec
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Zaradi omejitve števila programskih licenc in delovnih mest je število slušateljev omejeno na 10. Če je prijav več kot 10, imajo prednost tisti študenti, ki bodo znanje geomodeliranja potrebovali pri svoji magistrski nalogi, oziroma že imajo problem, ki bi ga lahko reševali z geomodeliranjem.	Due to the limited number of available software licenses and workplaces, the number of course attendants is limited to 10. Priority will be given to students who will need geomodeling knowledge in their Master Thesis, or who already have a topic which could be solved with the help of geomodeling.

Vsebina:	**Content (Syllabus outline):**
vrste podpovršinskih podatkov v geologiji uvod v programski paket Gocad/SKUA diskretno modeliranje naravnih objektov osnovni geometrijski elementi: točke, krivulje, ploskve volumski geometrijski elementi: voxet, sgrid diskretna gladka interpolacija (DSI) geološko modeliranje objektov: kontrolni pogoji in efekti prelomov celovit digitalni 3D geološki model kontrola kvalitete (QC) osnove prostorske geostatistike modeliranje zveznih in diskretnih spremenljivk deterministične in stohastične metode modeliranja prostorske porazdelitve posebna poglavja: inverzija in geološka kontrola geofizikalnih podatkov, modeliranje vodnega toka in prenosa snovi v podpovršju, strukturno retrodeformiranje	types of subsurface data in Geology introduction to the Gocad/SKUA software discrete modeling of geological objects basic geometrical objects: points, curves, surfaces volumetric geometrical objects: voxet, sgrid Discrete Smooth Interpolation (DSI) geological modeling on objects: control constraints and effects of faulting integral 3D digital geological model quality control (QC) basics of spatial geostatistics modeling of continuous and categorical variables deterministic and stochastic modeling of spatial variability special topics: inversion and geological control of geophysical data, modeling of subsurface fluid flow, structural retrodeformation

Temeljna literatura in viri/Readings:

MALLET, J.L., 2002, Geomodeling, Oxford University Press, 624 str. MALLET, J.L., 2008, Numerical Earth Models, European Association of Geoscientists & Engineers, 147 str. CAERS, J., 2005, Petroleum Geostatistics, Society of Petroleum Engineers, 88 str.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študenti se spoznajo z modernimi metodami geometrijskega modeliranja strukture podpovršja. KOMPETENCE: Sposobnost izbire ustrezne metode modeliranja za dan problem. Sposobnost uporabe moderne programske opreme za modeliranje podpovršja.	OBJECTIVES: Students get familiarized with modern methods for geometrical modeling of subsurface structure. COMPETENCES: Ability to select a modeling method suited for a given problem. Capability of using modern software for subsurface modeling.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobljeno poglobljeno znanje iz geometrijskega modeliranja strukture podpovršja. Izdelava interpretativnih modelov podpovršja iz pomanjkljivih podatkov. Kritična uporaba podatkov in kontrola kvalitete modelov. Poznavanje dela s programskim paketom Paradigm Gocad/SKUA.	Students acquire in-depth knowledge of geometrical modeling of subsurface structure. They are able to create interpretative models from incomplete datasets. They can critically evaluate the data and control the quality of derived models. They are familiar with working in Paradigm Gocad/SKUA software package.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja. Vodene seminarske vaje s praktičnim delom na računalniku (45 ur). Domače naloge (izdelava manjših samostojnih projektov).	Lectures. Lab exercises involving practical work on computers (45 hrs). Homework in the form of small independent projects.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
zaključni projekt	50,00 %	final project
zagovor zaključnega projekta	50,00 %	oral defense
Na koncu študenti izdelajo zaključni projekt in ga zagovarjajo. Na zagovoru morajo pokazati tudi zadovoljivo poznavanje teoretičnih osnov predmeta.		At the end of the coursework, students prepare their final project, which they then defend orally. In the defense students must also demonstrate satisfactory knowledge of theoretical foundations.

Reference nosilca/Lecturer's references:

VRABEC, Marko, ČAR, Jože, VEBER, Igor. Kinematics of the Šoštanj Fault in the Velenje basin area - insights from subsurface data and paleostress analysis. RMZ-mater. geoenviron., 1999, vol. 46, str. 623-634. ŽALOHAR, Jure, VRABEC, Marko. Combined kinematic and paleostress analysis of fault-slip data: the Multiple-slip method. J. struct. geol., 2008, vol. 30, str. 1603-1613. VRABEC, Marko. Image analysis as a tool in geometrical description and structural analysis of outcrops. RMZ-mater. geoenviron., 1999, vol. 46, str. 613-622.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geomorfologija 2
Course title:	Geomorphology 2
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0596371
Koda učne enote na članici/UL Member course code:	11418

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
15	15	15	0	15	60	4

Nosilec predmeta/Lecturer:	Andrej Šmuc, Tomislav Popit
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Vpis v 2. letnik študija 2. stopnje.	Entering the 2st year of 2nd grade program.

Vsebina:	Content (Syllabus outline):
Reke in rečni sistemi: Fluvialno okolje rek in porečja, erozijska baza, razvoj porečja, Erozijske fluvialne oblike (grape, živoskalna korita, aluvialna korita, geometrija korit), Poplavne ravnice in terase. Glacialna in periglacialna okolja: Ledeniške erozijske in residualne oblike, Depozicijske ledeniške oblike, glaciofluvialne, subglacialne in periglacialne oblike. Puščave: Uvod (definicija, različne vrste puščav, nastanek, delovanje vetra in vode, Erozijske, deflacijske in depozicijske oblike. Obalna geomorfologija: Uvod (valovi, plima, obalni tokovi, cunamiji), Erozijske in depozicijske oblike, plimske ravnice, delte in estuarji. Pobočni procesi: Geomorfologija obravnava nastanek različnih oblik površja in deformacij pobočnih sedimentov; značilnosti površja plazov, kot posledica geoloških struktur; prepoznavanje oblik, kot tudi razširjenosti in lastnosti površja posameznih sedimentnih teles s pomočjo vizualne interpretacije senčenega modela reliefa (lidar) v kombinaciji z geološkim in geomorfološkim kartiranjem ter identifikacijo deformacij počasnih kamninskih pobočij (globokih gravitacijskih plazov). Posebno poglavje je tudi dendrogeomorfološka analiza s katero lahko prepoznamo in datiramo pobočne masne procese na	Fluvial geomorphology: Drainage basins, water and sediment in channels, channel form and processes, floodplains. Glacial and periglacial environments: Glacial erosion and residual forms, deposition glacial forms, glacifluvial, subglacial and periglacial forms. Deserts: Introduction (definition, different types of deserts, formation, activity of wind and water, erosion, deflation and depositional forms. Coastal geomorphology: Introduction (waves, tides, coastal currents, tsunamis), forms of erosion and deposition, tidal plains, deltas and estuaries. Slope proceses: Geomorphology of landslides deals with origin of different surface and slope deformation of slope deposit; landslides surface features and their relationship to its geological structures; identification of the form of the prevalence and surface characteristics of individual sedimentary bodies by visual interpretation of the shaded digital elevation model calculated from the data of airborne laser scanning (lidar) in the combination of geological and geomorphological mapping and identification of slow rock-slope (deep-seated gravitational slope) deformation; Special chapter is dendrogeomorphological analysis of mass wasting

podlagi sprememb v letnih prirastnih plasteh (branikah) dreves. Kartografija plazov pa obravnava: oblikovanje, simbolizacija in vizualizacija geomorfoloških kart, primer kartiranja kvartalnih pobočnih sedimentov na konkretnem primeru. Antropogena geomorfologija: Posredni in neposredni vplivi človeka na okolje, glavna vplivna delovanja človeka.	processes, where the different parameters of tree rings are used to identify and date idnividual mass wasting processes. Cartography delas with design, symbolization and visualization of geomorphological maps, case studies: Mapping Quaternary slope deposit. Antropogenic geomorphology: study of role of humans in creating landforms and modifying the geomorphological processes.

Temeljna literatura in viri/Readings:

Knjige / Books

- ANDERSON, R.S. & ANDERSON S.P.2010: Geomorphology The mechanics and Chemistry of landscape. - Cambridge, 637 pp.
- BOWMAN, D. 2019: Principles of Alluvial fan morphology. – Springer, 151 pp, ISBN 978-94-024-1558-2.
- BURBANK, D.W. & ANDERSON R.P. 2001: Tectonic geomorphology. – Blackwell Science, 274 pp.
- CHARLES, G. 2014: Interpreting aerial photographs to identify natural hazards. – Elsevier, 184 pp.
- CLAGUE, JJ., STEAD, D. 2012: Landslides. Types, Mechanisms and Modeling. Cambridge University Press 436 pp.
- DE BLASIO, F.V. 2011: Introduction to the Physics of Landslides. Springer, 408 pp.
- LEOPOLD L.B., WOLMAN G.M. & MILLER J.P. 1995: Fluvial processes in geomorphology. - Dover, 522 pp.
- READING, H., G. *Sedimentary Environments: Processes, Facies and Stratigraphy*. 3rd edition. Oxford, University of Oxford, 1996, 688 pp.
- SMITH, M.J., PARON, P. & GRIFFITHS, S. 2011: Geomorphological mapping, methods and applications. – Elsevier. 612 pp.
- STOFFEL, M., BOLLSCHWEILER, M., BUTLER, D., R., LUCKMAN, B., H. 2010: *Tree Rings and natural hazards: A state-of-the-Art,* Advances in Global Change Research 41, Springer, 440 pp.
- SUMMERFIELD, M.A. 1991: Global Geomorphology. - Longman, 537 pp., ISBN: 0-582-30156-4.
- SZABO J., DAVID L. & LOCZY. 2010: Anthropogenic geomorphology: A guide to man-made landforms. – Springer. 298 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Slušatelj nadgradi znanja o interakciji med eksogenimi in endogenimi procesi na zemeljski površini in o rezultatih tega medsebojnega učinkovanja. Študent se izpopolni v principih terenskega merjenja in jih zna vpeti v prostor. Nauči se nadgraditi znanje pridobljeno pri posameznih poglavjih v okviru predmetov iz 1. stopnje študija geologije. Nauči in nadgradi se tehnike geomorfološkega kartiranja, vizualizacije, interpretacije in kvantifikacije Zemljinega površja. Nauči se opremiti in oblikovati geomorfološko karto s simboli in primerno vizualizacijo in izdelati lastno geomorfološko karto kvartarnih sedimentov. KOMPETENCE: Vsebina predmeta študentu omogoča in hkrati od študenta zahteva, da na konkretnih primerih posamezne geomorfne oblike ustrezno kvalitativno opiše in jih kvantitativno izmeri ter genetsko in procesno opredeli. Zmožen je izvajanja geomorfoloških kvartarnih pobočnih sedimentov in je sposoben raziskovalnega dela v kvartarni geologiji in geomorfologiji v povezavi z raziskovanjem Zemljinih oblik na površju.	OBJECTIVES: The students build on the knowledge of the interaction between exogenous and endogenous processes and the resulting landforms. They learn how to build on the knowledge acquired in the individual chapters within the subjects of the first level geology course. They learn about techniques in applied geomorphological mapping, vizualization, interpretation and quantification of landforms. Students learn design, symbolisation and visualization of geomorphological maps and wil made own geomorphological map of Quaternary slope deposit. COMPETENCES: The content of the course enables and at the same time requires students to describe individual geomorphic forms in a qualitatively and quantitatively appropriate manner and to identify them genetically and processually. Student is able to describe and quantitatively measure different geomorphological features and interpret processes of their formation.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje, pridobljeno pri predmetu predstavlja osnovno podlago za geološko znanstvenoraziskovalno delo na območju Slovenije in širše okolice. Študent pozna in razume vzročne povezave med geomorfnimi procesi in	Knowledge of the course presents the fundamental bae for geological research work in Slovenia and its surroundings. Student is able to understand the connection between the geomorphic process and form.

oblikami. V različnih praktičnih situacijah je na podlagi pridobljenega znanja sposoben genetsko razumeti posamezno geomorfno obliko ali proces in razumeti ter oceniti njen (njegov) morebiten vpliv na naravno in antropogeno okolje. Predmet študentu omogoča razmislek o povezanosti vseh geomorfnih oblik z antagonizmom in sinergizmom med eksogenimi in endogenimi procesi v konkretnih terenskih situacijah. Študent zna povezovati znanje, ki ga je pridobil pri posameznih poglavjih v okviru drugih predmetov. Hkrati se seznani s praktičnimi aplikacijami pridobljenega znanja na druga področja.	In practical situations the students understands genetic origin of particular geomorphic form or a process and is able to evaluate its influence on natural and anthropogenic environment. The student is able to ponder over interconnections between all endogenic and eksogenic processes reflected in a speciphic form. The student is able to woek with processionals from other fields (civil engineers, biologists, ..) and is able to use domestic and foreign professional and scientific literature .

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, kabinetne vaje in terensko delo.	Lectures, tutorial and field work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	80,00 %	Written and/or oral exam
Seminar	20,00 %	Seminar work

Reference nosilca/Lecturer's references:

POPIT, Tomislav, ROŽIČ, Boštjan, ŠMUC, Andrej, KOKALJ, Žiga, VERBOVŠEK, Timotej, KOŠIR, Adrijan. A LIDAR, GIS and basic spatial statistic application for the study of ravine and palaeo-ravine evolution in the upper Vipava valley, SW Slovenia. *Geomorphology : an international journal of pure and applied geomorphology*, ISSN 0169-555X. [Print ed.], 2014, vol. 204, str. 638-645.http://dx.doi.org/10.1016/j.geomorph.2013.09.010.

POPIT, Tomislav, SUPEJ, Blaž, KOKALJ, Žiga, VERBOVŠEK, Timotej. Primerjava metod za geomorfometrične analize hrapavosti površja na primeru Vipavske doline = Comparison of methods for geomorphometric analysis of surface roughness in the Vipava valley. *Geodetski vestnik : glasilo Zveze geodetov Slovenije*, ISSN 0351-0271. [Tiskana izd.], 2016, vol. 60, št. 2, str. 227-240, ilustr., doi: 10.15292/geodetski-vestnik.2016.02.227-240.

VERBOVŠEK, Timotej, POPIT, Tomislav, KOKALJ, Žiga. VAT method for visualization of mass movement features : an alternative to hillshaded DEM. *Remote sensing*, ISSN 2072-4292, 2019, vol. 11, iss. 24, str. 1-14, doi: 10.3390/rs11242946.

TROBEC, Ana, ŠMUC, Andrej, POGLAJEN, Sašo, VRABEC, Marko. Submerged and buried Pleistocene river channels in the Gulf of Trieste (Northern Adriatic Sea) : geomorphic, stratigraphic and tectonic inferences. Geomorphology, ISSN 0169-555X. [Print ed.], 2017, vol. 286, str. 110-120.

JAMŠEK RUPNIK, Petra, ČUŠ, Franc, ŠMUC, Andrej. Geomorphology and wine : the case of Malvasia in the Vipava valley, Slovenia = Geomorfologija in vino : primer sorte malvazija v Vipavski dolini. Acta geographica Slovenica, ISSN 1581-6613. [Tiskana izd.], 2016, 56, št. 1, str. 7-23,

ŠMUC, Andrej, JANECKA, Karolina, LEMPA, Michał, KACZKA, Ryszard J. The spatio-temporal dynamics of the Ciprnik complex landslide, Tamar valley, Julian Alps, Slovenia. Studia Geomorphologica Carpatho-Balcanica, ISSN 0081-6434, 2015, vol. 49, str. 35-54.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geomorfometrija
Course title:	Geomorfometry
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0596402
Koda učne enote na članici/UL Member course code:	11420

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
20	25	0	0	0	45	3

Nosilec predmeta/Lecturer:	Timotej Verbovšek
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Jih ni.	None.

Vsebina:	Content (Syllabus outline):
• Uvod (uporaba za geologe, vzorčenje, napake, definicija reliefa). Težava naklonov. Hipsometrija, analiza izohips, izračun prave 3D površine površja, Teselacija – Voronoi/Thiessen, Delaunayeva triangulacija. • Digitalni modeli višin (ASTER, SRTM, lidar), primerjava. • 1-D in 2-D Fourierjeva analiza cikličnosti površja. Smerni variogrami površja. • Analize hrapavosti in ukrivljenosti površja (indeks TRI po Rileyu, variabilnosti višin in naklonov, indeks TPI). • Alternativne metode rastrske obdelave in vizualizacije površja: težave senčenih modelov površja, odprtost terena oz. Openness, Sky View Factor, metoda VAT, večkratno hkratno senčenje, model lokalnega reliefa. • Prostorska kvantifikacija erozije: Gavrilovićeva metoda, ostale metode, izračuni volumna sedimenta pri transportu. • Kraška morfometrija: izračun volumnov po metodah OCC in WSB na primeru vrtač, indeksi zakrasevanja (pitting index Rp), indeks krožnosti Ci, analize površin.	• Introduction (usage in geology, sampling, errors, relief). Slopes. Hypsometry, contour analysis, 3D surfaces. Voronoi/Thiessen tesselation , Delauney triangulation. Digital elevation models (ASTER, SRTM, lidar...) and their comparison. • 1-D and 2-D Fourier analysis of cyclicity of the surface. Directional variograms. • Terrain ruggedness indices and curvatures analysis (TRI index, TPI index, slope and height variability). • Alternative methods of raster analysis and visualization: problems of hillshaded models, openness, Sky View Factor, VAT method, multiple direction shading, local relief model. • Spatial quantification of erosion: Gavrilović method, other methods, sediment volume calculation. • Karstic geomorphometry: volume calculation by OCC and WSB methods on doline examples, pitting index Rp, circularity index Ci, surface analyses. • Morphometry of river networks: network density, orders, Horton and Hack laws, relationship to fractals, self-organized river basins. • Spatial autocorrelation (Moran I-index, Getis-Ord Gi* index), GWR (Geographic Weighted Regression).

• Morfometrija rečnih topologij: gostota mreže, redovi, povezave med dolžinami rek in površinami zaledij (Hortonovi zakoni, Hackov zakon, Strahlerjeva numeracija), povezave s fraktali, samoorganizirani rečni bazeni. • Prostorska avtokorelacija (Moranov I-indeks), Getis-Ordove analize vročih točk (Hot-spot Gi* indeks), GWR (metoda geografske regresije) • Fraktali. Metode določanja fraktalnih dimenzij, analize površja, težave pri vzorčenju (cenzuriranje in krajšanje), uporaba v geologiji, fraktalne porazdelitve, R/S Hurstova analiza, nastanek fraktalov, samoorganizirana kritičnost.	• Fractals. Determination methods of fractal dimension, censoring and truncation problems, fractal distributions, R/S Hurst analysis, origin of fractals, self-organized criticality.

Temeljna literatura in viri/Readings:

1. Chorley, R. J., 1972: Spatial Analysis in Geomorphology. Methuen & Co Ltd., 393 str.
2. Longley, P. A., Brooks, S. M., McDonnell, R., MacMillan, B., 1998: Geocomputation – A Primer. John Wiley & Sons, 278 str.
3. Haining, R., 2003: Spatial Data Analysis. Theory and Practice. Cambridge University Press, 432 str.
4. Geomorphometry: Concepts, Software, Applications Edited by Tomislav Hengl and Hannes I. Reuter. 772 p.
5. Rodríguez-Iturbe, I.U. & Rinaldo, A. 2001. Fractal River Basins: Chance and Self-Organization. Cambridge University Press, 570 str.
6. Turcotte, D., 2012: Fractals and Chaos in Geology and Geophysics.
7. Priročniki in navodila programov QGIS in ArcGIS

Cilji in kompetence:	**Objectives and competences:**
CILJI: Slušatelj osvoji kvantitativno obdelavo površja ter prostorskih analiz preko sodobnih GIS orodij. Slušatelj zna analitično reševati prostorske probleme in najti praktične rešitve za kvantitativne opredelitve geomorfoloških lastnosti površja. KOMPETENCE: Razumevanje geomorfoloških procesov, sposobnost matematične formulacije teh procesov, metod in tehnik, s katerimi se bodo študenti srečevali; formulacija problemov z izbiro potrebnih podatkov, metodo in interpretacijo meritev, ter upoštevanjem poenostavitev.	OBJECTIVES: Students gain the knowledge of quantitative spatial analyses by modern GIS methods. Students know to analytically perform the spatial problems and find practical solutions to quantitatively define the geomorphological properties of the surface. COMPETENCES: Understanding of geomorphological processes, ability to mathematically formulate these processes, methods and techniques; formulation of problems with selection of suitable data, methods and interpretation of measurements, by considering the simplifications needed for spatial analyses.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Razumevanje pojavov v naravi, ki jih študentje opredelijo s kvantitativnimi pristopi. Modeliranje problemov z uporabo poenostavitev (nebistvenih lastnosti); izbira potrebnih podatkov; interpretacija meritev.	Understanding of natural phenomena based on simple (abstract) laws, justification of simplifications and approximations. Modelling of problems using simplifications; choice of necessary data and interpretation of measurements.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, vodeno in samostojno reševanje računskih vaj in problemov z računalniškimi in računskimi orodji. Vaje se izvajajo kot seminarske vaje.	Lectures with demonstrations, assisted and individual problem solving with computer and computational methods. Exercises are performed as seminar exercises.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Izpit: pisni in/ali ustni (teoretični del)	60,00 %	Exam: written and/or oral exam
Kolokvij: pisni (praktični del na računalnikih)	40,00 %	Exercises: examination on computers

Pogoji za pristop k izpitu: pozitivno opravljen kolokvij Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Prerequisites for written exam: positively graded exercises Grades: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10), according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

VERBOVŠEK, Timotej, GABOR, Laura. Morphometric properties of dolines in Matarsko podolje, SW Slovenia. *Environmental earth sciences*, ISSN 1866-6280, 2019, vol. 78, iss. 14, str. 1-16, doi: 10.1007/s12665-019-8398-6.

VERBOVŠEK, Timotej, POPIT, Tomislav, KOKALJ, Žiga. VAT method for visualization of mass movement features : an alternative to hillshaded DEM. *Remote sensing*, ISSN 2072-4292, 2019, vol. 11, iss. 24, str. 1-14, doi: 10.3390/rs11242946.

VERBOVŠEK, Timotej, POPIT, Tomislav. GIS-assisted classification of litho-geomorphological units using Maximum Likelihood Classification, Vipava Valley, SW Slovenia. *Landslides : Journal of the international consortium on landslides*, ISSN 1612-510X. [Print ed.], 2018, vol. 15, iss. 7, str. 1415-1424, doi: 10.1007/s10346-018-1004-2.

POPIT, Tomislav, SUPEJ, Blaž, KOKALJ, Žiga, VERBOVŠEK, Timotej. Primerjava metod za geomorfometrične analize hrapavosti površja na primeru Vipavske doline = Comparison of methods for geomorphometric analysis of surface roughness in the Vipava valley. *Geodetski vestnik : glasilo Zveze geodetov Slovenije*, ISSN 0351-0271. [Tiskana izd.], 2016, vol. 60, št. 2, str. 227-240, ilustr., doi: 10.15292/geodetski-vestnik.2016.02.227-240.

POPIT, Tomislav, ROŽIČ, Boštjan, ŠMUC, Andrej, KOKALJ, Žiga, VERBOVŠEK, Timotej, KOŠIR, Adrijan. A LIDAR, GIS and basic spatial statistic application for the study of ravine and palaeo-ravine evolution in the upper Vipava valley, SW Slovenia. *Geomorphology : an international journal of pure and applied geomorphology*, ISSN 0169-555X. [Print ed.], 2014, vol. 204, str. 638-645. http://dx.doi.org/10.1016/j.geomorph.2013.09.010.

POPIT, Tomislav, VERBOVŠEK, Timotej. Analysis of surface roughness in the Sveta Magdalena paleo-landslide in the Rebrnice area = Analiza hrapavosti površja fosilnega plazu Sveta Magdalena na območju Rebrnic. *RMZ - Materials and geoenvironment : periodical for mining, metallurgy and geology*, ISSN 1408-7073. [Tiskana izd.], dec. 2013, vol. 60, no. 3, str. 197-204.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Globalna geofizika
Course title:	Global Geophysics
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562398
Koda učne enote na članici/UL Member course code:	723

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	30	0	0	0	75	5

Nosilec predmeta/Lecturer:	Andrej Gosar
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Pogoj za pristop k izpitu: opravljena izpita iz Geofizike (1. stopnja) in Geofizikalnih metod raziskav (2. stopnja).	To take an exam passed Geophysics (1st grade) and Geophysical research methods exam (2nd grade) are mandatory.

Vsebina:	Content (Syllabus outline):
Uvod: Zemlja kot planet, razvoj znanosti o Zemlji, Zemljina polja, osnove notranje zgradbe Zemlje Težnost in oblika Zemlje: osnove gravitacije, referenčni sferoid in geoid, težnostno polje, izostazija, gostota kamnin, meritve težnega pospeška, korekcije v gravimetriji, Bouguerjeva težnostna anomalija, regionalne in rezidualne anomalije, interpretacija težnostnih anomalij, gravimetrične karte Magnetno polje Zemlje: osnove magnetizma, polje notranjega izvora (dipolno in nedipolno polje), sekularne variacije, polje zunanjega izvora (časovne spremembe), magnetna susceptibilnost, remanentni magnetizem, magnetometri, korekcije v magnetometriji, magnetne anomalije, interpretacija magnetnih anomalij, paleomagnetizem, paleomagnetizem in globalna tektonika, magnetne karte Zemljina toplota: viri Zemljine toplote, prehajanje toplote v Zemlji (kondukcija, konvekcija, radiacija), geotermične raziskave, določevanje temperature, toplotna prevodnost kamnin, gostota toplotnega toka, toplota Zemlje in globalna tektonika, Zemljina toplota kot vir energije, geotermične karte Notranja zgradba Zemlje: seizmološke raziskave	Introduction: Earth as a planet, development of Earth sciences, Earth's fields, principles of the internal structure of the Earth Gravity and figure of the Earth: reference spheroid and geoid, gravity field, isostasy, rock density, gravity measurements, gravity corrections, Bouguer anomaly, regional and residual anomaly, interpretation of gravity data, gravity maps Earth's magnetic field: origin of magnetic field, inner magnetic field (dipole and non-dipole), secular variations, outer magnetic field, temporal variations, magnetic susceptibility, remanent magnetism, magnetometers, magnetic corrections, interpretation of magnetic anomalies, paleomagnetism and global tectonics, magnetic maps Earth's heat: sources of Earth's heat, transfer of heat (conduction, convection, radiation), geothermal investigations, temperature measurements, thermal conductivity, heat flow density, Earth's heat and global tectonics, geothermal energy, geothermic maps Earth's interior: seismological investigations of the Earth's interior, surface waves analysis, seismic discontinuities, models of Earth's interior, global seismic

notranjosti Zemlje, glavne seizmične diskontinuitete, modeli Zemljine notranje zgradbe, globalna seizmična tomografija, analiza površinskih seizmičnih valov, prosta oscilacija Zemlje Tektonika plošč: sistem litosfera-astenosfera, litosferske plošče, razvoj teorije tektonike plošč, kontinentalna in oceanska skorja, stiki med ploščami (divergentni, konvergentni, transformni), vroče točke, tektonika plošč in globalna seizmičnost, reologija, geodinamika, gravimetrične, paleomagnetne in geotermične raziskave globalne tektonike, globoke seizmične raziskave litosfere	tomography, seismic surface waves analyses, free oscillation of the Earth Plate tectonics: lithosphere-asthenosphere system, lithospheric plates, development of plate tectonic theory, continental and oceanic crust, divergent, convergent and transform plate boundaries, hot spots, plate tectonics and global seismicity, rheology, global geodynamics, gravity, magnetic and geothermal investigations of global tectonics, deep seismic sounding of the lithosphere

Temeljna literatura in viri/Readings:

GOSAR, A. 2011: Globalna geofizika. UL-Naravoslovnotehniška fakulteta. 87 str.
FOWLER, C.M.R. 2005: The solid earth. An intruduction to global geophysics. Cambridge University Press, 2nd ed., 685 pp.
LOWRIE, W. 1997: Fundamentals of geophysics. Cambridge University Press, 354 pp.
LILLIE, R. J. 1999: Whole Earth geophysics. Prentice Hall, 361 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: seznanitev z osnovami globalne geofizike in zgradbe Zemlje, poznavanje Zemljinih polj, seizmologije in tektonike plošč, poznavanja metod raziskav v globalni geofiziki, povezovanje fizikalnih, geoloških in tehničnih znanj za razumevanje globalnih geofizikalnih in tektonskih pojavov. KOMPETENCE: razumevanje globalne geofizike, Zemljinih polj, osnov seizmologije in globalne tektonike, obvladovanje fizikalnega in geološkega ozadja globalnih geofizikalnih procesov.	OBJECTIVES: understanding principles of global geophysics and internal structure of the Earth, knowledge on Earth's fields, seismology and plate tectonics, integration of physical, geological and technical knowledge for understanding global geophysical and tectonic features. COMPETENCES: ability to conduct basic research work in geophysics, understanding physical and geological background of global geophysical processes.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: fizikalnega in geološkega ozadja globalnih geofizikalnih in tektonskih značilnosti, Zemljinih polj (težnostno, magnetno, toplotno), potresov in tektonike plošč, metod raziskav v globalni geofiziki.	Knowledge and understanding: physical and geological background of global geophysical and tectonic processes Earth's fields (gravity, magnetic, thermal), earthquakes and plate tectonics, research methods in global geophysics.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z uporabo prezentacij. Vodeno seminarsko delo s prezentacijami.	Lessons using presentations. Leaded seminar work with presentations.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
izpit iz snovi seminarja	40,00 %	Seminar examination
izpit iz snovi predavanj	60,00 %	Lectures examination
Izpit iz seminarja je praviloma ustni. Izpit iz snovi predavanj je praviloma pisni, lahko pa je tudi ustni. Ocenjevalna lestvica:51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Seminar examination is usually oral. Lectures examination is usually written, but can be also oral. Grades: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10), according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

Brückl, E., Bleibinhaus, F., GOSAR, Andrej, Grad, M., Guterch, A., Hrubcova, P., Keller, G.R., Majdański, M., Šumanovac, F., Tiira, T., Yliniemi, J., Hegedüs, E., Thybo, H. 2007: Crustal Structure Due to Collisional and Escape Tectonics in the Eastern Alps Region Based on Profiles Alp01 and Alp02 from the ALP 2002 Seismic Experiment. Journal of Geophysical Research, 112, B06308, 1-25.

GOSAR, Andrej 2012: Application of Environmental Seismic Intensity scale (ESI 2007) to Krn Mountains 1998 Mw = 5.6 earthquake (NW Slovenia) with emphasis on rockfalls. Nat. hazards earth syst. sci., 12/5, 1659-1670.Moulin, A., Benedetti, L., GOSAR, Andrej, Jamsek Rupnik, P., Rizza, M., Bourles, D., Ritz, J.-F. 2014: Determining the present-day kinematics of the Idrija fault (Slovenia) from airborne LiDAR topography. Tectonophysics, vol. 628, 188-205.

GOSAR, A. 2017: Study on the applicability of the microtremor HVSR method to support seismic microzonation in the town of Idrija (W Slovenia). Natural Hazards and Earth System Sciences, 17, 925-937.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Hidrogeokemija
Course title:	Hydrogeochemistry
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562399
Koda učne enote na članici/UL Member course code:	720

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	30	0	0	75	5

Nosilec predmeta/Lecturer:	Timotej Verbovšek
Vrsta predmeta/Course type:	Izbirni /Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
K izpitu lahko pristopi, kdor ima opravljen prvostopenjski študij geologije ali podobne naravoslovne smeri.	Finished first-level (BSc) of geology or similar course.

Vsebina:	Content (Syllabus outline):
Predavanja: Uvod. Kemične in fizikalne lastnosti vode, kemična sestava vod v atmosferi, površinskih in podzemnih vodah ter v oceanih. Kemično ravnotežje, kinetika, topnost, indeks nasičenja. Meritve in geokemične analize, metodika meritev, natančnost metod in napake v analizi, laboratoriji, akreditacija in uveljavljeni standardi. Sestava naravnih površinskih in podzemnih vod. TDS, prevodnost, trdota, glavni, stranski in sledni elementi v vodah, plini, radioaktivne snovi. Fizikalne lastnosti (vonj, motnost, prevodnost). Vplivi na sestavo vod: izvor in vsebnost glavnih ionov v vodnem okolju, interakcija vod s kamninami. Karbonatni in SiO2 sistem. Kemične reakcije in procesi v vodnem okolju: kislinsko-bazne reakcije, izločanje/raztapljanje, speciacija in kompleksacija, redoks reakcije, mešanje, sorpcija, ionska izmenjava, evaporacija, vplivi temperatur, zakrasevanje, transport snovi. Numerično modeliranje hidrogeokemičnih procesov in reakcij, kvantitativni izračuni. Inverzno modeliranje, določanje izvora in spremembe sestave voda.	Lectures: Introduction. Chemical and physical properties of water, surface and ground water, oceans. Chemical equilibrium, kinetics, solubility, saturation index. Measurements and analyses, techniques, accuracy and analytical errors, laboratories and standards. Composition of natural surface and ground waters. TDS, conductivity, hardness, major, minor and trace elements in waters, gases, radioactive species. Physical properties (smell, turbidity, conductivity). Influences on water composition: origin and values of ions in water environment, water-rock interaction. Carbonate and SiO2 systems. Chemical reactions and processes in aquatic environment: reactions, precipitation/dissolution, speciation and complexation, redox reactions, mixing, sorption, ion exchange, evaporation, temperature influence, karstification, transport. Numerical modeling of hydrogeochemical processes and reactions, quantitative calculations. Inverse modeling, determination of origin and changes of ground waters. Classification of waters and facies. Thermal and thermomineral waters.

Klasifikacija vod in faciesi. Termalne in termomineralne vode. Uporaba izotopov v hidrogeokemiji (frakcionacijski efekti, vrednosti v različnih okoljih, datacije, geotermometri). Onesnaževala v vodnem okolju. Zaščita vod. Prikaz rezultatov s kartami in diagrami (Piper, Durov, Schoeller,...). Zakonodaja s področja sestave in kvalitete površinskih in podzemnih vod. Predstavitev aktualnih problemov. Vaje: Računske in računalniške vaje (geokemični programa MS Excel in Phreeqc for Windows).	Isotopes in hydrogeochemistry (fractionation, values, age dating, geothermometers). Pollutants and water protection. Display of water composition by maps and geochemical diagrams (Piper, Durov, Schoeller...). Water legislation on composition and quality of surface and ground waters. Presentation of recent actual activities and problems. Exercises: Calculation and computer exercises (hand calculations, MS Excel, geochemical software Phreeqc for Windows).

Temeljna literatura in viri/Readings:

Izbrana poglavja iz knjig:
APPELO, C. A. J., POSTMA, D. Geochemistry, Groundwater and Pollution. 2nd ed. Taylor and Francis, 2005. 649 str.
MERKEL, B. J., PLANER-FRIEDRICH, B. Groundwater Geochemistry. A Practical Guide to Modeling of Natural and Contaminated Aquatic Systems. Berlin : Springer, 2005. 200 str.
GRAY, N. F., 2008: Drinking Water Quality. Problems and Solutions. Cambridge University Press, 520 str.
PEZDIČ, J., 1999: Izotopi in geokemijski procesi. Univerzitetni učbenik, Naravoslovnotehniška fakulteta, Oddelek za geologijo, Ljubljana, 269 str..
ZHU, C. & ANDERSON, G., 2005: Environmental Applications of Geochemical modeling. Cambridge University Press, 284 str.
Periodika (revije, npr. Applied Geochemistry, Environmental Geology, Hydrogeology Journal, Journal of Contaminant Geology, Geochimica and Cosmochimica Acta, Geologija, RMZ – Materials and Geoenvironment), zakonski akti, spletni viri.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Osvojiti znanje s področja sestave in vplivov na kvaliteto podzemnih voda ter zakonodajo. Spoznati geokemične procese v vodnem okolju. KOMPETENCE: Sposobnost samostojnega reševanja problematike s področja kvalitete, sestave in razvoja vod ter onesnaženja vodnih virov.	OBJECTIVES: To obtain the knowledge of influences on the ground water composition (processes in aquatic environment), and legislation. COMPETENCES: Ability to understand and solve the problems related to composition, quality and protection of ground waters.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Kandidati poznajo sestavo in vplive na kvaliteto podzemnih voda, razumejo geokemične procese v vodnem okolju.	Candidates obtain the knowledge of water composition and processes influencing the ground water composition.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (prezentacije, 45 ur) in laboratorijske oz. kabinetne vaje (30 ur).	Lectures (presentations, 45 hours) and laboratory/cabinet exercises (30 hours).

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit: teoretična vprašanja	60,00 %	Written and/or oral exam: theoretical questions
Kolokvij: računske in računalniške vaje	40,00 %	Exercise: computational and computer calculations
Pogoji za pristop k izpitu: pozitivno opravljen kolokvij Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Prerequisites for written exam: positively graded exercises. Grades: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10), according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

VERBOVŠEK, Timotej, KANDUČ, Tjaša. Isotope geochemistry of groundwater from fractured dolomite aquifers in Central Slovenia. Aquatic geochemistry, 2016, vol. 22, no. 2, str. 131-151, doi: 10.1007/s10498-015-9281-z
KANDUČ, Tjaša, KOCMAN, David, VERBOVŠEK, Timotej. Biogeochemistry of some selected Slovenian rivers (Kamniška Bistrica, Idrijca and Sava in Slovenia) : insights into river water geochemistry, stable carbon isotopes and weathering material flow = Biogeokemija izbranih slovenskih rek (Kamniška Bistrica, Idrijca in Sava v Sloveniji) : vpogled v rečno vodno geokemijo, stabilne izotope ogljika in snovne tokove preperevanja. Geologija, ISSN 0016-7789. [Tiskana izd.], 2017, vol. 60, št. 1, str. 9-26, ilustr., doi: 10.5474/geologija.2017.001
KANDUČ, Tjaša, MORI, Nataša, KOCELI, Ajda, VERBOVŠEK, Timotej. Hydrogeochemistry and isotope geochemistry of Velenje Basin groundwater = Hidrogeokemija in izotopska geokemija podzemnih vod Velenjskega bazena. Geologija, ISSN 0016-7789. [Tiskana izd.], 2016, vol. 59, št. 1, str. 7-22, ilustr., doi: 10.5474/geologija.2016.001.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Hidrogeologija onesnaževal
Course title:	Contaminant Hydrogeology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562400
Koda učne enote na članici/UL Member course code:	726

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	15	30	0	0	75	5

Nosilec predmeta/Lecturer:	Mihael Brenčič
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Zaključena dodiplomska (prva) stopnja. Pogoj za pristop k izpitu so opravljeni izpiti iz Matematike 1, Matematike 2 in Fizike iz obsega 1. stopenjskega študija geologije.	Bachelor degree. To take an exam, completed exams in Mathematics 1, Mathematics 2, and Physics included in the curriculum of BcS in Geology are mandatory.

Vsebina:	**Content (Syllabus outline):**
Predavanja: Kemija podzemne vode – interakcija vode in kamnin Vrste onesnaževal v podzemni vode Masni transport v nasičenem medzrnskem poroznem mediju Širjenje onesnaževal v razpoklinskih in kraško razpoklinskih sistemih Transformacija, zadrževanje in sprememba onesnaževal v vodonosnikih Masni transport v nenasičenem poroznem mediju Večfazni tok onesnaževal v vodonosnikih Anorganska onesnaževala podzemne vode Organska onesnaževala podzemne vode Monitoring podzemne vode in monitoring tal Vaje: Seminarske vaje (računske vaje iz masnega transporta v poroznem mediju) Laboratorijske vaje (uporaba matematičnih modelov za modeliranje masnega transporta v poroznem mediju).	Lectures: Chemistry of groundwater – water rock interaction Contaminants of groundwater Mass transport in saturated intergranular porous media Distribution of pollutants in fissured and karstic systems Transformation, retardation and decay of contaminants in aquifers Mass transport in unsaturated porous media Multi-phase flow in aquifers Inorganic contaminants of groundwater Organic contaminants of groundwater Groundwater and soil monitoring Exercises: Seminar exercises (mathematical exercises in the mass transport in groundwater) Laboratory exercises (application of mathematical models in modelling mass transport in porous media).

Temeljna literatura in viri/Readings:

Posamezna poglavja iz / Chapters from:
FETTER, C.W., 1999: Contaminant Hydrogeology. PRENTICE HALL.
BEAR, J. & VERUJIT, A., 1987: Modelling Groundwater Flow And Pollution. D. REIDEL PUBLISHING COMPANY.
KEHEW, A. E., 2001: Applied Chemical Hydrogeology. PRENTICE HALL.
LANGMUIR, D., 1997: Aqueous Environmental Geochemistry. PRENTICE HALL.
DOMENICO, P.A. & SCHWARTZ, F.W, 1990: Physical And Chemical Hydrogeology. WILEY.
SCHWARTZ, F.W. & ZHANG, H., Fundamentals Of Ground Water. WILEY.
BATU, V., 2006: Applied Flow And Solute Transport Modeling In Aquifers : Fundamental Principles And Analytical And Numerical Methods. WILEY.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Poglobiti razumevanje širjenja onesnaževal v podzemni vodi in vodonosnikih. Razumevanje konceptov masnega toka v različnih poroznih medijih v geološkem okolju. Podati teoretične osnove masnega transporta v različnih vodonosnikih in poroznih medijih z namenom uporabe znanj pri praktičnih primerih izkoriščanja podzemne vode za oskrbo prebivalstva s pitno vodo in zaščite vodnih virov. KOMPETENCE: Sposobnost analize in simulacije širjenja onesnaževal v različnih vodonosnikih.	OBJECTIVES: To deepen understanding of the spread of contaminants in groundwater and aquifers. Understanding the concepts of mass flow in various porous media in a geological environment. To introduce the theoretical basis of mass transport in various aquifers and porous media with the purpose of using knowledge in practical cases of exploitation of groundwater for supplying drinking water to the population and protection of water resources. COMPETENCES: Ability to analyze and simulate the spread of contaminants in different aquifers.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobljeno poglobljeno znanje iz masnega transporta v geološkem poroznem mediju. Pridobljene osnove poznavanja kemizma podzemne vode. Razumevanje procesov masnega toka v poroznem mediju. Osvojene računske spretnosti za modeliranje masnega toka v poroznem mediju. Dobro razumevanje procesov onesnaževanja podzemne vode in možnosti modeliranja so dobra osnova za izvajanje zaščitev podzemnih virov pitne vode.	The acquired in-depth knowledge of mass transport in geological porous media. Acquiring bases of knowledge of groundwater chemistry. Understanding the processes of mass flow in a porous medium. Credible skills for modeling the mass flow in the porous medium. A good understanding of groundwater pollution processes and modeling options is a good basis for the implementation of the protection of underground sources of drinking water.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, laboratorijske vaje, seminar.	Lectures, laboratory practices, seminar.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
snov predavanj	70,00 %	knowledge from the lectures
snov vaj	30,00 %	knowledge from exercises
Ocene: 6-10 (pozitivno;) ob upoštevanju Statuta UL in fakultetnih pravil.		Marks: 6-10 (positive) according to the UL Statute and faculty rules.

Reference nosilca/Lecturer's references:

BRENČIČ, Mihael, DAWSON, Andrew, FOLKESON, Lennart, FRANÇOIS, Denis, LEITǍO, Teresa E. Pollution mitigation. V: DAWSON, Andrew (ur.). Water in road structures : movement, drainage & effects, (Geotechnical, geological, and earthquake engineering). Dordrecht [etc.]: Springer, 2008, str. 283-297.
BRENČIČ, Mihael. Prečkanja cest preko vodovarstvenih območij = Crossing of drinking water resources protection zones by roads. Geologija., 2004, knj. 47, 2, str. 273-281.
BRENČIČ, Mihael, VIDMAR, Saška. Razlitja nevarnih snovi in njihov vpliv na podzemno vodo = Toxic fluid spills and their effects on groundwater. Ujma (Ljublj.), 2002, št. 16, str. 167-172.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Hidrologija za geologe
Course title:	Hydrology for Geologists
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0615368
Koda učne enote na članici/UL Member course code:	11412

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	15	0	0	45	3

Nosilec predmeta/Lecturer:	Mihael Brenčič
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
1. Uvodna izhodišča – zakaj je poznavanje hidroloških procesov pomembno za geologe. 2. Zgodovina vode na Zemlji in v vesolju – porazdelitev vode ob nastanku. 3. Vodni krog; globalni vodni krog, plitvi in globoki vodni krog; globalna vodna bilanca. 4. Voda v atmosferi – osnove hidrometeorologije; meritve parametrov klime potrebne za opredelitev padavin, opredelitev padavine, evapotranspiracija. 5. Površinske vode – hidrometrija, površinska vodna telesa, geomorfologija površinskih vodnih teles, padavine odtok, hidrogram in njegova analiza, poplave. 6. Morje in oceani – osnove oceanografije; morski tokovi, plimovanje morja. 7. Uporaba statistike v hidrologiji – osnovni statistični koncepti, porazdelitvena analiza in analiza povratne dobe, sintetični hidrogram, osnove hidrološke napovedi. 8. Paleohidrologija – zgodovina in razvoj vodnega kroga na Zemlji skozi geološka obdobja. 9. Voda v geoloških procesih – sedimentacija, diageneza kamnin, nastanek rudišč, tektonika, geomorfologija. 10. Voda in človek – človek kot hidrološki dejavnik. 11. Klimatske spremembe in vodni krog.	1. Introductory starting points – why understanding of hydrological processes is important. 2. History of water on Earth and space – how water was distributed at the begining. 3. Water cycle; global water cycle, shallow and deep water cycle; global water balance. 4. Water in the atmosphere – basics of hydrometeorology; basic climatic parameters measurements important for understanding of precipitation, characterisation of precipitation, evapotranspiration. 5. Surface water – hydrometry, surface water bodies, geomorphology of surface water bodies, run-off, hydrogram and its analysis, floods. 6. Oceans and seas – basics of ceanography, sea currents, tides. 7. Application of statistics in hydrology – basic statistical concepts in hydrology, distribution analysis and return periods, hydrological forecasting. 8. Paleohydrology – history and development of water cycle on Earth through geological periods. 9. Water in geological processes – sedimentation, diagenesis of rocks, ore genesis, tectonics, geomorphology. 10. Water and man – man as hydrological factor. 11. Climate change and hydrological cycle.

Temeljna literatura in viri/Readings:

BRENČIČ, M., 2020: Hidrologija v geologiji – izbrana poglavja. Študijsko gradivo v pripravi.
BRILLY, M. & ŠRAJ, M., 2014: Osnove hidrologije. Fakulteta za gradbeništvo in geodezijo, 309 str.
HENDRIKS, M.R, 2010: Introduction to Physical Hydrology, 352 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Seznanitev študentov z osnovami hidrologije in vlogo vode v geoloških procesih. Cilj predmeta je dvojen, na eni strani seznaniti študente z osnovami hidrologije, ki jih mora poznati geolog, da lahko kompetentno presoja geološke procese, na drugi strani pa študentu podati osnove hidroloških znanj, da jih bo lahko ustrezno uporabil v inženirsko geološki praksi. KOMPETENCE: Sposobnost izvajanja hidroloških analiz za potrebe geološkega dela ter sposobnost sodelovanja z drugimi strokami, ki delujejo na področju hidrologije.	OBJECTIVES: Introducing students to the basics of hydrology and the role of water in geological processes. The objective of the course is twofold; on the one hand to acquaint the students with the basics of hydrology that a geologist must know in order to be able to judge geological processes competently, and on the other hand to give the student the basics of hydrological knowledge so that he can apply them appropriately in engineering geological practice. COMPETENCES: Ability to perform hydrological analyzes for the needs of geological work and ability to cooperate with other professions active in the field of hydrology.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobljeno poglobljeno znanje s podoročja hidrologije. Možnost uporabe hidroloških znanj v vsakdanji inženirski praksi (npr. gradbeništvu, rudarstvu, planiranju, načrtovanju in upravljanju prostora). Vloga in pomen hidrologije v vsakdanji inženirski praksi ter njena uporaba pri interpretaciji geoloških procesov. Sposobnost izbire in uporabe ustrezne tuje in domače literature. Sposobnost komunikacije z drugimi strokami, sposobnost analize podatkov in sinteze. Uporaba različnih računalniških programov ter prehod iz kvalitativnega na kvantitativno obdelavo podatkov.	Knowledge obtained in the field of hydrology. Possibility of application of hydrological knowledge in engineering practice (e.g. civil engineering, mining, planning, design, spatial management). Meaning and role of hydrology in engineering practice and its application in the interpretation in geological processes. Ability to choose and use relevant domestic and foreign literature. The ability to communicate with other professions, the ability to analyze and synthesize information. Using a variety of computer programs, and the transition from qualitative to quantitative data processing.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in kabinetne vaje.	Lectures and laboratory exercises.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
snov predavanj (pisni in/ali ustni izpit)	60,00 %	knowledge from the lectures (written and/or oral exam)
snov vaj (pisni in/ali ustni izpit)	40,00 %	knowledge from exercises (written and/or oral exam)
Ocene: 6-10 (pozitivno) ob upoštevanju Statuta UL in fakultetnih pravil.		Marks: 6-10 (positive) according to the UL Statute and faculty rules.

Reference nosilca/Lecturer's references:

BRENČIČ, M., KONONOVA, N., VREČA, P., 2015: Relation between isotopic composition of precipitation and atmospheric circulation patterns. Journal of Hydrology. vol. 529, part 3, str. 1422-1432.
BRENČIČ, M., 2016: Statistical analysis of categorical time series of atmospheric elementary circulation mechanisms - Dzerdzeevski classification for the Northern hemisphere. PloS one. vol. 11, iss. 4, str. 1-24.
BRENČIČ, M., 2016: Extreme historical droughts in the South-Eastern Alps - analyses based on standardised precipitation index. Acta Geophysica. vol. 64, no. 5, str. 1731-1754.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Inženirskogeološki praktikum
Course title:	Engineering Geological Practicum
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	2. semester

Univerzitetna koda predmeta/University course code: 0640172

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
	15	30		30	75	5

Nosilec predmeta/Lecturer: Karmen Fifer Bizjak, Timotej Verbovšek

Vrsta predmeta/Course type: Izbirni/Elective

Jeziki/Languages:		
	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
-	-

Vsebina:	Content (Syllabus outline):
• Praktično inženirsko geološko delo. Izvajanje geomehanskih laboratorijskih preiskav za zemljine in kamnine, analiza rezultatov. Spoznavanje obnašanja zemljin in kamnin pod različnimi obremenitvami. Geomehanski popis vrtin. Priprava Poročila o lastnostih tal, ki je osnova za nadaljnji geotehnični projekt. • Terensko delo: izvajanje inženirsko geoloških popisov gradbenih jam za geotehnične objekte, stanovanjske objekte in izkopov v predorih. Pridobitev praktičnega znanja, ki se zahteva pri zaposlitvah na inštitutih in gradbenih podjetjih. Inženirsko geološki popisi izkopov, ki so osnova za nadaljnjo gradnjo geotehničnih objektov. Terenske preiskave plazov, popisi elementov plazu, meritve premikov plazov, izdelava inženirsko geološke karte na izbranem območju, kjer se pojavljajo plazovi. Ogled izbranih plazov ter praktičnih in-situ terenskih raziskav.	• Practical work. Geomechanical laboratory investigations for soils and rocks, analysis of results. Response of soils and rocks under variable stress conditions. Geomechanical reports of drill cores. Preparation of the Report of soil properties, which forms a basis for a further geotechnical project. • Field work: engineering geological reports of excavation pits for geotechnical objects, residential buildings, and excavations in the tunnels. Acquisition of practical knowledge required at further work at institutes and civil engineering employments. Field investigations of landslides, detailed mapping of landslide elements, landslide movement measurements, making of engineering geological map of a selected area with landslides. Field trip to selected landslides and in-situ field investigations.

Temeljna literatura in viri/Readings:

- Cornforth, D.H., 2005: Landslides in Practice, John Wiley & Sons.
- Highland, L. M. & Bobrowsky, P., 2008: The Landslide Handbook— A Guide to Understanding Landslides, Geological Survey of Canada. USGS Circular 1325.
- Hoek, E., 2007: Practical Rock Engineering, http://www.rocscience.com/hoek/PracticalRock

- Marjoribanks, R., 2010: Geological Methods in Mineral Exploration and Mining. 2nd ed., Springer.
- Price, D. G., 2009: Engineering Geology. Principles and Practice. Springer, Berlin.

Cilji in kompetence:	**Objectives and competences:**
Cilji: Študent bo nadgradil svoje osnovno znanje iz inženirske geologije za praktično delo pri inženirsko geoloških posegih na terenu. Kompetence: slušatelji pridobijo dodatne sposobnosti za opravljanje del, ki jih opravlja inženirski geolog pri popisih, izkopih ter terenskemu delu. Poudarek je na večjem praktičnem in terenskem oz. specifičnem znanju pri tematikah inženirske geologije, ki jih v sklopu osnovnih predmetov zaradi časovnih omejitev ni možno pridobiti.	Objectives: Student will improve his/her basic knowledge of engineering geology for a practical work during the field research. Competences: Students gather the additional capabilities for work, which is done by engineering geologist at various field interventions and mitigation of natural disasters. Emphasis will be given on greater field work and/or specific knowledge of engineering geological topics, which can not be obtained during the BSc study due to temporal limitations.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobitev praktičnih znanj za delo inženirskega geologa, potrebno pri zaposlitvah na inštitutih ali gradbenih podjetjih. Predmet omogoča, da študent pri pristopu k reševanju problemov preide k samostojnem reševanju življenjskih in konkretnih problemov in ne ostane na nivoju teoretičnih pristopov. Znanje iz osnovnih naravoslovnih in geoloških predmetov mora študent prenesti in uporabiti kot osnovno bazo, na kateri gradi inženirski pristop, potreben pri poznavanju metod geoloških raziskav. To znanje lahko nato uporabi pri drugih praktično usmerjenih predmetih.	Student gains the practical knowledge, which an engineering geologist uses further work at institutes and civil engineering employment. Student is able to solve concrete engineering-related problems and does not stay on a theoretical level only. Basic geological knowledge is upgraded to a higher engineering geological approach, and the latter can be used also at the other practically related subjects.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Seminar, vaje in terenske vaje .	Seminar, exercises and field exercises.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Oddano poročilo.	100,00 %	Written report.

Reference nosilca/Lecturer's references:

- ŽIVEC, Tina, ANŽUR, Andreja, VERBOVŠEK, Timotej. Determination of rock type and moisture content in flysch using TLS intensity in the Elerji quarry (South-West Slovenia). Bulletin of engineering geology and the environment. [Print ed.]. 2019, vol. 78, iss. 3, str. 1631-1643. ISSN 1435-9529. DOI: 10.1007/s10064-018-1245-2. [COBISS.SI-ID 1392990], [JCR, SNIP, WoS do 10. 8. 2020: št. citatov (TC): 1, čistih citatov (CI): 1, Scopus]
- VERBOVŠEK, Timotej, KOŠIR, Adrijan, TERAN, Maša, ZAJC, Marjana, POPIT, Tomislav. Volume determination of the Selo landslide complex (SW Slovenia) : integrating field mapping, ground penetrating radar and GIS approaches. Landslides : Journal of the international consortium on landslides. [Print ed.]. 2017, vol. 14, iss. 3, str. 1265-1274. ISSN 1612-510X. DOI: 10.1007/s10346-017-0815-x. [COBISS.SI-ID 1322334], [JCR, SNIP, WoS do 23. 1. 2021: št. citatov (TC): 5, čistih citatov (CI): 1, Scopus do 29. 11. 2020: št. citatov (TC): 7, čistih citatov (CI): 3]
- JEMEC AUFLIČ, Mateja, JEŽ, Jernej, POPIT, Tomislav, KOŠIR, Adrijan, MAČEK, Matej, LOGAR, Janko, PETKOVŠEK, Ana, MIKOŠ, Matjaž, CALLIGARIS, Chiara, BOCCALI, Chiara, ZINI, Luca, REITNER, Jürgen, VERBOVŠEK, Timotej. The variety of landslide forms in Slovenia and its immediate NW surroundings. Landslides : Journal of the international consortium on landslides. [Print ed.]. 2017, vol. 14, iss. 4, str. 1537-1546, ilustr. ISSN 1612-510X. DOI: 10.1007/s10346-017-0848-1. [COBISS.SI-ID 8095585], [JCR, SNIP, WoS do 13. 12. 2020: št. citatov (TC): 7, čistih citatov (CI): 0, Scopus do 10. 8. 2020: št. citatov (TC): 9, čistih citatov (CI): 1]
- FIFER BIZJAK, Karmen, LIKAR, Barbara, LENART, Stanislav. Using recycled material from the paper industry as a backfill material for retaining walls near railway lines : a systematic literature review. Sustainability, ISSN 2071-1050, 2021, vol. 13, iss. 2, str. 1-17, ilustr. https://www.mdpi.com/2071-1050/13/2/979, doi: 10.3390/su13020979. [COBISS.SI-ID 49132547]

- FIFER BIZJAK, Karmen, GERŠAK, Andraž. Quantified joint surface description and joint shear strength of small rock samples = Geometrijske lastnosti površine razpok in strižna trdnost po razpoki za manjše vzorce kamnin. Geologija, ISSN 0016-7789. [Tiskana izd.], 2018, 61, št. 1, str. 25-32, ilustr., doi: 10.5474/geologija.2018.002.
- FIFER BIZJAK, Karmen, LENART, Stanislav. Life cycle assessment of a geosynthetic-reinforced soil bridge system - a case study. Geotextiles and geomembranes, ISSN 0266-1144. [Print ed.], Oct. 2018, vol. 46, iss. 5, str. 543-558, ilustr. https://www.journals.elsevier.com/geotextiles-and-geomembranes, doi: 10.1016/j.geotexmem.2018.04.012
- LIKAR, Barbara, KUK, Vikica, FIFER BIZJAK, Karmen. Water retention properties of stiff silt = Retencijske lastnosti trdnih meljev. Geologija, ISSN 0016-7789. [Tiskana izd.], 2017, 60, št. 1, str. 37-47, ilustr., doi: 10.5474/geologija.2017.003.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Izbirni predmet modula
Course title:	Module elective
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik	2. semester
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik	2. semester
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0111902
Koda učne enote na članici/UL Member course code:	821

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
35	0	40	0	0	75	5

Nosilec predmeta/Lecturer:

Vrsta predmeta/Course type:

Jeziki/Languages:		
	Predavanja/Lectures:	
	Vaje/Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**

Vsebina:	**Content (Syllabus outline):**

Temeljna literatura in viri/Readings:

Cilji in kompetence:	**Objectives and competences:**

Predvideni študijski rezultati:	**Intended learning outcomes:**

Metode poučevanja in učenja:	**Learning and teaching methods:**

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**

Reference nosilca/Lecturer's references:

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Izbirni predmet modula
Course title:	Module elective
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik, 2. letnik	1. semester
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik, 2. letnik	1. semester
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0111909
Koda učne enote na članici/UL Member course code:	824

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
35	0	40	0	0	75	5

Nosilec predmeta/Lecturer:

Vrsta predmeta/Course type:

Jeziki/Languages:		
	Predavanja/Lectures:	
	Vaje/Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**

Vsebina:	**Content (Syllabus outline):**

Temeljna literatura in viri/Readings:

Cilji in kompetence:	**Objectives and competences:**

Predvideni študijski rezultati:	**Intended learning outcomes:**

Metode poučevanja in učenja:	**Learning and teaching methods:**

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**

Reference nosilca/Lecturer's references:

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Izotopska geokemija
Course title:	Isotope Geochemistry
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0596429
Koda učne enote na članici/UL Member course code:	718

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
20	25	0	0	0	45	3

Nosilec predmeta/Lecturer:	Matej Dolenec
Vrsta predmeta/Course type:	Obvezni / Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Zaključen dodiplomski študij, osnovna računalniška pismenost.	Completed undergraduate study, basic computer literacy.

Vsebina:	**Content (Syllabus outline):**
• Ionizirajoča sevanja: fizikalne osnove, detekcija, biološki učinki, značilne doze, osnove o predpisih, radioaktivni odpadki, viri sevanja v industriji, varstvo pred sevanji pri rentgenskih analitičnih napravah, zaščita pred zunanjim sevanjem, metode PIXRF, INNA, MC-ICPMS... • Mehanizmi in procesi frakcioancije in razpada stabilnih in radioaktivnih izotopov. • Spremenljivost razmerij stabilnih izotopov v naravi (O, H, C, S, N) - kozmični material, litosfera, hidrosfera, biosfera, atmosfera. • Stabilni izotopi H, B, Li, Si, Cl, O, C, N, S ter njihova frakcionacija na Zemlji v različnih medijih, sledi izotopov v onesnaževalih (nitrati, kloridi, borati, fosfati), izotopska ekologija, ribje farme,.. • Geotermometrija. • Geokemične lastnosti dolgoživečih in kratkoživečih radioaktivnih izotopov pri nastanku in transportu sedimentnih, magmatskih in metamorfnih kamnin, vodi in sedimentu ter oceanih. • Geokemija radioaktivnih izotopov v kamninah, tleh in vodi. • Najpomembnejši izotopski geokronometri: K-Ar (and Ar-Ar), Rb-Sr, U(Th)-Pb, Sm-Nd...	• Ionising radiation: physical basics, detection, biological effects, permissible dose, radioactive waste, radiation sources in industry, radiation protection for X-ray analytical devices (XRD and XRf), external radiations,… • Stable and radioactive Isotope fractionation processes • Variations of stable isotope ration in nature (O, H, C, S, N) – extra-terrestrial materials, lithosphere, hydrosphere, biosphere, atmosphere. • Stable isotopes H, B, Li, Si, Cl, O, C, N, S and their fractionation in Earth systems – practical problems, isotopes as tracers (nitrates, chlorides, borates and phosphates), isotopic ecology, fish farms,… • Isotope geothermometers • Long and short-lived radionuclides geochemical properties in the formation and transport of sedimentary, igneous and metamorphic rocks, water, sediments and oceans. • Geochemistry of radionuclides in rocks, soils and water • The most important isotope geochronometers: K-Ar (and Ar-Ar), Rb-Sr, U(Th)-Pb, Sm-Nd... • Laboratory work: Solving specific environmental problems related to isotopes.

• Delo v laboratoriju: Reševanje konkretnih okoljskih problemov povezanih z izotopi.	

Temeljna literatura in viri/Readings:

Izbrana poglavja iz knjig:
HOEFS, J., 2018, Stable Isotope Geochemistry, Springer, 432 pp., Berlin.
FAURE & T. M. Mensing: Isotopes - Principles and applications 3th Edition. J.W & SONS, INC, New Jersey, 2004, 897 pp.
Allègre, C. (2008). Isotope Geology (C. Sutcliffe, Trans.). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511809323
DICKIN, A. P., 1995: Radiogenic Isotope Geology, Cambridge University Press, 492 pp., Cambridge.
Gopalan, K. (2017). Principles of Radiometric Dating. Cambridge: Cambridge University Press. doi:10.1017/9781108186551

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študent pridobi znanje nekaterih kemijskih metod, potrebnih za analizo geoloških materialov in prostora. Seznani se s principi datacije z različnimi radioaktivnimi izotopi ter z uporabo stabilnih izotopov pri ugotavljanju okolja in pogojev nastanka različnih geoloških materialov. Zna kvalitativno in kvantitativno predvideti posledice okoljskih onesnaženj. KOMPETENCE: Pri reševanju geoloških problemov je sposoben vključiti ustrezne izotopske analize.	OBJECTIVES: Student acquires knowledge of selected chemical methods, necessary to analyse geological materials and environment. Student gets familiar with principles of radioactive isotope dating and use of stable isotopes for establishing environment and conditions of formation of different geological materials. He is able to qualitatively and quantitatively predict consequences of environmental pollution. COMPETENCES: Student is able to include the appropriate isotopic analysis in solving geological problems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent razume nastanek in frakcionacijo izotopov.	Student understands origin and fractionation of isotopes.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, vaje v laboratoriju in računalniški učilnici, samostojno reševanje problema v obliki seminarske naloge.	Lectures, laboratory work and work with computers, independent resolving of the problem in the form of the seminar work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	60,00 %	Written and/or oral exam
Samostojno izdelane naloge	40,00 %	Independent seminar work
Ocena je vedno sestavljena po tretjinah iz vsakega od področij, ki jih zajema predmet. Ocenjevalna lestvica: (6-10) pozitivno, ob upoštevanju Statuta UL in fakultetnih pravil.		Assessment is always composed of thirds of each areas covered by the subject. Grades: (6-10) positive assessment, according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

DOLENEC, Matej, SERAFIMOVSKI, Todor, DANEU, Nina, DOLENEC, Tadej, ROGAN ŠMUC, Nastja, VRHOVNIK, Petra, LOJEN, Sonja. The case of the carbonatite-like dyke of the Madenska River complex at the Kriva Lakavica section in the Republic of Macedonia : oxygen and carbon isotopic constraints. Turkish journal of earth sciences, ISSN 1300-0985, 2015, vol. 24, no. 6, str. 627-639
DOLENEC, Matej, OGORELEC, Bojan. Organic carbon isotope variability across the P/Tr boundary in the Idrijca Valley section (Slovenia : a high resolution study = Variabilnost izotopske sestave organskega ogljika na permsko-triasni meji v dolini Idrijce : detajlna študija. Geologija, ISSN 0016-7789. [Tiskana izd.], 2001, let. 44, 2, str. 331-340.
DOLENEC, Matej, ŽVAB ROŽIČ, Petra, MIHELČIĆ, Goran, LAMBAŠA, Živana, LOJEN, Sonja, KNIEWALD, Goran, DOLENEC, Tadej, ROGAN ŠMUC, Nastja. Use of stable nitrogen isotope signatures of anthropogenic organic matter

in the coastal environment: a case study of the Kosirina Bay (Murter Island, Croatia). Geologia Croatica, ISSN 1330-030X, 2011, vol. 64, no. 2, str. 143-152.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Karbonatni mikrofacies
Course title:	Carbonate Microfacies
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0596365
Koda učne enote na članici/UL Member course code:	11415

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
15	38	30	0	7	90	6

Nosilec predmeta/Lecturer:	Boštjan Rožič
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Vpis v 1. letnik študija 2. stopnje.	Entering the 1st year of 2nd grade program.

Vsebina:	Content (Syllabus outline):

• Ponovitev predhodnega znanja o karbonatih osredotočena na klasifikacije, diagenezo in karbonatna sedimentacijska okolja.
• Predstavitev koncepta karbonatnih faciesov in mikrofaciesov.
• Carbonatni sistemi skozi geološki čas, katerega sedimentacijska zaporedja dobimo v Alpsko-Dinarski prehodni coni:
  • paleozojski sistem karbonatno klastične klančine,
  • spodnje in srednjetriasni klastično-karbonatna in čista karbonatna plaforma ,
  • srednjetriasni sistem karbonatna platforma – bazen,
  • zgornjetriasni sistem obrobljena karbonatna platforma – bazen,
  • spodnje in srednjejurski sistem platforma – bazen – podmorska planota,
  • zgornjejurski sistem obrobljena karbonatna platforma – bazen,
  • zgornjekredna karbonatna klančina in bazen,
  • spodnjepaleogenska karbonatna klančina in bazen,
  • srednje miocenski sistem karbonatna platforma/klančina – bazen.
	• Overview of pre-existing knowledge of carbonates with focus on clasifications, diagenesis and carbonate sedimentary environments.
	• Presentation of concept of carbonate facies and microfacies.
	• Carbonate systems during geological time, the sedimentary successions of which are outcroping in the Alpine-Dinaric transition zone:
	  • Paleozoic system of carbonate – clastic ramp,
	  • Lower and Middle Triassic clastic-carbonate and pure carbonate platform,
	  • Middle Triassic system carbonate platform – basin,
	  • Upper Triassic rimmed carbonate platform – basin,
	  • Lower and Middle Jurassic system carbonate platform – basin – submarine plateau,
	  • Upper Jurassic rimmed carbonate platform – basin,
	  • Upper Cretaceous carbonate ramp – basin,
	  • Lower Paleogene carbonate ramp – basin,
	  • Middle Miocene system carbonate platform/ramp – basin.

Temeljna literatura in viri/Readings:

- Boggs, S. Jr., 2009: Petrology of Sedimentary Rocks. Cambridge Univ. Press, Cambridge, 600 p.
- Flügel, E.& Munnecke, 2010: Microfacies of carbonate rocks : analysis, interpretation and application, Springer, Berlin, 976 p.
- Nichols, G., 1999: Sedimentology and Stratigraphy. Blackwell Science, Oxford, 355 p.
- Vernon, R. H., 2004: A practical Guide to Rock Microstructure, Cambridge University Press, UK, 594 p.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Poglobljeno znanje o karbonatnem mikrofaciesu celotnega sistema platforma/klančina - bazen Alpsko – Dinarske prehodne cone, ki temelji na enkratni možnosti študije teh sistemov v regiji in sicer v zelo dolgem obdobju geološkega časa (med srednjim triasom in miocenom). Študent spozna kompleksnost različnih tipov karbonatnih sedimentacijskih okolij, ki se nepretrgoma spreminjajo tako skozi čas, kot tudi paleogeografski prostor. KOMPETENCE: Študent je zmožen samostojne analize katerega koli regionalnega sedimentacijskega zaporedja, saj ima znanje o mikrofaciesnih združbah tako plitvomorskih kot tudi globokomorskih sedimentacijskih okolij. Hkrati je zmožen prepoznavati razlike med sedimentacijskimi zaporedjimi značilnimi za karbonatne platforme in klančine. Zelo pomemben je tudi časovni vidik karbonatnih sistemov, ki se spreminjajo tudi glede na posamezna obdobja evolucije življenja.	OBJECTIVES: Profound knowledge on carbonate microfacies of the entire system carbonate platform/ramp – basin of the Alpine – Dinaric transition zone, which is founded on special possibility of studying these systems in the region during long interval of geological time (Middle Triassic – Miocene). Student gets to know complexity of diverse types of carbonate sedimentary environments, which are repeatedly changing through time as well as in paleogeographic setting. COMPETENCES: Student is capable of indipendent analysis of any regional sedimentary succession, because he gains knowledge on microfacies assamblages of the shallow marine as well as deep marine sedimentary environments. Simultaneously, he/she is able do distinguish between sedimentary successions characteristic of carbonate platforms and ramps. Very important is also time view of carbonate systems, which are changing also due to particular periods of the evolution of life.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent osvoji in razume napredno sedimentološko terminologijo in preiskušeno, a še vedno najbolj temeljito metodo proučevanja karbonatnih sedimentnih kamnin, optično mikroskopijo. Sposoben je prepoznavanja vseh mikrofacielnih združb, ki so pogojene tako s tipi karbonatnih systemov, sedimentacijskimi okolji znotraj njih, kot tudi z geološkim časom.	Students learn and understand advanced sedimentological terminology and well known, but still most used method for studying carbonate sedimentary rocks, the optical microscopy. Student is capable of recognition of all microfacies assemblages which are dependent on types of carbonate systems, sedimentary systems within them, as well as with geological time.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, vaje, seminar, terensko delo.	Lectures, tutorial, seminar, field-work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	50,00 %	Written and/or oral exam
Seminar work	50,00 %	Seminar work

Reference nosilca/Lecturer's references:

ROŽIČ, Boštjan, POPIT, Tomislav, GALE, Luka, VERBOVŠEK, Timotej, VIDMAR, Ines, DOLENEC, Matej, ŽVAB ROŽIČ, Petra. Origin of the Jezero v Ledvicah lake : a depression in a gutter-shaped karstic aquifer (Julian Alps, NW Slovenia) = Nastanek Jezera v Ledvicah - globel v žlebu podobnem kraškem vodonosniku (Julijske Alpe, SZ Slovenija). *Acta carsologica*. [Tiskana izd.]. 2019, letn. 48, št. 3, str. 265-282.

GALE, Luka, KOLAR-JURKOVŠEK, Tea, KARNIČNIK, Barbara, CELARC, Bogomir, GORIČAN, Špela, ROŽIČ, Boštjan. Triassic deep-water sedimentation in the Bled Basin, eastern Julian Alps, Slovenia = Triasna globljevodna

sedimentacija v Blejskem bazenu, vzhodne Julijske Alpe, Slovenija. *Geologija*. [Tiskana izd.]. 2019, vol. 62, no .2, str. 153-173. ISSN 0016-7789. DOI: 10.5474/geologija.2019.007.
ROŽIČ, Boštjan, GALE, Luka, BRAJKOVIĆ, Rok, POPIT, Tomislav, ŽVAB ROŽIČ, Petra. Lower jurassic succession at the site of potential Roman quarry Staje near Ig (central Slovenia) = Spodnjejurske plasti na območju morebitnega rimskega kamnoloma Staje pri Igu. *Geologija*. [Tiskana izd.]. 2018, 61, št. 1, str. 49-71, ilustr. ISSN 0016-7789. DOI: 10.5474/geologija.2018.004.
GALE, Luka, SKABERNE, Dragomir, PEYBERNES, Camille, MARTINI, Rossana, ČAR, Jože, ROŽIČ, Boštjan. Carnian reefal blocks in the Slovenian Basin, eastern Southern Alps. *Facies*. [Print ed.]. 2016, vol. 62, iss. 4, str. 1-15. ISSN 0172-9179. DOI: 10.1007/s10347-016-0474-8.
ROŽIČ, Boštjan, KOLAR-JURKOVŠEK, Tea, ŠMUC, Andrej. Late Triassic sedimentary evolution of Slovenian Basin (eastern Southern Alps): description and correlation of the Slatnik Formation. *Facies*. [Print ed.]. 2009, vol. 55, no. 1, str. 137-155. ISSN 0172-9179. DOI: 10.1007/s10347-008-0164-2.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Kvantitativna strukturna geologija
Course title:	Quantitative Structural Geology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562377
Koda učne enote na članici/UL Member course code:	749

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	45	0	0	0	75	5

Nosilec predmeta/Lecturer:	Marko Vrabec
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Solidno znanje strukturne geologije (na nivoju dodiplomskega študija), poznavanje osnov geomehanike, poznavanje osnovnih geometrijskih tehnik analize geoloških kart.	Solid BSc-level knowledge of Structural Geology, knowledge of basic Geomechanics, and familiarity with basic geological-map analysis techniques.

Vsebina:	**Content (Syllabus outline):**
- tehnike in orodja za strukturno kartiranje - geometrijski opis strukturnih elementov z metodami diferencialne geometrije - osnove mehanike kontinuov - mehanika elastičnih, lomnih in viskoznih deformacij - tehnike paleonapetostne analize - tehnike računalniško podprtega uravnotežanja profilov s programsko opremo MVE Move 2D in Move 3D - geomehansko modeliranje lomnih deformacij v kamninskem mediju s programsko opremo MVE Move - modeliranje distribucije in orientacije razpok v kamninskem mediju - rekonstrukcija deformacij z mehanskim modeliranjem z metodo končnih elementov s programsko MVE Move	- techniques and tools for strucutral mapping - geometrical description of structural elements with differential geometry - fundamentals of mechanics of continua - mechanics of elastic, brittle and viscous deformation - techniques of paleostress analysis - techniques of kinematic section balancing using MVE Move 2D and Move 3D software - geomechanial modeling of brittle deformation in rocks with MVE Move software - modeling spatial distribution and orientation of fractures in rocks - reconstructing deformation with mechanical modeling using MVE Move software

Temeljna literatura in viri/Readings:

TWISS R.J., MOORES E.M.: Structural Geology (2. izdaja). W. H. Freeman, 2006, 532 str.
POLLARD D.D., FLETCHER R.C.: Fundamentals of Structural Geology. Cambridge University Press, 2005, 512 str.

Cilji in kompetence: **Objectives and competences:**

CILJI: Po opravljenem predmetu bodo študenti sposobni napraviti kvantitativno strukturno analizo lomnih in duktilnih struktur v merilu izdanka in v regionalnem merilu. KOMPETENCE: - Obvladovanje postopkov strukturnih meritev - Osnovno znanje dela s programskim paketom MVE Move	OBJECTIVES: At the end of the course, students will be able to perform quantitative structural analysis of brittle and ductile deformational features at the outcrop and map scale. COMPETENCES: - Mastering the techniques of structural measurements - Fundamental knowledge of MVE Move software suite

Predvideni študijski rezultati:	**Intended learning outcomes:**
- Razumevanje osnovnih konceptov mehanike kontinuov. - Sposobnost napraviti osnovno kvantifikacijo tektonskih procesov.	- Understanding the basic concepts of continuum mechanics. - Ability to perform basic quantification of tectonic processes

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, kabinetne vaje in vaje v računalniški učilnici. Seminarsko delo študentov.	Lectures, lab sessions, computer lab sessions. Seminar work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	60,00 %	Written and/or oral examination
Seminar	40,00 %	Seminar
Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Grading: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10)), according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

ŽALOHAR, Jure, VRABEC, Marko. Combined kinematic and paleostress analysis of fault-slip data: the Multiple-slip method. Journal of Structural Geology, 2008, vol. 30, str. 1603-1613.
ŽALOHAR, Jure, VRABEC, Marko. Kinematics and dynamics of fault reactivation: the Cosserat approach. Journal of Structural Geology, 2010, vol. 32, str. 15-27.
ŽIBRET, Lea, VRABEC, Marko. Palaeostress and kinematic evolution of the orogen-parallel NW-SE striking faults in the NW External Dinarides of Slovenia unraveled by mesoscale fault-slip data analysis. Geologia Croatica, 2016, vol. 69, str. 295-305.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Magistrsko delo
Course title:	Masters Diploma
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	2. letnik	2. semester
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	2. letnik	2. semester
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	2. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0067740
Koda učne enote na članici/UL Member course code:	852

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
0	0	0	0	450	450	30

Nosilec predmeta/Lecturer:	
Vrsta predmeta/Course type:	Obvezni / Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljeni vsi izpiti programa.	Completed all exams.

Vsebina:	Content (Syllabus outline):
Magistrsko delo je lahko interdisciplinarno naravnano ali ožje specializirano na poljubno področje znotraj obveznih strokovnih ali izbirnih strokovnih vsebin s področja, ki ga pokriva drugostopenjski študij Geologija. Magistrsko delo vsebuje: namen dela, predstavitev problema oz. razlog za raziskavo (identifikacija problema), pregled znanj iz literature oz. tuje in domače izkušnje, nakazane rešitve problema, sklepi in priporočila. Magistrsko delo študent izdela pod mentorstvom izbranega učitelja, ga javno predstavi in zagovarja.	Master thesis may be interdisciplinary or specialized in any area within the compulsory or elective professional course from the area covered by the first-stage studies of Geology. Master thesis includes: the purpose of the work, the presentation of the problem or reason for a survey (identification of the problem), review of literature and knowledge and/or foreign and domestic experiences, implicit solution of the problem, conclusions and recommendations. Student completes the diploma thesis under the supervision of a teacher and finishes the study with the public presentation and defend.

Temeljna literatura in viri/Readings:

Izbrana literatura glede na nalogo, ki jo opravlja. / Selected readings, depending on the thesis he is working on.

Cilji in kompetence:	Objectives and competences:
CILJI: Študent je sposoben reševati konkretne probleme iz geološkega področja. V času priprave magistrskega	OBJECTIVES: The student is able to solve specific problems from the geological field. During the

dela po možnosti sodeluje v tekočih projektih, ki po vsebini sovpadajo s konceptom teme magistrskega dela. Dopolnjuje in poglablja temeljna znanja, ter razvija sposobnosti za reševanje geoloških problemov. KOMPETENCE: Predstavi in reši določen problem iz geološkega področja s praktično uporabo znanja pridobljenega med študijem. Sposoben je uporabljati in povezovati temeljna in aplikativna geološka znanja.	preparation of the master's thesis, student is involved in current projects that are close to the topic of his thesis. Student complements and deepens basic knowledge, and develops the ability for solving the geological problems. COMPETENCES: Introduces and solves a particular problem from the geological field with the practical application of knowledge acquired during their study. Student is able to use and integrate basic and applied geological knowledge.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Razvijanje sposobnosti lastnega učenja in prilagajanja ter uporaba znanja na svojem strokovnem področju.	Development of the ability for self-learning and adaptation and use of knowledge in own professional field.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Praktično delo, branje literature, konzultacije z mentorjem, pisanje naloge.	Practical work, literature reading, consultations with advisor, diploma thesis writing.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
povprečna ocena izpitov	70,00 %	average grade of exams
ocena zaključnega dela	20,00 %	final thesis evaluation
ocena zagovora	10,00 %	defending of the thesis

Reference nosilca/Lecturer's references:

Reference nosilcev razvidne iz učnih načrtov pri posameznih predmetih v okviru prvostopenjskega študija Geologija. / References of lecturers listed in the curricula of individual courses in the undergraduate program of Geology.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mehanika kamnin
Course title:	Rock Mechanics
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0597241
Koda učne enote na članici/UL Member course code:	713

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
25	0	20	0	15	60	4

Nosilec predmeta/Lecturer:	Timotej Verbovšek
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Splošno: Osnove projektiranja v geotehnični praksi Inženirski pristop v geologiji Sodelovanje geologov z ostalimi inženirskimi strokami pri izdelavi geotehničnih objektov **Inženirska geologija:** Podrobna klasifikacije hribine po postopkih RQD, RMR, Q in GSI. Podrobne terenske meritve inženirsko geoloških parametrov Osnovne laboratorijskih preiskav kamnine Metode meritev deformacij in napetosti na plazovitih območjih Metode meritev deformacij in napetosti v predorih Inženirsko geološka spremljava gradnje in sanacije geotehničnih objektov Osnove načrtovanja monitoringa geotehničnih objektov Ocenjevanje nevarnosti velikih deformacij ali porušitve geotehničnih objektov Stabilnostne analize brežin v razpokani kamnini Stabilnostne analize za predore v razpokani kamnini Izračun nosilnosti tal v kamnini za potrebe temeljenja	**General:** Fundamentals of design in geotechnical practice Engineering approach in geology Knowledge transfer between geologists and other engineering professions in the construction of geotechnical structures **Engineering geology:** Detailed rock classifications according to RQD, RMR, Q and GSI. Detailed field measurements of engineering geological parameters Basic laboratory tests of rock Methods of measuring deformations and stresses in landslide areas Methods of measuring deformations and stresses in tunnels Engineering monitoring of geotechnical structures and rehabilitation of geotechnical facilities Planning of the monitoring of geotechnical structures Assessment of the risk of large deformations or collapse of geotechnical structures Stability analyzes of slopes in cracked rock Stability analyzes for tunnels in cracked rock Calculation of bearing capacity of rock for the structure foundation

Temeljna literatura in viri/Readings:

Izbrana poglavja iz / Selected chapters from:
Pariseau, W.G. 2011. Design Analysis in Rock Mechanics
Goodman R. E., 1985. Block Theory and its Application to rock engineering.
Duncan, D. W. 2004. Rock Slope Engineering and Civil Mining. Spon Press, London.
Hoek, E., Brown, E.T., 1996. Underground Excavation in Rock. E& FN Spon, London.
Harrison, J.P., Hudson, J.A. 2000. Engineering Rock Mechanics. An Introduction to the principles. Pergamon, Amsterdam.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Seznanitev študentov z osnovami inženirskega dela v geologiji in za potrebe drugih sorodnih inženirskih ved (gradbeništvo, rudarstvo, energetika, prostorsko planiranje in načrtovanje); usposobiti slušatelje za samostojno delo na področju inženirskih aplikacij na področju geologije in uporabe geologije pri posegih v prostor. KOMPETENCE: Sposobnost samostojnega dela na področju mehanike kamnin in sposobnost sodelovanja z drugimi inženirskimi strokami pri posegih v prostor.	OBJECTIVES: To acquaint students with the basics of engineering work in geology and in other related engineering disciplines (construction, mining, energetics, spatial planning and design); to train students to work independently in the field of engineering applications in the field of geology and application of geology in spatial planning applications. COMPETENCES: Ability to work independently in the field of rock mechanics and the ability to collaborate with other engineering disciplines in large construction works.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobljeno poglobljeno znanje s podoročja aplikativne geologije. Možnost uporabe geoloških znanj v vsakdanji inženirski praksi (npr. gradbeništvu, rudarstvi, planiranju, načrtovanju in upravljanju prostora). Vloga in pomen mehanike kamnin v vsakdanji inženirski praksi. Sposobnost izbire in uporabe ustrezne tuje in domače literature. Sposobnost komunikacije z drugimi strokami, sposobnost analize podatkov in sinteze. Uporaba različnih računalniških programov ter prehod iz kvalitativnega na kvantitativno obdelavo podatkov.	Knowledge obtained in the field of applied geology. Possibility of application of geological knowledge in engineering practice (e.g. civil engineering, mining, planning, design, spatial management). Meaning and role of rock mechanics in engineering practice. Ability to choose and use relevant domestic and foreign literature. The ability to communicate with other professions, the ability to analyze and synthesize information. Using a variety of computer programs, and the transition from qualitative to quantitative data processing.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, terenske vaje in kabinetne vaje.	Lectures, filed and laboratory exercises.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
snov predavanj (pisni in/ali ustni izpit)	60,00 %	knowledge from the lectures (written and/or oral exam)
snov vaj (pisni in/ali ustni izpit)	40,00 %	knowledge from exercises (written and/or oral exam)
Ocene: 6-10 (pozitivno) ob upoštevanju Statuta UL in fakultetnih pravil.		Marks: 6-10 (positive) according to the UL Statute and faculty rules.

Reference nosilca/Lecturer's references:

ŽIVEC, Tina, ANŽUR, Andreja, VERBOVŠEK, Timotej. Determination of rock type and moisture content in flysch using TLS intensity in the Elerji quarry (South-West Slovenia). Bulletin of engineering geology and the environment. [Print ed.]. 2019, vol. 78, iss. 3, str. 1631-1643. ISSN 1435-9529. DOI: 10.1007/s10064-018-1245-2.
VERBOVŠEK, Timotej. Extrapolation of fractal dimensions of natural fracture networks from one to two dimensions in dolomites of Slovenia. *Geosciences Journal*. 2009, vol. 13, no. 4, str. 343-351. ISSN 1226-4806.
VERBOVŠEK, Timotej, VRABEC, Martin. Rockfall in massive Triassic dolomite in the area of Podstudenec, central Slovenia = odroni u masivnom trijaskom dolomitu na području Podstudenca, središnja Slovenija. V: SOKOLIĆ, Igor (ur.), et al. *Geotechnical challenges in karst : Karl Terzaghi and karst in Croatia 110 years ago : International conference/ISRM Specialised Conference, 8th Conference of Croatian Geotechnical Society, Split / Omiš, 11. - 13. 4.*

2019 = Geotehnički izazovi u kršu : Karl Terzaghi i hrvatski krš prije 110 godina : Međunarodna konferencija/ISRM Specialised Conference, 8. savetovanje Hrvatskog geotehničkog društva. Omiš: Hrvatsko geotehničko društvo / Croatian Geotechnical Society, 2019. Str. 437-440. ISBN 978-953-95486-8-9.
VERBOVŠEK, Timotej, ROŽIČ, Boštjan, LAJEVEC, Domen, GALIČ, Rajko. Geološke značilnosti Debelega rtiča in ogroženost obale pred padanjem kamenja in skal. V: ROŽIČ, Boštjan (ur.). *Razprave, poročila = Treatises, reports*. 24. posvetovanje slovenskih geologov = 24th Meeting of Slovenian Geologists, Ljubljana, november 2019. Ljubljana: Univerza v Ljubljani, Naravoslovnotehniška fakulteta, Oddelek za geologijo, 2019. [št.] 25, str. 146-150. Geološki zbornik, 25. ISSN 0352-3802.
VERBOVŠEK, Timotej, RIBIČIČ, Mihael. Inženirskogeološke lastnosti. V: PAVŠIČ, Jernej (ur.), GOGALA, Matija (ur.), SELIŠKAR, Andrej (ur.). *Slovenska Istra I : neživi svet, rastlinstvo, živalstvo in naravovarstvo*. Ljubljana: Slovenska matica, 2019. Str. 61-72. Slovenske pokrajine, 3. ISBN 978-961-213-304-7.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Metode hidrogeoloških raziskav
Course title:	Hydrogeological Methodology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562390
Koda učne enote na članici/UL Member course code:	844

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	30	0	15	75	5

Nosilec predmeta/Lecturer:	Mihael Brenčič
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Zaključena dodiplomska (prva) stopnja. Pogoj za pristop k izpitu so opravljeni izpiti iz Matematike 1, Matematike 2 in Fizike iz obsega 1. stopenjskega študija geologije.	Bachelor degree. To take an exam, completed exams in Mathematics 1, Mathematics 2, and Physics included in the curriculum of BcS in Geology are mandatory.

Vsebina:	**Content (Syllabus outline):**
Predavanja: Metodika hidrogeoloških raziskav Metodika inženirskega dela Metodika hidrogeološkega kartiranja Črpalni poizkusi Nalivalni poizkusi Dimenzioniranje hidrogeoloških objektov (opazovalnih vrtin, vodnjakov, ponikalnic, drenaž) Izvedba objektov za vodooskrbo Umetno napajanje podzemne vode Odvodnjevanje gradbenih jam in rudniških objektov Precejanje podzemne vode pod in v hidrotehnične objekte Injektiranje Načrtovanje kvantitativnega in kvalitativnega monitoringa podzemne vode Dimenzioniranje objektov za zaščito podzemne vode Vaje: Seminarske vaje (dimenzioniranje hidrogeoloških objektov in načrtovanje monitoringov) Teren: izvedba terenskega hidrogeološkega poizkusa	Lectures: Methodology of hydrogeological investigations Methodology of engineering work Methodology of hydrogeology mapping Pumping tests Inflow (slug) tests Design of hydrogeological constructions (observation wells, wells, sinking wells, drainage ditches) Design for drinking water supply Artificial recharge of aquifers Drainage of construction cites and mining works Seepage in hydrotechnics Injection Design of observational monitoring Design of constructions for groundwater protection Exercises: Seminar (design of hydrogeological constructions and operational monitoring) Field work – hydrogeological in situ test

Temeljna literatura in viri/Readings:

Posamezna poglavja iz / Selected chapters from:
RUSHTON, K.K., 2005: Groundwater Hydrology. Wiley.
LEBBE, L.C., 1999: Hydraulic Parameter Identification. Springer.
BATU, V., 1998: Aquifer Hydraulic. Wiley.
BRENČIČ, M., 2009: Dinamika podzemne vode. NTF študijsko gradivo
DOMENICO, P.A. & SCHWARTZ, F.W, 1990: Physical and Chemical Hydrogeology. Wiley.
SCHWARTZ, F.W. & ZHANG, H., 2003: Fundamentals of Ground Water. Wiley.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Osvojitev osnovnih hidrogeoloških inženirskih znanj za delo v praksi na področju oskrbe s pitno vodo. Poglobiti razumevanje toka podzemne vode in njene porazdelitve v geološkem poroznem mediju. Razumevanje konceptov različnih poroznih medijev v geološkem okolju. Podati teoretične osnove dinamike toka podzemne vode v različnih vodonosnikih in poroznih medijih z namenom uporabe znanj pri praktičnih primerih izkoriščanja podzemne vode za oskrbo prebivalstva s pitno vodo in zaščite vodnih virov. KOMPETENCE: Sposobnost projektiranja in načrtovanja hidrogeoloških objektov ter načrtovanje kvantitativnega in kvalitativnega monitoringa podzemne vode.	OBJECTIVES: Attaining the hydrogeological engineering skills to work in practice in the field of drinking water supply. To deepen the understanding of groundwater flow and its distribution in the geological porous media. Understanding the concepts of various porous media in the geological environment. Cross the theoretical basis of the dynamics of groundwater flow in different aquifers and porous media with a view to the application of knowledge to practical cases of exploitation of underground water for supplying the population with drinking water and protection of water resources. COMPETENCES: Ability to design and planning of hydrogeological constructions and the planning of quantitative and qualitative monitoring of groundwater.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobljeno poglobljeno znanje iz hidravlike podzemne vode. Poglobljeno znanje o toku podzemne vode v sedimentih in razpoklinskih kamninah ter v kamninah z dvojno poroznostjo. Uporaba hidrogeoloških podatkov in njihova analiza. Dimenzioniranje hidrogeoloških objektov. Vloga in pomen aplikativne hidrogeologije v vsakdanji inženirski praksi. Sposobnost uporabe kompleksne programske opreme. Sposobnost prostorskega prikaza kompleksnih geoloških pojavov. Inženirsko načrtovanje.	The acquired in-depth knowledge of hydraulics of groundwater. In-depth knowledge about the flow of groundwater in sediments and fractured rocks and in rock with dual porosity. Application of hydrogeological data and their analysis. Design of hydrogeological constructions. Importance and role of hydrogeology in common engineering practice. The ability to use complex software. The ability to illustrate complex geological phenomena. Engineering design.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, laboratorijske vaje, seminar.	Lectures, laboratory practices, seminar.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
snov predavanj	70,00 %	knowledge from the lectures
snov vaj	30,00 %	knowledge from exercises
Ocene: 6-10 (pozitivno;) ob upoštevanju Statuta UL in fakultetnih pravil.		Marks: 6-10 (positive) according to the UL Statute and faculty rules.

Reference nosilca/Lecturer's references:

BRENČIČ, Mihael, DAWSON, Andrew, FOLKESON, Lennart, FRANÇOIS, Denis, LEITǍO, Teresa E., 2008: Pollution mitigation. In: DAWSON, Andrew (ed.). Water in road structures : movement, drainage & effects. Springer, pp. 283-297.
BRENČIČ, Mihael, POLTNIG, Walter, 2008: Podzemne vode Karavank /Grundwasser der Karawanken. Ljubljana: Geološki zavod Slovenije; Graz: Joanneum Research Forschungsgesellschaft, 144 str.
BRENČIČ, Mihael, 2006: Groundwater and highways interaction: past and present experiences of highway construction in Slovenia. Environmental Geology, 49/6,804-813.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikropaleontologija
Course title:	Micropaleontology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562363
Koda učne enote na članici/UL Member course code:	742

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
10	30	0	0	5	45	3

Nosilec predmeta/Lecturer:	Luka Gale
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpit iz paleontologije, sedimentologije in stratigrafije so pogoj za pristop k izpitu. Študent mora redno (vsaj 75% udeležba) obiskovati predavanja in vaje.	Finished courses in Paleontology, Sedimentology, Stratigraphy are mandatory to take an exam. Students are obliged to attend to lectures and practical work (at least 75% of teaching hours).

Vsebina:	Content (Syllabus outline):
Študentje se seznanijo z naslednjimi vsebinami: - kaj je mikropaleontologija, s čim se ukvarja in kakšne so njene metode proučevanja, - vzorčenje: količina vzorca, načini preparacije (litificirana kamnina in nevezan sediment, izdelava zbruska, razpuščanje in topljenje kamnine), - ponovitev lastnosti posameznih fosilnih skupin: foraminifere, radiolariji, konodonti, diatomeje, silikoflagelati, palinomorfi, kalpionele, dazikladaceje, koralinaceje, ostrakodi, kokolitofore. V okviru seminarskih vaj študentje izvedejo več vaj, ki jih seznanijo z uporabo mikrofosilov v biostratigrafiji (prepoznavanje in določanje biocon) in paleoekologiji (določanje relativne količine kisika in organske snovi na podlagi morfotipov pri foraminiferah, določanje relativne globine in območja sedimentacije na primeru mlajših in/ali recentnih združb). S pomočjo predavatelja samostojno rešijo konkretni raziskovalni problem. Na terenu se praktično spoznajo z načinom vzorčenja in uporabo mikrofosilov.	Students get familiar with the following topics: - what is Micropaleontology, what it deals with and what are the research methods, - sampling: quantity of the samples, preparation techniques (lithified and unlithified sediment, thin sections, phisical and chemical methods of preparations), - properties of various groups of microfossils: foraminifera, radiolarians, conodonts, diatoms, silicoflagellates, palynomorphs, calpionellids, dasycladacean green algae, corallinacean algae, ostracods, coccolithophores. As part of their practical work, they get to know the use of microfossils in biostartigraphy (recognition and determination of biozones) and palaeoekology (determination of relative amounts of oxygen and organic matter with the use of morphotypes in foraminifera, determination of relative depth and depositional environment on the basis of recent of geologically young foraminiferal assemblage). At the end, they resolve a specific research problem.

	In the field, students get a hands-on experience in sampling and the potential of microfossils.

Temeljna literatura in viri/Readings:

ARMSTRONG, H., Brasier, M., 2005, Microfossils (2nd ed.), Blackwell Publishing, 296 str.
BIGNOT, G., 1985, Elements of Micropalaeontology, Graham & Trotman, 217 str.
FLÜGEL, E., 2004, Microfacies of carbonate rocks, Springer Verl., 976 str.
HAMMER, Ø., HARPER, D., 2006, Paleontological data analysis. – Blackwell Sci. Publ., 351 pp.
HAQ, B. U., BOERSMA, A., 1998, Introduction to Marine Micropaleontology, Elsevier, 376 str.
MARTIN, R.E. (ed), 2000, Environmental Micropaleontology: The application of Microfossils to Environmental geology, Kluwer Academic/Plenum Publishers, 504 str.
MOLINA, E. (ed.), 2004, Micropaleontología, Prensas Universitarias de Zaragoza, 704 str.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Slušatelji spoznajo najznačilnejše skupine mikrofosilov, njihovim prepoznavanjem in uporabo kot orodje za določevanje starosti in paleo-okolja. KOMPETENCE: Slušatelji so sposobni odločanja o pravilni tehniki vzorčenja in usposobljeni za preparacijo različnih skupin mikrofosilov; sposobni so poiskati relevantno določevalno literaturo in razumejo principe biostratigrafije in paleoekologije.	OBJECTIVES: Students gain knowledge about different groups of microfossils, their identification, taxonomy and use as a tool for determining age and paleoenvironment. COMPETENCES: Students should be able to decide upon the correct sampling method and to choose the right type of preparation; they are capable of finding and using the correct litherature for species determination; they understand principles of biostratigraphy and palaeoecology.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent je sposoben pravilnega vzorčenja na terenu, izdelave ustreznih preparatov ter določanja mikrofosilov s pomočjo ustrezne literature. Sposoben je biostratigrafske in paleoekološke interpretacije. Pri praktičnem delu je sposoben sodelovati s strokovnjaki iz drugih področij geologije (sedimentologija, stratigrafija, paleoekologija, paleogeografija) in izven geologije (biologi, arheologi), uporabljati domačo in tujo strokovno literaturo ter relevantne računalniške programe in statistične metode.	Students are capable of correct sampling in the field, of sample preparation and correct identification of different microfossil groups. He is able to make stratigraphic and paleoenvironmental interpretations. They are compatible with experts in sedimentology, stratigraphy, paleoecology, paleogeography, as well as with biologists and archaeologists. They are familiar with foreign and home literature and with the use of specific software.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (10 ur) z uporabo prezentacij. Vaje potekajo kot vodene seminarske vaje (30 ur). Na terenu (5 ur) se študentje naučijo pravilnega vzorčenja.	Power-point presentation (10 hours) will be given to students. Practical part is designed as seminar work with microscopes and binoculars (30 hours). Field work takes 5 hours – students are learnt how to sample.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit, kolokvij iz vaj.	100,00 %	Written and/or oral exam from theoretical part. Colloqium.
Aktivna udeležba na predavanjih in vajah, uspešen zagovor in predstavitev seminarske vaje. Ocenjevalna lestvica po pravilniku UL: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10).		Students have to attend lectures and excercises regularly. To pass the exam, they have to successfully defend and present their seminar work. Grades (according to norm set by the UL): 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10).

Reference nosilca/Lecturer's references:

GALE, Luka, NOVAK, Uroš, KOLAR-JURKOVŠEK, Tea, KRIŽNAR, Matija, STARE, France. Characterization of silicified fossil assemblage from upper Carnian Amphiclina beds at Crngrob (central Slovenia). Geologija, 2017, vol. 60, no. 1, str. 61-75, doi: 10.5474/geologija.2017.005.
GALE, Luka, BARATTOLO, Filippo, RETTORI, Roberto. Morphometric approach to determination of Lower Jurassic siphovalvulinid foraminifera. *Rivista italiana di paleontologia e stratigrafia*, 2018, vol. 124, no. 2, str. 265-282.
GALE, Luka, SKABERNE, Dragomir, PEYBERNES, Camille, MARTINI, Rossana, ČAR, Jože, ROŽIČ, Boštjan. Carnian reefal blocks in the Slovenian Basin, eastern Southern Alps. Facies, 2016, vol. 62, no. 4, str. 1-15, doi: 10.1007/s10347-016-0474-8.
GALE, Luka, KOLAR-JURKOVŠEK, Tea, KARNIČNIK, Barbara, CELARC, Bogomir, GORIČAN, Špela, ROŽIČ, Boštjan. Triassic deep-water sedimentation in the Bled Basin, eastern Julian Alps, Slovenia. *Geologija,* 2019, vol. 62, no .2, str. 153-173.
GALE, Luka, KELEMEN, Matej. Early Jurassic foraminiferal assemblages in platform carbonates of Mt. Krim, central Slovenia. Geologija, 2017, vol. 60, no. 1, str. 99-115, doi: 10.5474/geologija.2017.008.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mikroskopija rud
Course title:	Ore Microscopy
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562417
Koda učne enote na članici/UL Member course code:	733

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	45	0	0	75	5

Nosilec predmeta/Lecturer:	Matej Dolenec
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Osnovno znanje mineralogije, petrologije in geokemije. Študent mora redno obiskovati vaje, oddati vse zahtevane samostojne naloge ter opraviti preiskuz teoretičnega in praktičnega znanja.	Basic knowledge of mineralogy, petrology and geochemistry. The student must attend regular exercises, submit all required independent tasks and conduct a test of theoretical and practical knowledge.

Vsebina:	Content (Syllabus outline):
Spoznavanje teksturnih in strukturnih značilnosti rud iz različnih tipov rudišč (magmatska, pegmatitska, pneumatolitska, hidrotermalna, sedimentna rudišča, rudišča preperevanja), določanje zaporedja kristalizacije rudnih in jalovinskih mineralov ter pogojev njihovega nastanka in redistribucije komponent rudnih in jalovinskih mineralov pri procesih preperevanja. Pri vajah se študentje seznanijo s podrobnejšim določevanjem mineralnih paregenez in interpretacijo značilnosti in pogojev nastanka različnih vrst orudenj in hidrotermalnimi spremembami prikamnine.	Recognition of the textural and structural characteristics of ores from various types of mineral deposits (magmatic, pegmatitic, pneumatolithic, hydrothermal, sedimentary, weathering mineral deposits), determination of the sequence of crystallization of ore and gangue minerals, and conditions of their formation and redistribution of ore and gangue mineral components during the weathering. During the exercises, students learn about detailed determination of mineral paregenes and the interpretation of the characteristics and conditions of the formation of various types of mineralisation and hydrothermal changes of the adjacent rocks.

Temeljna literatura in viri/Readings:

Dolenec, T., Dolenec, M., 2007, Mikroskopija rud (prosojnice), NTF, Oddelek za geologijo, 66 pp.
Drovenik, M., 1978, Mikroskopija rud, 197 pp.
Izbrana poglavja iz:
Ramdohr, P., 1975, Die erzmineralien und ihre verwachsungen, Akademie Verlag, 1277 pp.
Craig, J.R., 1981, Ore Microscopy and Ore Petrography, John Wiley & Sons Inc, 448 pp.
Bard, J.P., 1986, Microtextures of Igneous and Metamorphic Rocks, Reidel,134 pp.

Cilji in kompetence:	Objectives and competences:
CILJI: Osvojiti uporabo mikroskopa, se naučiti prepoznavanja rudnih mineralov ter zaporedja kristalizacije. KOMPETENCE: Slušatelj je usposobljen za mikroskopsko prepoznavanje rudnih mineralov in produktov bogatenja, za določevanje zaporedja kristalizacije rudnih in jalovinskih mineralov v različnih tipih rudnih nahajališč (magmatska, pegmatitska, pnevmatolitska, hidrotermalna, sedimentna in rudišča preperevanja).	OBJECTIVES: To gain the use of a microscope, to learn to identify ore minerals and the sequence of crystallization. COMPETENCES: The student is trained in the microscopic identification of ore minerals and enrichment products, to determinate the sequence of crystallization of ore and gangue minerals in various types of mineral deposits (magmatic, pegmatitic, pneumatolithic, hydrothermal, sedimentary, weathering mineral deposites).

Predvideni študijski rezultati:	Intended learning outcomes:
Študent spozna optične značilnosti različnih rudnih mineralov v odsevni svetlobi. Sposoben je prepoznati in določiti zaporedje kristalizacije rudnih in jalovinskih mineralov v različnih tipih rudišč in hidrotermalne spremembe prikamnine.	Predavanja, prikaz slikovnega gradiva (LCD projektor), mikroskopiranje rudnih preparatov iz različnih tipov rudišč in njihovo makroskopsko prepoznavanje. Mikroskopiranje svežih in hidrotermalno spremenjenih magmatskih in drugih kamnin iz rudišč različnega nastanka.

Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja, prikaz slikovnega gradiva (LCD projektor), mikroskopiranje rudnih preparatov iz različnih tipov rudišč in njihovo makroskopsko prepoznavanje. Mikroskopiranje svežih in hidrotermalno spremenjenih magmatskih in drugih kamnin iz rudišč različnega nastanka.	Lectures, presentation of image material (LCD projector), microscopy of ore preparats from different types of mineral deposits and their macroscopic recognition. Microscopy of fresh and hydrothermaly changed igneous and other rocks from the mineral deposits of different origin.

Načini ocenjevanja:	Delež/Weight	Assessment:
Pisni in/ali ustni izpit	50,00 %	Written and/or oral exam
Praktični del	50,00 %	Practical exam
Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Evaluation scale: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) having regard to the Statute of UL and faculty rules.

Reference nosilca/Lecturer's references:

LESKOVAR, Blaž, VRABEC, Mirijam, DOLENEC, Matej, NAGLIČ, Iztok, DOLENEC, Tadej, DERVARIČ, Evgen, MARKOLI, Boštjan. Temperature-initiated structural changes in FeS[sub]2 pyrite from Pohorje, Eastern Alps, North-Eastern Slovenia = S temperaturo povzročene strukturne spremembe FeS[spodaj]2 pirita iz Pohorja, vzhodne Alpe, severovzhodna Slovenija. *Materiali in tehnologije*, ISSN 1580-2949. [Tiskana izd.], 2017, letn. 51, št. 2, str. 259-265, ilustr. http://mit.imt.si/Revija/izvodi/mit172/leskovar.pdf, doi: 10.17222/mit.2015.328.

NAGLIČ, Iztok, ILIĆ, Semjon, MARKOLI, Boštjan, DOLENEC, Matej, LESKOVAR, Blaž, FILIPIČ, Žan, PERHOČ, Matej, KRANER, Jakob, BIZJAK, Matej, SKELA, Božo, KELHAR, Luka, KOZOLE, Špela, GERČAR, David, RAMŠAK, Teja. Modifikacija zlitine AlSi7Mg lite v peščeno formo = Modification of AlSi7Mg alloy cast in to a sand mould. *Livarski vestnik : glasilo Društva livarjev Slovenije*, ISSN 0024-5135, 2016, letn. 63, št. 1, str. 37-47.

VRHOVNIK, Petra, SERAFIMOVSKI, Todor, ROGAN ŠMUC, Nastja, DOLENEC, Matej, TASEV, Goran, DOLENEC, Tadej. Uranium in different samples from Eastern Macedonia - a case study. V: ALBUQUERQUE, Teresa (ur.), ANTUNES, Margarida (ur.). *International Workshop "Uranium, Environment and Public Health" (UrEnv 2013), Instituto Politécnico de Castelo Branco - Portugal, 25 October 2013*, (Procedia Earth and Planetary Science, ISSN 1878-5220, Vol. 8). Amsterdam: Elsevier. 2014, vol. 8, str. 98-102, doi: 10.1016/j.proeps.2014.05.020.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Mineralogija glin
Course title:	Clay Mineralogy
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0562418
Koda učne enote na članici/UL Member course code:	734

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	30	0	0	0	75	5

Nosilec predmeta/Lecturer:	Matej Dolenec
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Zaključen dodiplomski študij, osnovna računalniška pismenost.	Completed undergraduate study, basic computer literacy.

Vsebina:	Content (Syllabus outline):
Struktura, nomenklatura in nastanek glinenih mineralov Tehnike priprave vzorcev za določanje glinenih mineralov Določanje glinenih mineralov (kaolinit, illit, smektiti, vermikulit, klorit) in z njimi povezanih mineralov (silikati, karbonati, Fe oksidi in hidroksidi, sulfidi in soli) Prepoznavanje glinenih mineralov z zmesno strukturo Kvalitativne in kvantitativne analize Uporabnost glinenih mineralov Vpliv na zdravje človeka	Structure, nomenclature, and occurrences of clay minerals Sample preparation techniques for clay minerals Identification of clay minerals (kaolinite, illite, montmorillonite, vermiculite, chlorite) and associated minerals (silica minerals, carbonates, Fe-oxydes/hydroxides, sulphides, salts) Basic identification of mix-layered clay minerals Qualitative and quantitative analysis Clay minerals applications Clays and human health

Temeljna literatura in viri/Readings:

BERGAYA, F., THENG, B.K.G., LAGALY, G. 2006: Handbook of clay science. Elsevier, Amsterdam, 1223 p.p.
MURRAY, H.H., 2007: Applied clay mineralogy. Elsevier, Amsterdam, 180 p.p.
PARKER, A., Rae, J.E., 1998: Environmental interaction of clays. Springer, Berlin, 271 p.p.
DUANE, M.M., C. ROBERT, and Jr. REYNOLDS, 1997: X-ray Diffraction and the Identification and Analysis of Clay Minerals. Oxford University Press, New York, 378 p.p.

Cilji in kompetence:	Objectives and competences:
CILJI: Študent pridobi znanje o strukturah glinenih mineralov, Študent se spozna z osnovami kvalitativnega	OBJECTIVES: Student acquires knowledge of clay minerals structure. Student gets familiar with:

in kvantitativnega določanja tipov glinenih mineralov v naravnih materialih, poznavanje njihovega nastanka, pojavljanja in primernosti uporabe ter vpliva na okolje. KOMPETENCE: Študenti znajo: - prepoznati glinene minerale z uporabo rentgenske preškovne difrakcije (z uporabo HighScore+ programa) - določiti mineralno sestavo glin - razumeti pomembnost lastnosti glinenih mineralov in glin - določiti potrebne postopke predpriprave vzorcev za določanje mineralov glin.	principles of qualitative and quantitative determination of different types of clay minerals in geomaterials, occurrences and applications of clay minerals and their impact on the environment. COMPETENCES: Students are able to: - identify clay minerals using XRD technique (using HighScore+ software) - determine the mineralogical composition of clays - understand the environmental significant properties of clay and clay minerals - determine required sample preparation techniques for clay minerals.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent pozna strukturo glinenih mineralov, razume njeno povezanost z uporabnimi lastnostmi glinenih mineralov in zna kvalitativno in kvantitativno določiti glinene minerale in primernost njihove uporabe. Pri ugotovljeni prisotnosti glinenih mineralov v naravnih materialih pozna in razume njihov vpliv v okolju.	Students gets familiar with clay minerals structures, understand its relationship with the clay minerals properties and are able to qualitatively and quantitatively identify and determine appropriate use of clay minerals. Acquires knowledge about clay minerals impact on the environment.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarske vaje (30) v laboratoriju in računalniški učilnici, samostojno reševanje problema v obliki seminarske naloge.	Lectures, laboratory work and work with computers, independent resolving of the problem in the form of the seminar work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
teoretična vprašanja	40,00 %	theory
reševanje treh različnih difraktogramov	40,00 %	identification of three diffractograms
seminarska naloga	20,00 %	seminar work
Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Grading scale: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) UL and faculty rules.

Reference nosilca/Lecturer's references:

GLAVAŠ, Neli, MOURELLE, Lourdes Maria, GÓMEZ, Carmen P., LEGIDO, José Luis, ROGAN ŠMUC, Nastja, DOLENEC, Matej, KOVAČ, Nives. The mineralogical, geochemical, and thermophysical characterization of healing saline mud for use in pelotherapy. Applied clay science, ISSN 0169-1317. [Print ed.], 2017, vol. 135, str. 119-128, ilustr.
KOMAR, Darja, DOLENEC, Matej, LAMBAŠA, Živana, SANJA SLAVICA, Matešić, LOJEN, Sonja, KNIEWALD, Goran, VRHOVNIK, Petra, DOLENEC, Tadej, ROGAN ŠMUC, Nastja. Geochemical characterization and environmental status of Makirina Bay sediments (northern Dalmatia, Republic of Croatia). Geologia Croatica : a journal of the Institute of Geology Zagreb and Croatian Geological Society, ISSN 1330-030X, 2015, vol. 68, no. 1, str. 79-92.
KOMAR, Darja, DOLENEC, Matej, LAMBAŠA, Živana, SANJA SLAVICA, Matešić, LOJEN, Sonja, KNIEWALD, Goran, VRHOVNIK, Petra, DOLENEC, Tadej, ROGAN ŠMUC, Nastja. Geochemical characterization and environmental status of Makirina Bay sediments (northern Dalmatia, Republic of Croatia). Geologia Croatica : a journal of the Institute of Geology Zagreb and Croatian Geological Society, ISSN 1330-030X, 2015, vol. 68, no. 1, str. 79-92.
GLAVAŠ, Neli, ROGAN ŠMUC, Nastja, DOLENEC, Matej, KOVAČ, Nives. The seasonal heavy metal signature and variations in the microbial mat (petola) of the Sečovlje Salina (northern Adriatic). Journal of soils and sediments, ISSN 1439-0108, 2015, vol. 15, iss. 12, str. 2359-2368.
VRHOVNIK, Petra, ROGAN ŠMUC, Nastja, DOLENEC, Tadej, SERAFIMOVSKI, Todor, DOLENEC, Matej. An evaluation of trace metal distribution and environmental risk in sediments from the Lake Kalimanci (FYR Macedonia). Environmental earth sciences, ISSN 1866-6280, 2013, vol. 70, iss. 2, str. 761-775.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Modeliranje toka podzemne vode
Course title:	Groundwater Flow Modeling
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	1. semester 2. semester

Univerzitetna koda predmeta/University course code:	0615345
Koda učne enote na članici/UL Member course code:	11421

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
15	5	25	0	0	45	3

Nosilec predmeta/Lecturer:	Mihael Brenčič
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
PREDAVANJA Uvod Kratek opis osnovnih enačb toka podzemne vode in transportnih enačb. Numerične metode v hidrogeologiji. Robni in začetni pogoji. Odprtokodni in komercialni programi za modeliranje toka podzemne vode. Povezava numeričnih modelov z računalniškimi orodji v GIS okolju. **SEMINAR** Kako postaviti numerični model toka podzemne vode? Priprava konceptualnega hidrogeološkega modela **VAJE** Gradnja numeričnega modela toka podzemne vode na realnem primeru v naravi z uporabo odprtokodnega računalniškega programa. Umerjanje modela, validacija modela. Analiza občutljivosti.	**LECTURES** Introduction. Short description of basic groundwater flow and transport equations. Numerical methods in hydrogeology. Initial and boundary condition. Open source and comercial software for groundwater flow modeling. Relation between numerical models and GIS environment. **SEMINAR** How to construct groundwater flow numerical model? Construction of basic hydrogeological conceptual model. **EXCERCISES**

	Construction of numerical groundwater flow model on real case study with the application of open source code. Model calibration, model validation. Sensitivity analysis.

Temeljna literatura in viri/Readings:

BRENČIČ, M., 2020: Dinamika toka podzemne vode. Študijsko gradivo v pripravi.
BEAR, J. & CHENG, A.H.G., Modeling Groundwater Flow and Contaminant Transport. Springer, 834 pp.
ANDERSON, M., WOESSNER, W.W., HUNT, R.J., 2015: Applied Groundwater Modeling: Simulation of Flow and Advective Transport. Elsevier, 564 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Seznanitev študentov z osnovami modeliranjem toka podzemne vode in transportom onesnaževal v vodonosnikih. Moderna hidrogeološka stroka zahteva od diplomantov, da obvladajo spretnosti numeričnega modeliranja, zato je velik del predmeta namenjen praktičnemu usposabjanju na konkretnih primerih iz prakse. KOMPETENCE: Sposobnost izvajanja numeričnih analiz toka podzemne vode in toka onesnaževal v vodonosnikih ter sposobnost sodelovanja z drugimi strokami, ki delujejo vodnih virov.	OBJECTIVES: Introducing students to the basics of groundwater flow modeling and the transport of pollutants in aquifers. The modern hydrogeological profession requires graduates which master numerical modeling skills, so a large part of the course is dedicated to practical training with real case studies. COMPETENCES: Ability to perform numerical modeling of groundwater flow and pollutant transport in aquifers, as well as the ability to collaborate with other water resources professions.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobljeno poglobljeno znanje s področja modeliranja toka podzemne vode. Možnost uporabe modeliranja toka podzemne vode v vsakdanji hidrogeološki praksi (npr. upravljanju z vodnimi viri, zaščiti vodnih virov, gradbeništvu, rudarstvu, planiranju, načrtovanju in upravljanju prostora). Vloga in pomen numeričnega modeliranja toka podzemne vode v vsakdanji inženirski praksi. Sposobnost izbire in uporabe ustrezne tuje in domače literature. Sposobnost komunikacije z drugimi strokami, sposobnost analize podatkov in sinteze. Uporaba različnih računalniških programov ter prehod iz kvalitativnega na kvantitativno obdelavo podatkov.	Knowledge obtained in the field of groundwater flow numerical modeling. Possibility of application of numerical groundwater flow modeling in engineering practice (e.g. water resources management and protection, civil engineering, mining, planning, design, spatial management). Meaning and role of groundwater flow numerical modeling in engineering practice. Ability to choose and use relevant domestic and foreign literature. The ability to communicate with other professions, the ability to analyze and synthesize information. Using a variety of computer programs, and the transition from qualitative to quantitative data processing.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in kabinetne vaje.	Lectures and laboratory exercises.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
snov predavanj (pisno ali ustno)	60,00 %	knowledge from the lectures (written or oral)
snov vaj (pisno ali ustno)	40,00 %	knowledge from exercises (written or oral)
Ocene: 6-10 (pozitivno) ob upoštevanju Statuta UL in fakultetnih pravil.		Marks: 6-10 (positive) according to the UL Statute and faculty rules.

Reference nosilca/Lecturer's references:

BRENČIČ, M., 2018: Comparison of the fully penetrating well drawdown in leaky aquifers between finite and infinite radius of influence under steady-state pumping conditions. Geologija 61/2, str. 205-214.

ADRINEK, S., BRENČIČ, M., 2019: Statistical analysis of groundwater drought on Dravsko-Ptujsko polje. Geologija 62/2, str. 251-266.
KOROŠA, A., BRENČIČ, M., MALI, N., 2020: Estimating the transport parameters of propyphenazone, caffeine and carbamazepine by means of a tracer experiment in a coarse-gravel unsaturated zone. Water Research, vol. 175, doi.org/10.1016/j.watres.2020.115680

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Okoljska in inženirska geofizika
Course title:	Environmental and Engineering Geophysics
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562392
Koda učne enote na članici/UL Member course code:	846

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	30	0	0	15	75	5

Nosilec predmeta/Lecturer:	Andrej Gosar
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Pogoj za pristop k izpitu: opravljen izpit iz predmeta Geofizikalne metode raziskav.	To take an exam passed exam of the course Geophysical research methods is mandatory.

Vsebina:	**Content (Syllabus outline):**
Uvod: vloga geofizikalnih raziskav v okoljskih in inženirskih študijah, glavne metode okoljske in inženirske geofizike, specifičnost geofizikalnih raziskav plitvega podpovršja, ločljivost geofizikalnih podatkov Mikrogravimetrija: terenske meritve, korekcije podatkov, ločevanje polj, direktna in inverzna interpretacija Magnetometrija: meritve celotnega polja in gradientne meritve, magnetna susceptibilnost kamnin, časovne korekcije, ločevanje regionalnih in lokalnih anomalij, direktna in inverzna interpretacija Geoelektrične metode: električne lastnosti kamnin, lastni potencial, upornostne metode, električna tomografija, elektromagnetne metode, inducirana polarizacija Georadar: dielektrične lastnosti kamnin in hitrost EM valovanja, dušenje signala, načini meritev, ločljivost, Visokoločljiva refleksijska seizmika: seizmični viri za plitve raziskave, metoda skupne sredinske točke, specifičnost obdelave podatkov za dosego visoke ločljivosti, Refrakcijska seizmika: raziskave z longitudinalnimi (P) in transverzalnimi (S) valovi, generalizirana recipročna metoda Seizmične metode površinskih valov: večkanalna analiza	Introduction: the role of geophysical investigations in environmental and engineering studies, the main methods of environmental and engineering geophysics, specifics of shallow geophysical investigations, resolution of geophysical data Microgravimetry: field data acquisition, data corrections, separations of potential fields, direct and inverse interpretation Magnetometry: total field and gradient measurements, magnetic susceptibility of rocks, temporal corrections, separation of regional and local anomalies, direct and inverse interpretation, Geoelectrical methods: electrical properties of rocks, self-potential, resistivity methods, electric tomography, electromagnetic methods, induced polarisation Ground Penetrating radar: dielectric properties of rocks and velocity of EM waves, signal attenuation, types of measurements, data resolution High-resolution reflection seismics: seismic sources for shallow investigations, Common-Mid-Point method, specific data processing to achieve high resolution Seismic refraction method: investigations with longitudinal (P) and transversal (S) waves, Generalized Reciprocal Method Seismic surface waves methods. Multichannel Analysis

površinskih valov (MASW), pasivne in aktivne meritve, inverzija disperzijske krivulje, uporaba v geotehniki in seizmologiji Seizmične meritve v vrtinah: down-hole, up-hole, cross-hole, seizmična tomografija Meritve vibracij zaradi miniranja (vibrometrija)	of Surface Waves (MASW), passive and active measurements, inversion of dispersion curve, applications in geotechnics and seismology Seismic measurements in boreholes: down-hole, up-hole, cross-hole, seismic tomography Vibration measurements caused by blasting (vibrometry)

Temeljna literatura in viri/Readings:

GOSAR, A. 2011: Inženirska geofizika. UL-Naravoslovnotehniška fakulteta, 121 str.
REYNOLDS, J. M. 1997: An introduction to applied and environmental geophysics. John Wiley & Sons, 796 pp.
SHARMA, P. V. 1997: Environmental and engineering geophysics. Cambridge University Press, 475 pp.
VOGELSANG, D. 1995: Environmental geophysics. Springer, 173 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: poznavanje osnov okoljske in inženirske geofizike, poznavanja metod raziskav v okoljski in inženirski geofiziki, povezovanje fizikalnih, geoloških in tehničnih znanj za razumevanje geofizikalnih metod in podatkov KOMPETENCE: sposobnost načrtovanja, izvajanja in interpretacije geofizikalnih raziskav sposobnost vključevanja geofizikalnih raziskav v okoljske, hidrogeološke, geotehnične in inženirskogeološke študije	OBJECTIVES: knowledge on principles of environmental and engineering geophysics, knowledge on research methods in environmental and engineering geophysics, integration of physical, geological and technical skills for understanding geophysical methods and data COMPETENCES: ability to plan, perform and interpret geophysical investigations ability to include geophysical investigations into environmental, hydrogeological, geotechnical and engineering geological studies

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje fizikalnega in geološkega ozadja geofizikalnih metod in podatkov, metod raziskav v okoljski in inženirski geofiziki.	Knowledge and understanding of physical and geological background of geophysical methods and data, of investigation methods in environmental and engineering geophysics.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z uporabo prezentacij. Vaje potekajo delno kot vodene seminarske vaje (15 ur), delno kot vodene kabinetne vaje (15 ur). Terenske vaje obsegajo 3 dni dela na terenu.	Lessons using presentations. Exercises, partly as leaded seminar work (15 h) and partly as leaded class work (15 h). Field work comprises 3 days working in the field.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
naloge iz snovi vaj	40,00 %	exercises problems
teoretična vprašanja	60,00 %	theoretical questions
Za pozitivno oceno mora biti pravilno rešenih najmanj 50% nalog iz snovi vaj in hkrati najmanj 50% teoretičnih vprašanj. Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		For a positive mark at least 50% of exercises problems should be solved and at least 50% theoretical questions answered correctly. Grades: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10), according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

GOSAR, Andrej 2005: Seismic reflection investigations for gas storage in aquifers (Mura Depression, NE Slovenia). Geologica Carpathica, 56/3, 285-294.

GOSAR, Andrej 2008: Gravity modelling along seismic reflection profiles in the Krško basin (SE Slovenia). Geologica Carpathica, 59/2, 147-158.
GOSAR, Andrej, Čeru T. 2016: Search for an artificial buried karst cave entrance using ground penetrating radar: a successful case of locating the S-19 Cave in the Mt. Kanin massif (NW Slovenia). International Journal of Speleology, 45/2, 135-147.
GOSAR, Andrej. 2017: Study on the applicability of the microtremor HVSR method to support seismic microzonation in the town of Idrija (W Slovenia). Natural Hazards and Earth System Sciences, 17, 925-937.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Okoljska mineralogija
Course title:	Environmental Mineralogy
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0596431
Koda učne enote na članici/UL Member course code:	11410

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
25	20	0	0	0	45	3

Nosilec predmeta/Lecturer:	Nastja Rogan Šmuc
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Zaključen prvostopenjski bolonjski študij naravoslovne smeri.	Completed the first-level of Bologna natural sciences study.

Vsebina:	**Content (Syllabus outline):**
Predavanja: 1. Kaj je okoljska mineralogija. 2. Analitične, eksperimentalne in računske metode v okoljski mineralogiji. 3. Eksperimentalni pristopi k aktualnim problemom prisotnim v okoljski mineralogiji. 4. Primerjalna reaktivnost silikatov, karbonatov, sulfidov in oksidov: eksperimentalno proti naravnemu okolju. 5. Mineralogija ključnih okoljskih sistemov. Kateri in zakaj? 6. Mineralogija in razvoj tal. 7. Mineralogija recentnih morskih sedimentov: znotraj geokemičnega okvirja. 8. Mikrobiološki vplivi na mineralogijo v različnih okoljih, geogenih in antropogenih. 9. Aerosolni delci v troposferi: Mineraloški uvod. 10. Mineralogija rudnih odpadkov. 11. Primernost mineralov za uporabo na območjih odlagališč in zadrževanja. **Vaje:** laboratorijska priprava okoljskih vzorcev, mineraloška in geokemijska analiza, kvalitativno in kvantitativno določanje mineralov z računalniškim programom, geokemični računi in statistična analiza rezultatov.	**Lectures:** 1. The nature and scope of environmental mineralogy. 2. Analytical, experimental and computational methods in environmental mineralogy. 3. Experimental approaches to environmental mineralogy problems. 4. Comparative reactivity of silicates, carbonates, sulphides and oxides: Experimental vs. natural environment. 5. Mineralogy of key environmental systems. Which and why? 6. Minerals and soil development. 7. Mineralogy of modern marine sediments: A geochemical framework. 8. Microbial controls on the mineralogy of the environment. 9. Aerosol particles in the troposphere: A mineralogical introduction. 10. Mineralogy of mine wastes. 11. Suitability of minerals for controlled landfill and containment. **Exercises:** laboratory preparation of environmental samples, mineralogical and geochemical analysis, qualitative and quantitative determination of minerals

	with computer programme, geochemical recalculations and statistical analysis of results.

Temeljna literatura in viri/Readings:

Izbrana poglavja iz knjig / Selected chapters from books:

Klein, C. in Philpotts A., 2016, Earth Materials 2nd Edition: Introduction to Mineralogy and Petrology. Cambridge university Press, 616 str.

Vaughan, D. J. in Wogelius, R. A., 2000, Environmental Mineralogy, University textbook (EMU Notes in Mineralogy). Eotvos University Press, Budapest, 434 str.

Vaughan, D. J. in Wogelius, R. A., 2012, Environmental Mineralogy II, University textbook (EMU Notes in Mineralogy). European Mineralogical Union and the Mineralogical Society of Great Britain & Ireland, 489 str.

Periodika, znanstvene in strokovne revije / periodicals, scientific and professional journals.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Slušatelj prepozna in obvlada osnovne probleme v zvezi z mineralogijo in varovanjem okolja, kako lahko dotične probleme analizira ter jih poskuša reševati v eksperimentalnem in realnem okolju, ter kako se okoljska mineralogija pri le-tem posledično povezuje z različnimi vejami geologije (mineralogija, aplikativna mineralogija, petrologija in okoljska geokemija). KOMPETENCE: Študent je sposoben spoznati vlogo okoljske mineralogije pri različnih okoljskih vplivih in problemih. Iz vidika okoljske mineralogije je sposoben predlagati njihovo sanacijo. Zna se povezovati s strokovnjaki drugih strok pri presoji in reševanju okoljskih problemov.	OBJECTIVES: The student recognizes and manages the basic problems related to mineralogy and environmental protection, how he can analyse the problems in question and try to solve them in an experimental and real environment, and consequently, how environmental mineralogy is integrated with different branches of geology (mineralogy, applied mineralogy, petrology and environmental geochemistry). COMPETENCES: The student is able to understand the role of environmental mineralogy in various environmental influences and problems, and, he is able to propose their remediation. Knows how to associate with experts in other fields of expertise in environmental issues.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študentje prepoznajo koncept okoljske mineralogije kot vede na področju varovanja okolja. Obvladajo različne analitične, eksperimentalne in računalniške metode, s katerimi lahko pristopijo k reševanju okoljskih problemov iz vidika okoljske mineralogije. Spoznajo in razumejo vlogo mineralogije v današnjih ključnih sistemih, in sicer v tleh in morskih sedimentih. Nadalje prepoznajo in razumejo glavne mikrobiološke vplive na prisotnost mineralov v različnih recentnih okoljih. Ukvarjajo se tudi s pojavom okoljske mineralogije v troposferi ter z razumevanjem in analitičnim reševanjem na področju mineralogije rudniških odpadkov in odlagališč. Spoznajo tudi, kako ključno je povezovanje z drugimi vedami in znanostmi, da lahko h okoljskim problemom pristopimo celostno in efektivno.	Students recognize the concept of environmental mineralogy as a science in the field of environmental protection. They are proficient in various analytical, experimental and computational methods that can help resolve environmental problems in terms of environmental mineralogy. They understand the role of mineralogy in today's key systems, in soil and marine sediments. Students further identify and understand the major microbiological impacts on the presence of minerals in various recent environments. They are also concerned with the occurrence of environmental mineralogy in the troposphere and with understanding and analytical resolution in the field of mineralogy of mining waste and landfills. Students also learn how crucial it is to integrate with other sciences that we can approach to different environmental issues holistically and effectively.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in laboratorijske vaje.	Lectures and laboratory work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	70,00 %	Written and/or oral exam
Praktični del	30,00 %	Practical exam

Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Evaluation scale: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) having regard to the Statute of UL and faculty rules.

Reference nosilca/Lecturer's references:

GLAVAŠ, Neli, MOURELLE, Lourdes Maria, GÓMEZ, Carmen P., LEGIDO, José Luis, ROGAN ŠMUC, Nastja, DOLENEC, Matej, KOVAČ, Nives. The mineralogical, geochemical, and thermophysical characterization of healing saline mud for use in pelotherapy. Applied clay science, ISSN 0169-1317. [Print ed.], 2017, vol. 135, str. 119-128, doi: 10.1016/j.clay.2016.09.013.

ROGAN ŠMUC, Nastja, SERAFIMOVSKI, Todor, DOLENEC, Tadej, DOLENEC, Matej, VRHOVNIK, Petra, VRABEC, Mirijam, JAĆIMOVIĆ, Radojko, LOGAR ZORN, Vesna, KOMAR, Darja. Mineralogical and geochemical study of Lake Dojran sediments (Republic of Macedonia). Journal of geochemical exploration, ISSN 0375-6742. [Print ed.], 2015, vol. 150, str. 73-83, doi: 10.1016/j.gexplo.2014.12.019.

KRAMAR, Sabina, LUX, Judita, MLADENOVIČ, Ana, PRISTACZ, Helmut, MIRTIČ, Breda, SAGADIN, Milan, ROGAN ŠMUC, Nastja. Mineralogical and geochemical characteristics of Roman pottery from an archaeological site near Mošnje (Slovenia). Applied clay science, ISSN 0169-1317. [Print ed.], 2012, vol. 57, str. 39-48, doi: 10.1016/j.clay.2011.12.00.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Paleoekologija
Course title:	Paleoecology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562368
Koda učne enote na članici/UL Member course code:	849

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
60	0	0	0	0	60	4

Nosilec predmeta/Lecturer:	Luka Gale
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljene obveznosti pri predmetih paleontologija, sedimentologija, stratigrafija na 1. bolonjski stopnji so pogoj za pristop k izpitu.	Finished courses in Palaeontology, Sedimentology and Stratigraphy are mandatory to take an exam.

Vsebina:	Content (Syllabus outline):
Predmet paleoekologija je namenjen študentom, ki potrebujejo poglobljeno razumevanje razvoja življenja, ekosistemov in Zemlje kot celote. Biotske spremembe skuša prikazati v logičnem časovnem zaporedju, od predkambrija do kvartarja, pri čemer predstavimo paleogeografski in paleoklimatski razvoj, večje spremembe, ki se zgodijo v razvoju biote na kopnem in v morju in vzroke zanje ter splošne značilnosti morskih in kopenskih paleoekosistemov. V prvem delu se spoznamo z izbranimi osnovami ekologije (habitat, pogoji, viri, interakcije med organizmi, lastnosti populacij, primeri modernih združb in ekosistemov). V drugem delu spoznamo bolje poznana nahajališča fosilnih združb ter interpretiramo združbe izbranih formacij z območja Slovenije.	The Palaeoecology course is intended for students who wish to gain a more in-depth knowledge about the evolution of life, ecosystems and the Earth. Biotic changes are shown in a logical succession, from Precambrian to Quaternary. We focus on major palaeogeographic, palaeoclimatic and biotic changes, the driving factors for the biotic changes and the main features of biotas from specific time intervals. In the first part we get to know some of the basics of Ecology (habitats, conditions, resources, interactions between organisms, features of population, modern examples of communities and ecosystems). In the second part we pass through some of the better known fossil assemblages. We also make interpretations of selective rock formations from Slovenia.

Temeljna literatura in viri/Readings:

Izbrana poglavja iz:

BRENCHLEY, P.J., HARPER, D.A.T., 1998, Palaeoecology, Ecosystems, Environments and evolution, Champan & Hall, 402 str.

BRIGGS, D.E.G. & CROWTHER, P.R. (ur.) 2003: Palaeobiology II. Blackwell Publishing: 583 str.

MCKERROW, W.S., 1981, The ecology of fossils: an illustrated guide, The MIT Press, 383 str.

LIEBERMAN, B.S., 2000, Paleobiogeography: Using fossils to study global change, plate tectonics and evolution, Kluwer Acad. Press., 208 pp.
PROTHERO, D.R., 1998, Bringing fossils to life, An Introduction to Paleobiology. McGraw-Hill, 503 str.
Selden, P.A. & Nudds, J.R. 2004: Evolution of fossil ecosystems. Barcelona; Manson Publishing: 160 str.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Slušatelji bodo s pomočjo paleoekoloških pravil vzrokov in posledic dobili sliko o evoluciji biosfere. Na podlagi fosilne združbe se bodo naučili interpretirati abiotske dejavnike . KOMPETENCE: Slušatelji bodo sposobni prepoznati ostanke različnih fosilnih skupin in na podlagi sestave in ohranjenosti ostankov sklepati na okoljske parametre v času depozicije (npr. globina in energija vode). S tem bi pomembno prispevali k interpretaciji kamnin in sodelovali s stratigrafi in sedimentologi.	OBJECTIVES: Students will gain insight into development of the biosphere. Moreover, they will learn to interpret abiotic conditions from the fossil record. COMPETENCES: Students will be able to recognize various fossil groups in the sedimentary record and interpret them from the paleoecological point of view. With their knowledge, they should be able to make interpretation on environmental parametres (water depth, energy…) and as such cooperate with stratigraphers and sedimentologists.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študentje razumejo interakcije med organizmi in njihovim okoljem. Poznajo ekosisteme preteklosti in specifike posameznega obdobja. Poznajo metode raziskovanja in pristop k problematiki.	Students comprehend interactions between organisms and their environment. They know ecosystems of the past and specifics of each of them. They are familiar with methods of research and with approach to research.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (60 ur) potekajo ob uporabi power-point prezentacij. Spodbuja se iskanje in branje znanstvenih člankov.	Lectures (60 h) are accompanied by power-point presentations. Students are tasked with home work (additional reading and searching for data).

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Ustni in/ali pisni izpit iz teoretičnega dela	100,00 %	Written and/or oral exam from theoretical part
Pogoji za pristop k izpitu: vsaj 75% prisotnost na predavanjih. Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Before the theoretical exam, student will have to: attend at least 75% of lectures. Grades (according to norm set by the UL): 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10).

Reference nosilca/Lecturer's references:

GALE, Luka, KELEMEN, Matej. Early Jurassic foraminiferal assemblages in platform carbonates of Mt. Krim, central Slovenia. Geologija, 2017, vol. 60, no. 1, str. 99-115, doi: 10.5474/geologija.2017.008.
GALE, Luka, NOVAK, Uroš, KOLAR-JURKOVŠEK, Tea, KRIŽNAR, Matija, STARE, France. Characterization of silicified fossil assemblage from upper Carnian Amphiclina beds at Crngrob (central Slovenia). Geologija, 2017, vol. 60, no. 1, str. 61-75, doi: 10.5474/geologija.2017.005.
GALE, Luka, PEYBERNES, Camille, CELARC, Bogomir, HOČEVAR, Manca, ŠELIH, Vid Simon, MARTINI, Rossana. Biotic composition and microfacies distribution of Upper Triassic build-ups : new insights from the Lower Carnian limestone of Lesno Brdo, central Slovenia. *Facies*. 2018, vol. 64, iss. 3, str. 1-24.
GALE, Luka, SKABERNE, Dragomir, PEYBERNES, Camille, MARTINI, Rossana, ČAR, Jože, ROŽIČ, Boštjan. Carnian reefal blocks in the Slovenian Basin, eastern Southern Alps. Facies, 2016, vol. 62, no. 4, str. 1-15, doi: 10.1007/s10347-016-0474-8.
SOTELŠEK, Tim, GRAČANIN, Nik, RIFL, Matic, GALE, Luka. Fosilni mnogoščetinci spodnjekarnijskega apnenca pri Lesnem Brdu. *Geologija,* 2018, 61, št. 1, str. 85-99.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Paleontološki praktikum
Course title:	Applied Paleontology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik, 2. letnik	1. semester 2. semester

Univerzitetna koda predmeta/University course code:	0597193
Koda učne enote na članici/UL Member course code:	532

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
10	25	0	0	10	45	3

Nosilec predmeta/Lecturer:	Luka Gale
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljen izpit iz Paleontologije iz prve stopnje študija Geologija (izpolnjevanje pogoja preveri študijska komisija Oddelka za geologijo).	Passed exam in Paleontology from the BSc study of Geology (eligibility is checked by the study commission of the Department of Geology).

Vsebina:	Content (Syllabus outline):
Priprava na terensko delo: strategija in zaščita. Kontaminacija vzorcev, preprečevanje sekundarne kontaminacije in prepoznavanje naravne kontaminacije vzorcev. Vzorčevanje, zaščita in hramba mikrofosilov, fosilov nevretenčarjev in vretenčarjev. Laboratorijsko delo: evidentiranje vzorcev, varnost pri delu, mehanske metode preparacije, kemične metode preparacije. Pridobivanje informacij iz fosilnega zapisa: prepoznavanje paleoekoloških parametrov, tafonomija, ihnofosili, avtohtone združbe, alohtone akumulacije. Opisovanje novih in že poznanih vrst. Sodobne metode raziskovanja fosilov (virtualna paleontologija). Morfometrija.	Preparation for the field work: strategy and protection during research. Sources of paleontological sample contamination, how to awoid and recognize contamination. Field sampling, conservation and storage of microfossils, invertebrate and vertebrate fossils. Laboratory techniques: keeping record of samples, safety at work, mechanical and chemical proceedures of sample preparation/conservation. Obtaining information from fossils: paleoecological parametres, taphonomy, ichnology, autochthonous and allochthonous accumulations. Description of new and allready known species. Modern methods of research in palaeontology (virtual palaeontology). Morphometry.

Temeljna literatura in viri/Readings:

FELDMAN, R. M., CHAPMAN, R. E. in HANNIBAL, J. T. (1989). Paleotechniques. The Paleontological Socity Special Publication, no. 4, 1-358.

GREEN, O.R. (2001). A manual of practical laboratory and field techniques in Palaeobiology. 538 pp. Kluwer Acad.Publ., ISBN: 0-412-58980-X.

GOLDRING, R. (1999): Field Palaeontology. 191 pp., Longman, ISBN: 0-582-35625-3.
GOLDRING, R. (1991): Fossils in the field: Information potential and analysis. 256 pp. Longman Scientific & Technical, ISBN 0-582-06261-6.
SPAJIĆ, O., MITROVIĆ, J., SUDAR, M. in MIHAJLOVIĆ, Đ. (1984): Metode biostratigrafsko paleontoloških istraživanja 403 pp., Rudarsko geološki fakultet Beograd, 1984.
SUTTON, M., RAHMAN, I. in GARWOOD, R. (2014): Techniques for virtual palaeontology. 200 pp. Wiley Blackwell.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Slušatelj se spozna s pripravami na terensko delo, načinom vzorčenja in laboratorijsko preparacijo vzorcev. Seznani se z različnimi raziskovalnimi pristopi, tudi modernimi metodami, kot so rentgensko skeniranje vzorcev in različni statistični testi in izračuni. Nauči se opisati vrsto in sestaviti sinonimiko vrste. Nauči se uporabljati več računalniških programov, namenjenih analizi paleontoloških podatkov in njihovi predstavitvi. KOMPETENCE: Študent je sposoben postaviti raziskovalno vprašanje, načrtovati terensko in laboratorijsko delo. Razume in pozna pomen oznak v sinonimiki. Zna izbrati primerno statistično metodo za preverjanje zastavljenih vprašanj in hipotez. Zna uporabljati Microsoft Excell, Inkscape, JMicroVision in zna izdelati 3D model fosila.	OBJECTIVES: Students learn about the preparation for field work, field sampling and laboratory techniques of preparation. They get to know different research approaches, including modern techniques in palaeontology, such as X-ray scanning, different statistical tests and analyses. They learn how to describe a fossil species and how to build a synonymy list. They learn to use different software designed for analysis, interpretation and presentation of data in palaeontology. COMPETENCES: Students are able to set research questions, plan field and laboratory work. They understand and know the meaning of remarks in synonymy lists. They are able to select among possible statistical tests and methods. They are competent in using Microsoft Excell, Inkscape, JMicroVision and how to build a 3D model of a fossil.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent spozna praktično delo v paleontologiji, seznani se z metodami pobiranja vzorcev in prepariranja fosilov. Sposoben je samostojnega pobiranja vzorcev za paleontološke raziskave na terenu in njihove obdelave v laboratoriju. Sposoben je pridobiti izolirane mikrofosile, izdelati zbrusek, preparirati in zaščititi makrofosile. Na podlagi poznavanja paleontologije je sposoben samostojnega terenskega in laboratorijskega dela, se odločati za pravilno metodo preparacije nabranega fosilnega gradiva. Znanje opazovanja in pridobivanja informacij na terenu bo znal neposredno uporabiti pri paleoekoloških, sedimentoloških raziskavah. Poznavanje načina vzorčevanja za posamezne fosilne skupine ter laboratorijske preparacije mu koristi pri stratigrafskih in regionalno-geoloških raziskavah ter za oceno kvalitete biostratigrafskih podatkov, ki mu jih v okviru raziskave posredujejo biostratigrafi.	The student gets to know the practical paleontological work, various methods of collecting paleontological samples and the laboratory preparation. The student is able to independantly collect samples for paleontological research and to take correct actions of sample preparation in the laboratory. He is able to obtain isolated microfossils, to make thin section and to take necessary steps in protecting macrofossils from decay. The student is autonomous in performing field and laboratory work, make decissions about the correct method of sample treatment and conservation of samples. The obtained knowledge of extracting information in the field is necessary to perform paleoecological and sedimentological research. The correct mehod of sampling is necessary for stratigraphic and regional-geological studies and to assess the quality of the biostratigraphic data aquired from the specialist.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z uporabo presentacij, delo s specializiranimi računalniškimi programi, demonstracija dela v laboratoriju, laboratorijsko delo in 1-2 dni terenskega dela.	Lectures with the use of presentations, work with specialised computer software, demonstration of preparation of samples in the laboratory and practical work, 1-2 days of field work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
terensko delo	65,00 %	field work
teoretični izpit	25,00 %	theoretical exam
predstavitev rezultatov	10,00 %	presentation of results

Reference nosilca/Lecturer's references:

GALE, Luka, NOVAK, Uroš, KOLAR-JURKOVŠEK, Tea, KRIŽNAR, Matija, STARE, France. Characterization of silicified fossil assemblage from upper Carnian Amphiclina beds at Crngrob (central Slovenia). Geologija, 2017, vol. 60, no. 1, str. 61-75, doi: 10.5474/geologija.2017.005.

GALE, Luka, KELEMEN, Matej. Early Jurassic foraminiferal assemblages in platform carbonates of Mt. Krim, central Slovenia. Geologija, 2017, vol. 60, no. 1, str. 99-115, doi: 10.5474/geologija.2017.008.

GALE, Luka, SKABERNE, Dragomir, PEYBERNES, Camille, MARTINI, Rossana, ČAR, Jože, ROŽIČ, Boštjan. Carnian reefal blocks in the Slovenian Basin, eastern Southern Alps. Facies, 2016, vol. 62, no. 4, str. 1-15, doi: 10.1007/s10347-016-0474-8.

GALE, Luka, BARATTOLO, Filippo, RETTORI, Roberto. Morphometric approach to determination of Lower Jurassic siphovalvulinid foraminifera. *Rivista italiana di paleontologia e stratigrafia*. 2018, vol. 124, no. 2, str. 265-282.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Petrogeneza magmatskih in metamorfnih kamnin
Course title:	Petrogenesis of Igneous and Metamorphic Rocks
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0562419
Koda učne enote na članici/UL Member course code:	735

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	45	0	0	0	75	5

Nosilec predmeta/Lecturer:	Matej Dolenec, Mirijam Vrabec
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Osnovno znanje kemije, mineralogije, petrologije in geokemije, pridobljeno na dodiplomskem študiju ali z izravnalnimi predmeti. Obveznosti študenta: Študent mora redno obiskovati vaje, oddati vse zahtevane samostojne naloge ter opraviti preizkus teoretičnega in praktičnega znanja.	Basic knowledge of chemistry, mineralogy, petrology and geochemistry obtained in undergraduate studies or balancing courses. Student's obligations: A student must attend tutorials on regular basis, submit all required homework's, and pass the test of theoretical and practical knowledge.

Vsebina:	Content (Syllabus outline):
Vsebina predmeta je razdeljena na teoretsko petrologijo, v okviru katere se študentje podrobneje spoznajo s petrogenezo magmatskih kamnin, njihovimi geokemičnimi in izotopskimi značilnostmi ter okoljem njihovega nastopanja. GRANITI: klasifikacije, fazni diagrami granitnih sistemov, fizikalne lastnosti granitne magme, nastanek struktur v granitih, diferenciacija granitne magme, meja vulkan-pluton, delno taljenje – restiti, mešanje granitne taline z bazaltno, mehanizmi kontrole dviga in umestitve magme, hitrosti dviga, kristalizacije in ohlajanja, oceanski plagiograniti, batoliti cordillerskega tipa (svetovni, evropski, slovenski), magmatizem znotraj plošče (A-tip in alkalni graniti), migmatiti, hlapne komponente in pegmatiti, izvor granitne taline glede na tektonska okolja, mafični vključki METAMORFNE KAMNINE: kemične reakcije in kemična kinetika v metamorfnih kamninah, termodinamika mineralov in fazna ravnotežja	The content of the course is divided into theoretical petrology, in which students learn about petrogenesis of the igneous rocks, their geochemical and isotopic characteristics, and the environment for their occurrence. GRANITES: classifications, phase diagrams of granite systems, physical properties of granite magma, formation of granite structures, granite magma differentiation, volcanic-pluton boundary, partial melting - resting, mixing of granite melt with basalt, mechanisms of lift control and magma placement, lift rates, crystallization and cooling , oceanic plagiogranites, batolites of the cordiller type (world, European, Slovene), magnetism inside the plate (A-type and alkaline granites), migmatites, volatile components and pegmatites, the origin of granite melt relative to tectonic environments, mafic inclusions METAMORPIC ROCKS: chemical reactions and chemical kinetics in

v metamorfnih kamninah, mineralna kemija metamorfnih kamnin, metamorfni kristalizacijski mehanizmi, geotermometrija in geobarometrija metamorfnih kamnin, geokemija metamorfnih kamnin, določanje narave izvornih kamnin, strukture in deformacije metamorfnih kamnin, delno taljenje med visoko stopnjo metamorfoze, fluidi in metasomatske reakcije med metamorfozo, geodinamski pomen metamorfnih kamnin, metamorfne kamnine v Sloveniji VAJE: makroskopsko in mikroskosko prepoznavanje različnih vrst magmatskih in metamorfnih kamnin (tudi hidrotermalno spremenjenih) ter uporaba različnih diagramov in računalniških programov za njihovo klasifikacijo in za frakcionirano kristalizacijo	metamorphic rocks, mineral thermodynamics and phase equilibrium in metamorphic rocks, mineral chemistry of metamorphic rocks, metamorphic crystallization mechanisms, geothermometry and geobarometry of metamorphic rocks, geochemistry of metamorphic rocks, nature of the protolith, structure and deformation of metamorphic rocks, partial melting during high grade metamorphism, fluids and metasomatic reactions during metamorphism, the geodynamic significance of metamorphic rocks, metamorphic rocks in Slovenia TUTORIALS: macroscopic and microscopic recognition of various types of magmatic and metamorphic rocks (including hydrothermal changes) and the use of different diagrams and computer programs for their classification and for fractional crystallization

Temeljna literatura in viri/Readings:

BARD, J.P.: Microtextures of Igneous and Metamorphic Rocks. D.Reidl Publishing Company, Dordrecht, Holland. 264 str., 1986.
BLATT, H., TRACY, R., OWENS, B. Petrology: igneous, sedimentary, and metamorphic. WH Freeman, 2005.
BUCHER, K., Frey, M.: Petrogenesis of metamorphic rocks, 341 pp., 1994.
HALL, A.: Igneous Petrology. Longman, 551 pp., 1996.
PITCHER, W. S.: The nature and origin of granites. Blackie Academic & Professional, 321 pp., 1993.
RAGLAND, P.C. Basic analytical petrology. New York: Oxford University Press, 1989.
RAYMOND, L.A. Petrology: the study of igneous, sedimentary and metamorphic rocks. Dubuque, IA: Wm. C. Brown, 1995.
SPEAR, F.S.: Metamorphic phase equilibria and pressure-temperature-time paths. Mineralogical Society of America Monograph, 1799 pp., 1993.
VERNON R. H.: A practical guide to Rock Microstructure. Cambridge University Press, 2004.
VERNON R.H. & CLARKE, G.L.: Principles of Metamorphic petrology, Cambridge University Press, 446pp., 2008.
YARDLEY, B.W.D.: Introduction to Metamorphic Petrology. (Eds. J. Zussman and W.S. McKenzie), Longman Earth Science Series, John Wiley & Sons, Inc., New York, USA 248 str., 1989.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študent se seznani s petrogenezo magmatskih in metamorfnih kamnin, njihovimi geokemičnimi in izotopskimi značilnostmi, mineralno sestavo in okoljem nastopanja, pri metamorfnih kamninah pa je povdarek na poznavanju kemičnih reakcij, faznih ravnotežij, mineralne kemije, termobarometrije ter geokemije metamorfnih kamnin. Spozna sestavo, značilnosti in nastanek širokega spektra magmatskih in metamorfnih kamnin, ki jih najdemo v Sloveniji. KOMPETENCE: S pomočjo mikroskopske analize se nauči razbrati mikrostrukturne značilnosti in deformacijske mehanizme magmatskih in metramorfnih kamnin. S študijem »psevdosekcij« in sodobnih geotermobarometričnih kalibraciojskih modelov se usposobi za izračun in modeliranje metamorfnih pogojev, ki so jim bile kamnine izpostavljene. Zna interpretirati nastanek in izvor kamnin.	OBJECTIVES: The student acquaints himself with the petrogenesis of magmatic and metamorphic rocks, their geochemical and isotopic characteristics, the mineral composition and the environment of performance, and in the metamorphic rocks, he is aware of the chemical reactions, phase equilibria, mineral chemistry, thermobrometry and geochemistry of metamorphic rocks. It recognizes the composition, characteristics and formation of a wide spectrum of magmatic and metamorphic rocks found in Slovenia. COMPETENCES: Microstructural characteristics and deformation mechanisms of magmatic and metramorphic rocks are learned using microscopic analysis. Through the study of pseudosections and modern geothermobarometric calibration models, he/she is trained to calculate and model the metamorphic conditions to which the rocks have been exposed. He/she can interpret the origin and origin of the rocks.

Predvideni študijski rezultati: **Intended learning outcomes:**

Študent pozna in razume različne magmatske procese ter zna izbrati potrebne analitske postopke, rezultate ovrednotiti in interpretirati nastanek posameznih kamnin ter odnose med njimi. Petrološko znanje vključuje v širši kontekst regionalne geologije. Povezuje znanje mineralogije, geokemije, petrologije, strukturne geologije in regionalne geologije ter prenaša način obravnave problemov med različnimi vejami geologije. Iskanje in citiranje literature, izbira analitskih tehnik, uporaba računalniških programov, razumevanje tujega jezika, timsko delo.	The student knows and understands various magmatic processes and can select the necessary analytical procedures, evaluate the results and interpret the formation of individual rocks and the relationships between them. Petrological knowledge includes the broader context of regional geology. It combines the knowledge of mineralogy, geochemistry, petrology, structural geology and regional geology, and transfers the way of dealing with problems between different fields of geology. Searching and quoting literature, selecting analytical techniques, using computer programs, understanding foreign languages, teamwork.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, prikaz slikovnega gradiva (LCD projektor), mikroskopiranje, delo z računalnikom.	Lectures, presentation of picture material (LCD projector), microscopy, computer work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
ocena vaj ter seminarja	50,00 %	exercises and seminar
ocena teoretičnega dela - pisni in/ali ustni izpit	50,00 %	theoretical part - written and/or oral examination
Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Grading scale: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) UL and faculty rules.

Reference nosilca/Lecturer's references:

VRABEC, Mirijam, JANÁK, Marian, FROITZHEIM, Nikolaus, DE HOOG, J.C.M. Phase relations during peak metamorphism and decompression of the UHP kyanite eclogites, Pohorje Mountains (Eastern Alps, Slovenia). Lithos, 2012, vol. 144-145, str. 40-55, doi: dx.doi.org/10.1016/j.lithos.2012.04.004.

JANÁK, Marian, CORNELL, David, FROITZHEIM, Nikolaus, HOOG, J.C.M. De, BROSKA, Igor, VRABEC, Mirijam, HURAI, Vratislav. Eclogite-hosting metapelites from the Pohorje Mountains (Eastern Alps): P-T evolution, zircon geochronology and tectonic implications. European journal of mineralogy, 2009, vol. 21, no. 6, str. 1191-1212, doi: 10.1127/0935-1221/2009/0021-1966.

JANÁK, Marian, FROITZHEIM, Nikolaus, VRABEC, Mirijam, KROGH RAVNA, Erling J., HOOG, J.C.M. De. Ultrahigh-pressure metamorphism and exhumation of garnet peridotite in Pohorje, Eastern Alps. J. metamorph. geol., 2006, vol. 24, no. 1, str. 19-31.;SERAFIMOVSKI, Todor, DOLENEC, Tadej, TASEV, Goran, ROGAN, Nastja, DOLENEC, Matej. The composition of major minerals from the Buchim porphyry copper deposit, Republic of Macedonia. Geol. Maced., 2008, vol. 22, str. 17-26.

DOLENEC, Matej, SERAFIMOVSKI, Todor, DANEU, Nina, DOLENEC, Tadej, ROGAN Å MUC, Nastja, VRHOVNIK, Petra, LOJEN, Sonja. The case of the carbonatite-like dyke of the Madenska River complex at the Kriva Lakavica section in the Republic of Macedonia : oxygen and carbon isotopic constraints. Turkish journal of earth sciences, ISSN 1300-0985, 2015, vol. 24, no. 6, str. 627-639, doi: 10.3906/yer-1502-28.

MILER, Miloš, AMBROŽIČ, Bojan, MIRTIČ, Breda, GOSAR, Mateja, ŠTURM, Sašo, DOLENEC, Matej, JERŠEK, Miha. Mineral and chemical composition of the Jezersko meteorite - a new chondrite from Slovenia. Meteoritics & planetary science, ISSN 1086-9379, 2014, vol. 49, no. 10, str. 1875-1887.

SERAFIMOVSKI, Todor, DOLENEC, Tadej, TASEV, Goran, ROGAN, Nastja, DOLENEC, Matej. The composition of major minerals from the Buchim porphyry copper deposit, Republic of Macedonia. Geol. Maced., 2008, vol. 22, str. 17-26.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Praktično usposabljanje
Course title:	Professional Internship
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0597185
Koda učne enote na članici/UL Member course code:	11414

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
0	15	0	0	75	90	6

Nosilec predmeta/Lecturer:	Luka Gale
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
Študent opravi 75 ur praktičnega dela v eni od organizacij ali podjetij, ki zaposlujejo profil regionalnega geologa. Delovne prakse, ki morajo biti s strokovnega področja regionalne geologije, razpišejo delodajalci v začetku tekočega študijskega leta. Študent obiskuje tudi seminar, na katerem strokovnjaki, raziskovalci in študenti predstavljajo strokovne in znanstvene novosti na področju regionalne geologije.	Student will perform 75 hrs of professional internship in one of the organizations or companies employing regional geologists. Internships, which must be related to the field of regional geology, are offered by employers at the beginning of the respective study year. Additionally, student will attend the seminar where professionals, researchers and students present current trends and new discoveries in the field of regional geology.

Temeljna literatura in viri/Readings:

Po potrebi glede na delo, ki ga na praksi opravlja. / As required, depending on the tasks assigned during internship.

Cilji in kompetence:	Objectives and competences:
CILJI: Osnovni cilj prakse je dopolniti teoretično znanje s praktičnim, ki po končanem študiju omogoča uspešno vključitev v delo s področja študijskega programa. Študenti pridobijo praktična strokovna znanja in veščine, potrebna pri reševanju zahtevnih strokovnih in delovnih problemov. Praksa krepi njihovo sposobnost za sporazumevanje v stroki in strokovno kritičnost, odgovornost, iniciativost in samostojnost. Pri seminarju se seznanijo z najnovejšimi trendi in tematikami v stroki,	OBJECTIVES: The basic objective is to supplement theoretical knowledge with practical experience, which will enable students to successfully integrate into work processes after graduation. Students gain practical professional skills needed to solve challenging professional and work-related problems. Internship increases their ability to communicate within their profession and develops critical thinking, responsibility, initiative and autonomy. At the seminar, students get

ki še niso vključene v redni študijski program. KOMPETENCE: • sposobnost fleksibilne uporabe znanja v praksi • sposobnost povezovanja temeljnih znanj, pridobljenih pri obveznih predmetih, ter njihove uporabe v praksi • sposobnost timskega dela, tj. pripravljenost na sodelovanje, kooperativnost, upoštevanje mnenj drugih in izpolnjevanje dogovorjene vloge v okviru tima oz. skupine; • poznavanje in razumevanje procesov v poslovnem okolju organizacije in sposobnost za njihovo analizo, sintezo in predvidevanje rešitev ter njihovih posledic	acquainted with cutting-edge trends and topics in the profession, which are not yet included in the regular study curriculum. COMPETENCES: • the ability of the flexible use of knowledge in professional practice • the ability to connect nad interrelate knowledge attained in mandatory courses, and the ability of its practical application • capability of teamwork, i.e. readiness to colaborate, cooperativity, respect for the opinion of others, and ability to fulfil designated roles in the team or group • knowledge and understanding of the processes in the business environment of the organization, and the capacity for analysis, synthesis, and for anticipating of solutions and their consequences

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent opravi praktično delo in v praksi preveri teoretično znanje. Vodi evidenco delovnih nalog. Pripravi poročilo o praktičnem izobraževanju.	Students perform practical work and verify in practice their theoretical knowledge. They keep record of work assignments. They prepare the report of their internship.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Praktično delo v podjetju ali organizaciji v skladu z razpisanim programom dela. Seminar.	Practical work in a company or organization following the internship program. Seminar.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Praksa se zaključi z oceno zaključnega poročila o praksi in oddajo evidenčnega lista. Oceni se z »opravil«, ali »ni opravil«.	100,00 %	The internship ends with the submission and assessment of the report, and submission of the record sheet. Grading is binary: »passed«, or »not passed«.

Reference nosilca/Lecturer's references:

ŠMUC, Andrej, DOLENEC, Matej, KIKELJ, Martina L., LUX, Judita, PFLAUM, Miran, ŠEME, Blaž, ŽUPANEK, Bernarda, GALE, Luka, KRAMAR, Sabina. Variety of black and white limestone tesserae used in ancient mosaics in Slovenia. Archaeometry, 2017, vol. 59, no. 2, str. 205-221, doi: 10.1111/arcm.12250.
GALE, Luka, KELEMEN, Matej. Early Jurassic foraminiferal assemblages in platform carbonates of Mt. Krim, central Slovenia. Geologija, 2017, vol. 60, no. 1, str. 99-115, doi: 10.5474/geologija.2017.008.
ŽVAB ROŽIČ, Petra, GALE, Luka, ROŽIČ, Boštjan. Analiza kamnin rimskih nagrobnih stel iz Podkraja in z Iga = Rock analysis of Roman tombstones from Podkraj and Ig near Ljubljana. Arheološki vestnik, 2016, vol. 67, str. 359-369.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Preiskave mineralnih materialov 2
Course title:	Instrumental Methods of Analysis 2
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	**Študijska smer**	**Letnik**	**Semestri**
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0597227
Koda učne enote na članici/UL Member course code:	11419

Predavanja	**Seminar**	**Vaje**	**Klinične vaje**	**Druge oblike študija**	**Samostojno delo**	**ECTS**
20	10	15	0	0	45	3

Nosilec predmeta/Lecturer:	Mirijam Vrabec
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**

Vsebina:	**Content (Syllabus outline):**
Napredni instrumenti za zajem mikroposnetkov: računalniška mikrotomografija (CT), optična katodoluminiscenca (op-CL) Napredna rentgenska kristalografija: SC (single-crystal) rentgenska difrakcija (SC XRD) Elektronska mikroskopija: vrstična elektronska mikroskopija (SEM, STEM, HAADF-STEM, kriogeni SEM, eSEM), transmisijska elektronska mikroskopija (TEM, liqiud TEM, CTEM, HRTEM), fokusirani ionski curek (FIB), spektroskopija izgube energije elektronov (EELS), SEM katodoluminescenca, tehnika uklona povratno sipanih elektronov (Electron Back-Scattered Diffraction - EBSD) Napredne elementne analize: instrumentalna nevtronska aktivacijska analiza (INNA) Masni spektrometri: termična ionizacijska masna spektrometrija (TIMS), masna spektrometrija z induktivno sklopljeno plazmo (ICP-MS), masna spektroskopija z vzorčevanjem z lasersko ablacijo (LA-ICP-MS), sekundarna ionska masna spektroskopija (SIMS) Druge spektroskopije: površinska spektroskopija (Time Of Flight-Secondary Ion Mass Spectrometry - ToF-SIMS), Mossbauerjeva spektroskopija (Mossbauer Spectroscopy), Ramanova spektroskopija (Raman	Advanced microimaging instruments: computed microtomography (CT), optical cathodoluminescence (op-CL) Advanced X-ray crystallography: SC (single-crystal) X-ray diffraction (SC XRD) Electron microscopy: scanning electron microscopy (SEM, STEM, HAADF-STEM, cryogenic SEM, eSEM), transmission electron microscopy (TEM, liqiud TEM, CTEM, HRTEM), focused ion beam (FIB), electron energy loss spectroscopy (EBS) SEM cathodoluminescence, Electron Back-Scattered Diffraction (EBSD) Advanced Elemental Analysis: Instrumental Neutron Activation Analysis (INNA) Mass spectrometers: thermal ionization mass spectrometry (TIMS), inductively coupled plasma mass spectrometry (ICP-MS), laser ablation inductive coupled plasma mass spectroscopy (LA-ICP-MS), secondary ion mass spectroscopy (SIMS) Other spectroscopies: surface spectroscopy (Time Of Flight-Secondary Ion Mass Spectrometry - ToF-SIMS), Mossbauer spectroscopy (Mossbauer Spectroscopy), Raman spectroscopy (Raman spectroscopy), infrared spectroscopy (IR spectroscopy) Thermal analyzes: thermogravimetric analysis (TG), derivative thermogravimetric analysis (DTG), differential

spectroscopy), infrardeča spektroskopija (IR spectroscopy) Termične analize: termogravimetrična analiza (TG), derivativna termogravimetrična analiza (DTG), diferenčna termična analiza (DTA), diferenčna dinamična kalorimetrija (DSC), termomehanična analiza (TMA), analiza sproščenih plinov (EGA)	thermal analysis (DTA), differential dynamic calorimetry (DSC), thermomechanical analysis (TMA), emitted gas analysis (EGA)

Temeljna literatura in viri/Readings:

CLARKE, EBERHARDT, 2002: Microscopy techniques for materials sciences. Woodhead Publishing Limited, 459 p.
EGERTON, R.F., 2016: Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM, 2nd ed. Springer, 196 p.
GOLDSTEIN et al., 2003: Scanning Electron Microscopy and X-Ray Microanalysis, 3rd ed. Kluwer Academic/ Plenum Publishers, 689 p.
REED, S.J.B, 2005: Electron Microprobe Analysis and Scanning Electron Microscopy in Geology, 2nd ed. Cambridge, 191p.
SKOOG, D.A. HOLLER, F.J., 2018: Principles of instrumental analysis, 7th ed. Cengage Learning, 959 p.
VRABEC, M.: Gradiva za predmet dostopna preko elektronskega sistema VIS. / Materials for the subject are accessible via the VIS electronic system.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Nadgradnja znanja pridobljenega pri predmetu preiskave mineralnih materialov na 1. stopnji. Poznavanje naprednih instrumentalnih tehnik za preiskavo mineralnih materialov. KOMPETENCE: Sposobnost izbora ustreznih instrumentalnih metod za določanje mineralne in kemične sestave mineralnih snovi. Pravilna priprava vzorca za posamezno analizo. Poznavanje dobrih in slabih strani posamezne metode, sposobnost obdelave in interpretacije dobljenih rezultatov. Sposobnost prepoznavanja neustreznih rezultatov in iskanja primernih rešitev.	OBJECTIVES: Upgrading the knowledge acquired in the BSc subject Instrumental Methods of Analysis. Knowledge of advanced instrumental techniques for the investigation of mineral materials. COMPETENCES: Ability to select appropriate instrumental methods for determining the mineral and chemical composition of mineral substances. Proper sample preparation for each analysis. Knowledge of the pros and cons of each method, the ability to process and interpret the results. Ability to identify inappropriate results and to find suitable solutions.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Poznavanje možnosti kemičnih in mineraloških analiz mineralnega materiala. Prepoznavanje mineralne in kemične sestave mineralnih materialov. Povezava med mineralno in kemično sestavo mineralnega materiala in sposobnost interpretacije rezultatov dobljenih s posamezimi analitskimi tehnikami. Sposobnost izbire in uporabe ustrezne domače in tuje literature iz področja analitskih metod.	Knowledge of the possibilities of chemical and mineral analyzes of mineral material. Recognition of mineral and chemical composition of mineral materials. The relationship between mineral and chemical composition of mineral material and the ability to interpret the results obtained with individual analytical techniques. Ability to select and use relevant domestic and foreign literature in the field of analytical methods.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, on-line predavanja, seminar, laboratorijske vaje.	Lectures, on-line lectures, seminar, lab tutorial.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
pisni ali ustni izpit	80,00 %	written or oral exam
seminar	20,00 %	seminar work
Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Grades: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10), according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

KANDUČ, Tjaša, ŠLEJKOVEC, Zdenka, MORI, Nataša, VRABEC, Mirijam, VERBOVŠEK, Timotej, JAMNIKAR, Sergej, VRABEC, Marko. Multielemental composition and arsenic speciation in low rank coal from the Velenje Basin, Slovenia. Journal of geochemical exploration, 2019, vol. 200, str. 284-300, doi: 10.1016/j.gexplo.2018.08.001.
SKRLJ GOLOB, Barbara, OLIVI, Giovanni, VRABEC, Mirijam, EL FEGHALI, Rita, PARKER, Steven, BENEDICENTI, Stefano. Efficacy of photon-induced photoacoustic streaming in the reduction of Enterococcus faecalis within the root canal : different settings and different sodium hypochlorite concentrations. Journal of endodontics, 2017, vol. 43, iss. 10, str. 1730-1735, doi: 10.1016/j.joen.2017.05.019.
UHER, Pavel, JANÁK, Marian, KONEČNÝ, Patrik, VRABEC, Mirijam. Rare-element granitic pegmatite of Miocene age emplaced in UHP rocks from Visole, Pohorje Mountains (Eastern Alps, Slovenia): accessory minerals, monazite and uraninite chemical dating. Geologica Carpathica, ISSN 1335-0552, 2014, vol. 65, iss. 2, str. 131-146, doi: 10.2478/geoca-2014-0009.;GLAVAŠ, Neli,

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Prosti izbirni predmeti
Course title:	Free elective
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	2. letnik	1. semester
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0111906
Koda učne enote na članici/UL Member course code:	823

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
75	0	75	0	0	150	10

Nosilec predmeta/Lecturer:

Vrsta predmeta/Course type:

Jeziki/Languages:	Predavanja/Lectures:	
	Vaje/Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**

Vsebina:	**Content (Syllabus outline):**

Temeljna literatura in viri/Readings:

Cilji in kompetence:	**Objectives and competences:**

Predvideni študijski rezultati:	**Intended learning outcomes:**

Metode poučevanja in učenja:	**Learning and teaching methods:**

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**

Reference nosilca/Lecturer's references:

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Prosti/Geološki izbirni predmet
Course title:	Free/Geology elective
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	2. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0564731
Koda učne enote na članici/UL Member course code:	11425

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	45	0	0	75	5

Nosilec predmeta/Lecturer:	
Vrsta predmeta/Course type:	

Jeziki/Languages:	Predavanja/Lectures:	
	Vaje/Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):

Temeljna literatura in viri/Readings:

Cilji in kompetence:	Objectives and competences:

Predvideni študijski rezultati:	Intended learning outcomes:

Metode poučevanja in učenja:	Learning and teaching methods:

Načini ocenjevanja:	Delež/Weight	Assessment:

Reference nosilca/Lecturer's references:

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Računalniške metode v geologiji
Course title:	Computer Methods in Geology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0562386
Koda učne enote na članici/UL Member course code:	716

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	45	0	0	75	5

Nosilec predmeta/Lecturer:	Timotej Verbovšek
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
K izpitu lahko pristopi, kdor ima opravljen prvostopenjski študij geologije ali podobne naravoslovne smeri.	Finished first-level (BSc) of geology or similar course.

Vsebina:	**Content (Syllabus outline):**
Predavanja: Metode in namen uporabe numeričnih, računalniških metod in modeliranja. Deterministični in stohastični modeli, konceptualni, matematični in fizikalni modeli. Vhodni in izhodni podatki, spremenljivke, parametri. Numerične aproksimacije (metoda končnih diferenc - FDM, metode končnih elementov - FEM, ostale). Robni pogoji. Stohastične metode, Monte Carlo pristopi. Prostorske analize z GIS orodji (QGIS ali ArcGIS): interpolacija prostorskih podatkov, rastrske analize, analiza naklonov in smeri površja, izohips, analize vidljivosti, izračuni površine in prostornine, izdelava 3-D prikaz površja ter izdelava kart napovedi in tveganja), obdelava lidarskih podatkov. Geostatistične analize (prostorska analiza semivariogramov, krigiranje, analize trendov, prostorske interpolacije podatkov. Uvod v specialne programe za obdelavo prostorskih podatkov (za hidrogeološko modeliranje, za inženirskogeološko modeliranje, za fraktalne analize podatkov in ostali). Vaje: Računalniške vaje z omenjenimi programi.	Lectures: Methods and aim of the usage of numerical, computer methods and modeling. Deterministic and stochastic models, conceptual, mathematical and physical models. Input and output data, variables, parameters. Numerical approximations (Finite Difference Method, Finite Element Method, others). Stochastic methods, Monte Carlo approaches. Spatial analysis with GIS tools (QGIS or ArcGIS): interpolation of spatial data, raster analyses, slope and relief analyses, contours, visibility, area and volume calculations, 3-D analyses, lidar data. Geostatistical methods (variograms, kriging, trend analysis, spatial interpolation). Special software for data management (hydrogeological and engineering geological modeling, fractals…) Exercises: Computer methods with adequate software. Seminar work (individual work on selected topic).

Seminarska naloga (samostojno reševanje prostorskega problema z izbranim računalniškim programom.	

Temeljna literatura in viri/Readings:

Izbrana poglavja iz knjig:
LONGLEY, P., GOODCHILD, M. F., MAGUIRE, D., RHIND, D., 2005: Geographic Information Systems and Science. 2005, Wiley, 536 str.
ANTIA, H. M., 2000: Numerical Methods for Scientists and Engineers. Birkhäuser Verlag, 842 str.
WANG, H.F. & ANDERSON, M.P., 1995: Introduction to Ground Water Modeling: Finite Difference and Finite Element Methods. Academic Press, 237 str.
KENNEDY, M., 2006: Introducing Geographic Information Systems with ArcGIS : featuring GIS software from environmental systems research institute. 2nd ed., Wiley, 588 str.
Interne pomoči računalniških programov in ESRI ArcGIS knjige, QGIS dokumentacija in prosto dostopne knjige na spletu.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Osvojiti konceptualno razumevanje modelov in njihove omejitve. Spoznati teoretične osnove, namen in pomen računalniških metod ter računalniškega modeliranja v geologiji. Poglobljeno uporabljati GIS metode ter programe za analitično in praktično delo na področju geologije. Samostojno reševati probleme, povezane s prostorskimi in časovnimi podatki. KOMPETENCE: Sposobnost analiziranja geoloških prostorskih podatkov in njihove aplikacije. Razumevanje pomena in omejitev uporabe računalniških metod in modelov.	OBJECTIVES: To obtain the knowledge on models and their limitations, theoretical background, aim and use of computer methods in geology. Deeper knowledge of GIS methods and software for analytical and practical work on geological topics. To individually perform and solve problems regarding spatial and temporal data. COMPETENCES: Ability to analyze geological spatial data and their application. Understanding of usage and limitation of computer methods and models.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študentje razumejo koncepte uporabe računalniških metod in modeliranja, njihove predmosti in omejitve. Poglobljeno uporabljajo računalniške in GIS metode in specialne programe za analitično in praktično delo na področju geologije. Samostojno rešujejo probleme, povezane s prostorskimi in časovnimi podatki.	Students know how to analyze geological spatial data and their application and understand the usage and limitation of computer methods and models. Deeper knowledge of computer and GIS methods for analytical and practical work in geology. They individually solve the problems related to spatial and temporal data.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja (prezentacije, 30 ur) kabinetne/računalniške vaje (45 ur).	Lectures (presentations, 30 hours), cabinet/computer exercises (45 hours).

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit: teoretična vprašanja	60,00 %	Written and/or oral exam: theoretical questions
Kolokvij: računske in računalniške vaje	40,00 %	Exercise: computational and computer calculations
Pogoji za pristop k izpitu: pozitivno opravljen kolokvij. Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Prerequisites for written exam: positively graded exercises. Grades: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10), according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

POPIT, Tomislav, SUPEJ, Blaž, KOKALJ, Žiga, VERBOVŠEK, Timotej. Primerjava metod za geomorfometrične analize hrapavosti površja na primeru Vipavske doline = comparison of methods for geomorphometric analysis of surface roughness in the Vipava valley. Geodetski vestnik, 2016, vol. 60, št. 2, str. 227-240, doi: 10.15292/geodetski-vestnik.2016.02.227-240.

VERBOVŠEK, Timotej. BCFD - a Visual Basic program for calculation of the fractal dimension of digitized geological image data using a box-counting technique. Geological Quarterly, ISSN 1641-7291, 2009, vol. 53, no. 2, str. 241-248.
ŽIBRET, Gorazd, VERBOVŠEK, Timotej. Quantitative analysis of randomness exhibited by river channels using chaos game technique: Mississippi, Amazon, Sava and Danube case studies. Nonlinear processes in geophysics, ISSN 1023-5809, 2009, vol. 16, no. 3, str. 419-429.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Rentgenska difrakcija s kristalografijo
Course title:	X-Ray Diffraction Crystallography
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562421
Koda učne enote na članici/UL Member course code:	737

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	30	0	0	0	75	5

Nosilec predmeta/Lecturer:	Matej Dolenec
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Zaključen dodiplomski študij, osnovna računalniška pismenost.	Completed undergraduate study, basic computer literacy.

Vsebina:	Content (Syllabus outline):
Simetrija v kristalih - zunanja simetrija in točkovne grupe - notranja simetrija in prostorske grupe Uporaba rentgenske svetlobe v kristalografiji Izvor rentgenskih žarkov Rentgenske cevi Absorbcija rentgenskih žarkov Osnove rentgenske difrakcije Rentgenski difraktometer - različne geometrije Priprava vzorcev za praškovno difrakcijo Pridobivanje kvalitetnih podatkov praškovne difrakcije Preliminarne obdelave podatkov in fazne analize Principi kvantitativne fazne analize - metode notranjega in zunanjega standarda, metode brez standarda Programska oprema za Ritveldovo metodo Prepoznavanje vrste in količine mineralov v izbranih materialih Določanje in prilagajanje osnovne celice (primeri)	Crystall symmetry - Finite symmetry and point groups - Infinite symmetry and space groups X-ray diffraction in crystallography Production of X-Rays X-Ray tubes X-Ray absorption Fundamentals of X-Ray diffraction X-Ray diffractometers – different geometry Sample preparation techniques Collecting quality powder diffraction data Preliminary data processing and phase analyses Quantitative phase analyses principles – internal/external/without standard methods Software for Rietveld refinement Phase identification and Quantitative Analysis in selected materials Determination and Refinement of the Unit Cell (examples)

Temeljna literatura in viri/Readings:

Izbrana poglavja iz:
GIACOVAZZO, C., 1992, Fundamentals of crystallography, Vol. 7, Oxford University Press, USA, 827 p.p.

BLOSS, F.D., 2000, Crystallography and crystal chemistry, MSA, Washington
PECHARSKY, V.K., & ZAVALIJ, P.Y., 2009, Fundamentals of powder diffraction and structural characterization of materials, vol. 69, Springer, New York, 741 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študenti pridobijo znanje o temeljih kristalografije, simetriji, strukturi kristalov ter z njo v povezavi kemijske in fizikalne lastnosti kristalov. Osvojijo teoretične principe rentgenske difrakcije, poznajo pripravo vzorcev in delovanje difraktometra ter so usposobljeni za kvalitativno in kvantitativno fazno analizo mineralnih materialov. KOMPETENCE: Sposobnost določanja fizikalnih in kemijskih lastnosti kristalov ter povezovanja s strukturo in sestavo, samostojno izvesti kvalitativno in kvantitativno mineraloško analizo poljubnega naravnega materiala z metodo praškovne rentgenske difrakcije.	OBJECTIVES: Students acquires knowledge of fundamentals of crystallography, symmetry, crystal structures with chemical and physical properties. Students gets familiar with teoretical principles of X-Ray diffraction, sample preparation and diffractometer geometry. Students are qualified for qualitative and quantitative phase analyses of mineral materials. COMPETENCES: Students are able to: - Determine physical and chemical properties of the crystals - Determine crystal structure - Perform qualitative and quantitative mineralogical analysis of any natural material with X-Ray powder diffraction method

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent pozna strukturo kristalov, razume njeno povezanost s fizikalnimi in kemijskimi lastnostmi, razume principe praškovne rentgenske difrakcije ter zna primerno izbrati in izvesti analizo ter kompetentno kvalitativno in kvantitativno vrednotiti rezultate analize.	Students get familiar with crystal structure and understands its relationship with physical and chemical properties. They develop knowledge and understanding about powder diffraction principles and are able to appropriate select, carry out and qualitatively and quantitatively evaluate the results of the analyses.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarske vaje (30) v laboratoriju in računalniški učilnici, samostojno reševanje problema v obliki seminarske naloge.	Lectures, laboratory work and work with computers, independent resolving of the problem in the form of the seminar work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
teoretična vprašanja	30,00 %	theory
kvantitativna mineraloška analiza dveh različnih difraktogramov	25,00 %	quantitative mineralogical analysis two diffractograms
določanje in prilagajanje osnovne celice (en primer)	25,00 %	determination and refinement of the unit cell (one example)
seminarska naloga	20,00 %	seminar work
Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Grading scale: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) UL and faculty rules.

Reference nosilca/Lecturer's references:

NAGLIČ, Iztok, ILIĆ, Semjon, MARKOLI, Boštjan, DOLENEC, Matej, LESKOVAR, Blaž, FILIPIČ, Žan, PERHOČ, Matej, KRANER, Jakob, BIZJAK, Matej, SKELA, Božo, KELHAR, Luka, KOZOLE, Špela, GERČAR, David, RAMŠAK, Teja. Modifikacija zlitine AlSi7Mg lite v peščeno formo = Modification of AlSi7Mg alloy cast in to a sand mould. Livarski vestnik, ISSN 0024-5135, 2016, vol. 63, no. 1, str. 37-47.
MILER, Miloš, AMBROŽIČ, Bojan, MIRTIČ, Breda, GOSAR, Mateja, ŠTURM, Sašo, DOLENEC, Matej, JERŠEK, Miha. Mineral and chemical composition of the Jezersko meteorite - a new chondrite from Slovenia. Meteoritics & planetary science, ISSN 1086-9379, 2014, vol. 49, no. 10, str. 1875-1887.
DOLENEC, Tadej, REČNIK, Aleksander, DANEU, Nina, DOBNIKAR, Meta, DOLENEC, Matej. Celestine from the Idrija mercury-ore deposit (Western Slovenia): its occurrence and origin = celestin iz živosrebrovega rudišča Idrija

(zahodna Slovenija): njegove značilnosti in pogoji nastanka. RMZ - Materials and geoenvironment, ISSN 1408-7073, 2005, vol. 52, no. 2, str. 429-436.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Rudna petrologija
Course title:	Ore petrology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0562411
Koda učne enote na članici/UL Member course code:	848

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	30	0	0	75	5

Nosilec predmeta/Lecturer:	Matej Dolenec
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Zaključen prvostopenjski bolonjski študij geologije.	Completed the first-level of Bologna geology study.

Vsebina:	Content (Syllabus outline):
Vsebina predmeta zajema fizikalno kemične pogoje nastanka nahajališč različnih kovinskih mineralnih surovin v času in njihove izotopske značilnosti. Poudarek je na modeliranju procesov, s katerimi je v zvezi nastanek in redistribucija komponent rudnih in jalovinskih mineralov v različnih tipih rudišč. Ugotavljanje pomena mineralne parageneze in kemične sestave mineralne surovine na uporabno vrednost surovine. Pregled nahajališč neklovinskih mineralnih surovin v slovenskem prostoru: kamnine (apnenci, dolomit, kremenove kamnine, tuf, magmatske in metamorfne kamnine, peščenjaki, skrilavci), gline, kremenovi peski, gramoznice. Nahajališča mineralnih surovin za občasno uporabo v restavratorstvu. Pri vajah se študentje seznanijo tudi z računalniškim programom WORKBENCH in njegovo uporabo pri modeliranju pogojev izločanja rudnih in jalovinskih mineralov v hidrotermalnih rudiščih ter redistribuciji njihovih komponent pri procesih preperevanja.	The content of the subject covers the physico-chemical conditions of the formation of deposits of various metal mineral resources in time and their isotopic characteristics. The emphasis is on modeling the processes of formation and redistribution components of ore and gangue minerals in various types of mineral deposits. Determination of the importance of mineral paragenesis and chemical composition of the mineral resource on the usable value of the raw material. Overview of non-metal deposits in Slovenia: rocks (limestone, dolomite, quartz rocks, tuff, igneous and metamorphic rocks, sandstones, slates), clays, quartz sands, gravel pits. Mineral resources deposits for occasional use in restoration. During the exercises, students are also acquainted with the WORKBENCH computer program and its use in modeling the conditions for the precipitation of ore and gangue minerals minerals in hydrothermal mineral deposits, and redistribution of their components in the weathering process.

Temeljna literatura in viri/Readings:

Drovenik, M., 1982, Nahajališča mineralnih surovin 1. del, NTF, Oddelek za geologijo, 370 pp.
Evans, A. M., 1993, Ore Geology and Industrial Minerals - An Introduction, Blackwell Science, 390 pp.
Pankhurst, R. J., 2005, Mineral Deposits and Earth Evolution, Geological Society of London, 265 pp.
Dimkovski, T., Rokavec, D., 2001, Nahajališča nekovinskih mineralnih surovin v Sloveniji, Geološki zavod Slovenije, 123 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študent pridobi znanje o značilnostih in pogojih nastanka različnih tipov rudnih in nekovinskih nahajališč. Zna določiti in predpostaviti mineralno paragenezo nahajališča. KOMPETENCE: Študent je sposoben prepoznavati značilnosti in pogoje nastanka nahajališč različnih rudnih in nekovinskih mineralov in kamnin. Sposoben je makroskopsko in mikroskopsko določiti strukturne in teksturne značilnosti rude iz različnih tipov rudišč, njeno mineralno sestavo in zaporedje kristalizacije rudnih ter jalovinskih mineralov. S pomočjo računalniških programov (Geochemist's Workbench) je sposoben modelirati značilnosti in pogoje izločanja rudnih in jalovinskih mineralov iz hidrotermalnih raztopin.	OBJECTIVES: The student acquires knowledge about the characteristics and conditions of the formation of different types of ore and non-metallic deposits. He is possible to determine and presume the mineral paragenesis of the deposits. COMPETENCES: The student is able to recognize the characteristics and conditions of the formation of deposits of various ore and non-metallic minerals and rocks. He is able to macroscopically and microscopically determine the structural and textural characteristics of ores from various types of mineral deposits, their mineral composition and the sequence of crystallization of ore and gangue minerals. With the help of computer programs (Geochemist's Workbench), he is able to model the characteristics and conditions of precipitation of ore and gangue minerals from hydrothermal solutions.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent spozna optične značilnosti različnih rudnih mineralov v odsevni svetlobi. Sposoben je prepoznati in določiti zaporedje kristalizacije rudnih in jalovinskih mineralov v različnih tipih rudišč in hidrotermalne spremembe prikamnine. Sprejema in razume odločitve o uporabni vrednosti nahajališča mineralnih surovin.	Student learns about the optical characteristics of different ore minerals in reflected light. He is capable to recognize and determine the sequence of crystallization of ore and gangue minerals in various types of mineral deposits and hydrothermal changes of the adjacent.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, prikaz slikovnega gradiva (LCD projektor), mikroskopiranje rudnih preparatov iz različnih tipov rudišč in njihovo makroskopsko prepoznavanje. Mikroskopiranje svežih in hidrotermalno spremenjenih magmatskih in drugih kamnin iz rudišč različnega nastanka. Praktično delo z računalniškim programom Workbench.	Lectures, presentation of image material (LCD projector), microscopy of ore preparats from different types of mineral deposits and their macroscopic recognition. Microscopy of fresh and hydrothermaly changed igneous and other rocks from the mineral deposits of different origin. He accepts and understands the decisions about the useful value of the mineral resource deposits. Practical work with the Workbench computer program.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	50,00 %	Written and/or oral exam
Praktični del	50,00 %	Practical exam
Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Evaluation scale: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) having regard to the Statute of UL and faculty rules.

Reference nosilca/Lecturer's references:

GLAVAŠ, Neli, MOURELLE, Lourdes Maria, GÓMEZ, Carmen P., LEGIDO, José Luis, ROGAN ŠMUC, Nastja, DOLENEC, Matej, KOVAČ, Nives. The mineralogical, geochemical, and thermophysical characterization of healing saline mud for use in pelotherapy. *Applied clay science*, ISSN 0169-1317. [Print ed.], 2017, vol. 135, str. 119-128, ilustr., doi: 10.1016/j.clay.2016.09.013.

BERDEN, Tina, DOLENEC, Matej. Identifikacija izvora surovin za izdelavo kamenih orodij z rentgensko fluorescenčno spektroskopijo (XRF) = Identtifyinig the origin of the raw materials in lithic productions using X-ray fluorescence spectroscopy (XRF). *Arheo : arheološka obvestila*, ISSN 0351-5958, 2016, št. 33, str. 25-38, ilustr.

KOMAR, Darja, DOLENEC, Tadej, DOLENEC, Matej, VRHOVNIK, Petra, LOJEN, Sonja, LAMBAŠA, Živana, KNIEWALD, Goran, ROGAN ŠMUC, Nastja. Physico-chemical and geochemical characterization of Makirina Bay peloid mud and its evaluation for potential use in balneotherapy (N Dalmatia, Republic of Croatia). *Indian journal of traditional knowledge*, ISSN 0972-5938, 2015, vol. 14, no. 1, str. 5-12.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Samostojni terenski projekt
Course title:	Individual Field Work Project
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0596366
Koda učne enote na članici/UL Member course code:	724

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
0	15	0	0	75	90	6

Nosilec predmeta/Lecturer:	Marko Vrabec
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent mora imeti izbranega mentorja in tematiko za svoj terenski projekt. Mentorja in projekt mora potrditi študijska komisija oddelka.	Student must select the supervisor and the topic of the field project in advance. Requires approval of the departmental Study Board.

Vsebina:	Content (Syllabus outline):
V okviru predmeta bo študent samostojno geološko kartiral izbrano ozemlje primerno velikega obsega. Delo pri predmetu obsega naslednje aktivnosti: - študent samostojno zbere literaturne podatke o geologiji izbranega terena - trije terenski dnevi na izbranem terenu skupaj z inštruktorjem, ki so namenjeni učenju tehnik kartiranja - najmanj 14 terenskih dni samostojnega dela študenta - izdelava in javni zagovor zaključnega poročila - en terenski dan za terenski zagovor skupaj z inštruktorjem.	In this course the student will independently map a selected terrain of appropriate extent. Coursework includes: - independent literature search about the selected terrain - three introductory field days in the selected terrain with the supervisor - at least 14 days of individual field work - preparing and presenting the final report - one field day for a field review with the supervisor.

Temeljna literatura in viri/Readings:

BARNES, J., 1995, Basic Geological Mapping, Geological Society of London Handbook Series, John Wiley and Sons Ltd., 132pp.

FRY, N., 1991, The Field Description of Metamorphic Rocks, Geological Society of London Handbook Series, John Wiley and Sons Ltd., 110 pp.

McCLAY, K., 1995, The Mapping of Geological Structures, Geological Society of London Handbook

THORPE, R. & BROWN, G., 1991, The Field Description of Igneous Rocks, Geological Society of London Handbook Series. John Wiley & Sons Ltd., 154 pp.

TUCKER, M.E., 1996, Sedimentary rocks in the field, John Wiley & Sons, 153 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študent bo razvil veščine terenskega kartiranja, upravljanja projektov in pisanja poročil. KOMPETENCE: Po opravljenem tečaju bo študent zmožen: - pridobiti primerne podatke za izdelavo tematske geološke karte izbranega območja - izdelati tematsko geološko karto in profile izbranega območja - učinkovito kartirati na geološko kompleksnem terenu - pregledno in konsistentno beležiti različne terenske geološke podatke na terenski karti in v terenskem dnevniku - načrtovati izrabo časa v manjšem projektu - napisati terensko poročilo.	OBJECTIVES: Student will develop skills and competences in geological mapping, project managment and report writing. COMPETENCES: After the completed course, the student will be able to: - acquire appropriate data for constructing a thematical geological map of a selected area - construct a geological map and representative cross-sections of the mapped area - efficiently map geologically complex terrains - neatly and consistently record various data and observations on field slips and in the field notebook - plan time management in a small-scale project - write a field report.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: - sposobnost geološkega kartiranja na kompleksnih terenih - izdelava tematske geološke karte - izdelava terenskega poročila	Knowledge and understanding: - ability to map complex terrains - ability to create thematical geological maps - ability to produce a mapping report

Metode poučevanja in učenja:	**Learning and teaching methods:**
Projektno delo. Mentor študenta na terenu spremlja 3 terenske dneve.	Project work. Supervisor will accompany the student in the field for 3 field days.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
terenska (manuskriptna) karta	25,00 %	field slips
terenski dnevnik	25,00 %	field notebook
interpretativna karta	25,00 %	fair copy map
izdelava in predstavitev zaključnega poročila	25,00 %	final report and presentation

Reference nosilca/Lecturer's references:

VRABEC, Marko. Style of postsedimentary deformation in the Plio-Quaternary Velenje basin, Slovenia. Neues Jahrb. Geol. Paläontol., Monatsh., 1999, 8, str. 449-463.
JAMŠEK RUPNIK, Petra, BENEDETTI, Lucilla, PREUSSER, Frank, BAVEC, Miloš, VRABEC, Marko. Geomorphic evidence of recent activity along the Vodice thrust fault in the Ljubljana Basin (Slovenia): A preliminary study. Annals of geophysics, 2013, vol. 56, 8 str., doi: 10.4401/ag-6252.
VRABEC, Marko. Evidence of Quaternary faulting in the Idrija fault zone, Učja canyon, NW Slovenia. RMZ - Materials and geoenvironment, 2012, 59, str. 285-298.;;;

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Samostojni terenski projekt
Course title:	Individual Field Work Project
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0596407
Koda učne enote na članici/UL Member course code:	724

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
0	15	0	0	75	90	6

Nosilec predmeta/Lecturer:	Marko Vrabec
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Študent mora imeti izbranega mentorja in tematiko za svoj terenski projekt. Mentorja in projekt mora potrditi študijska komisija oddelka.	Student must select the supervisor and the topic of the field project in advance. Requires approval of the departmental Study Board.

Vsebina:	**Content (Syllabus outline):**
V okviru predmeta bo študent samostojno geološko kartiral izbrano ozemlje primerno velikega obsega. Delo bo potekalo usklajeno s potencialnim zaposlovalcem pod mentorstvom izkušenih terenskih geologov (predviden inštitucije in firme so GeoZS, IRGO, ZAG, Geohidro, itd.). Pri predmetu bo delo obsegalo naslednje aktivnosti: - študent samostojno zbere literaturne podatke o geologiji izbranega terena - trije terenski dnevi na izbranem terenu skupaj z inštruktorjem, ki ga priskrbi izbrana sodelujoča inštitucija/firma in/ali mentorjem iz oddelka. Terenski dnevi so namenjeni spoznavanju dela z naročnikom in hkrati učenju morebitnih specifičnih tehnik geološkega kartiranja -en terenski dan z instruktorjem in/ali mentorjem je namenjen vmesnemu preverjanju in zagovoru opravljenega dela in izdelavi usmeritev za nadaljne delo - najmanj 14 terenskih dni samostojnega dela študenta - en terenski dan za zaključni terenski zagovor skupaj z inštruktorjem in mentorjem	In this course the student will independently map a selected terrain of appropriate extent. Work will be coordinated with potential employers and under the supervision of their experienced staff. Coursework includes: - independent literature search about the selected terrain - three introductory field days in the selected terrain with the supervisor assigned by the sponsoring company/institution and/or the faculty supervisor - 1 field day with instructor and/or supervisor for reviewing work in progress and receiving feedback and directions for subsequent fieldwork - at least 14 days of individual field work - preparing and presenting the final report - one field day for a field review with the instructur and supervisor - public presentation of the final report.

- izdelava in javni zagovor zaključnega poročila pred širšo skupino strokovnjakov ali raziskovalcev iz izbrane inštitucije/firme	

Temeljna literatura in viri/Readings:

BARNES, J., 1995, Basic Geological Mapping, Geological Society of London Handbook Series, John Wiley and Sons Ltd., 132pp.
FRY, N., 1991, The Field Description of Metamorphic Rocks, Geological Society of London Handbook Series, John Wiley and Sons Ltd., 110 pp.
McCLAY, K., 1995, The Mapping of Geological Structures, Geological Society of London Handbook
THORPE, R. & BROWN, G., 1991, The Field Description of Igneous Rocks, Geological Society of London Handbook Series. John Wiley & Sons Ltd., 154 pp.
TUCKER, M.E., 1996, Sedimentary rocks in the field, John Wiley & Sons, 153 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študent bo razvil veščine terenskega kartiranja, upravljanja projektov in pisanja poročil. KOMPETENCE: Po opravljenem tečaju bo študent zmožen: - pridobiti primerne podatke za izdelavo tematske geološke karte izbranega območja - izdelati tematsko geološko karto in profile izbranega območja - učinkovito kartirati na geološko kompleksnem terenu - pregledno in konsistentno beležiti različne terenske geološke podatke na terenski karti in v terenskem dnevniku - načrtovati izrabo časa v manjšem projektu - napisati terensko poročilo - komunikacija s potencialnim delodajalcem ali naročnikom terenskih geoloških raziskav.	OBJECTIVES: Student will develop skills and competences in geological mapping, project managment and report writing. COMPETENCES: After the completed course, the student will be able to: - acquire appropriate data for constructing a thematical geological map of a selected area - construct a geological map and representative cross-sections of the mapped area - efficiently map geologically complex terrains - neatly and consistently record various data and observations on field slips and in the field notebook - plan time management in a small-scale project - write a field report - communication with employers and clients .

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: - sposobnost geološkega kartiranja na kompleksnih terenih - izdelava tematske geološke karte - izdelava terenskega poročila	Knowledge and understanding: - ability to map complex terrains - ability to create thematical geological maps - ability to produce a mapping report

Metode poučevanja in učenja:	**Learning and teaching methods:**
Projektno delo. Mentor študenta na terenu spremlja 3 terenske dneve.	Project work. Supervisor will accompany the student in the field for 3 field days.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
terenska (manuskriptna) karta	25,00 %	field slips
terenski dnevnik	25,00 %	field notebook
interpretativna karta	25,00 %	fair copy map
izdelava in predstavitev zaključnega poročila	25,00 %	final report and presentation

Reference nosilca/Lecturer's references:

VRABEC, Marko. Style of postsedimentary deformation in the Plio-Quaternary Velenje basin, Slovenia. Neues Jahrb. Geol. Paläontol., Monatsh., 1999, 8, str. 449-463.

JAMŠEK RUPNIK, Petra, BENEDETTI, Lucilla, PREUSSER, Frank, BAVEC, Miloš, VRABEC, Marko. Geomorphic evidence of recent activity along the Vodice thrust fault in the Ljubljana Basin (Slovenia): A preliminary study. Annals of geophysics, 2013, vol. 56, 8 str., doi: 10.4401/ag-6252.
VRABEC, Marko. Evidence of Quaternary faulting in the Idrija fault zone, Učja canyon, NW Slovenia. RMZ - Materials and geoenvironment, 2012, 59, str. 285-298.;;;

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Sedimentologija in struktura krasa
Course title:	Karst Sedimentology and Structure
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0596375
Koda učne enote na članici/UL Member course code:	11417

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
10	10	0	0	25	45	3

Nosilec predmeta/Lecturer:	Andrej Šmuc, Petra Žvab Rožič
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Vpis v 2. letnik študija 2. stopnje.	Entering the 1st year of 2nd grade program.

Vsebina:	Content (Syllabus outline):

• Sedimentologija krasa - posebnosti kraških sedimentacijskih okolij:
  • raziskovalne metode kraških sedimentov
  • avtohtoni sedimenti in percipitati
  • alohtoni sedimenti
  • datacije
• Struktura krasa - strukturno-geološke posebnosti kraških terenov:
  • strukturni elementi v karbonatnih kamninah
  • vpliv strukturno geološke zgradbe na površinske in podpovršinske kraške oblike
  • metoda strukturno-geološkega kartiranja kraških terenov
	• Karst sedimentology: specification of karst sedimentary environments:
	  • research methods of karst sediments
	  • avtochtonous sediments and percipitates
	  • allochtonous sediments
	  • datations
	• Karst structure: structural – geological specification of karst terrains:
	  • structural elements in carbonate rocks
	  • influence of geological structure on surface and subsurface karst features
	  • method of structural-geological mapping of karst areas

Temeljna literatura in viri/Readings:

Čar, J., 2018: Geostructural mapping of karstified li-mestones.- Geologija, 61/2, 133–162. DOI: 10.5474/geologija.2018.010

Čar J. & Šebela S., 1997: Structural position of vertical karst objects on Postojnska Gmajna = Strukturna lega vertikalnih kraških objektov na Postojnski gm-ajni.- Acta Carsologica, 26, 2, 295−314.

Čar, J. & S. Šebela, 1998: Bedding planes, moved bedding planes, connective fissures and horizontal cave pas-sages (Examples from Postojnska Jama cave).- Acta Carsologica, 27, 2, 75−95.

Čar, J., 2001: Structural bases for shaping of dolines = Strukturne osnove oblikovanja vrtač (In Slovene, English Summary).- Acta Carsologica, 30 (2) 239−256.

Fairchild I.J., Baker A. 2012. Speleothem science, From process to Past Environments.- Wiley Blackwell, 432 str.
Ferk M., Lipar M., Šmuc A., Drysdale R.N., Zhao J. 2019. Chronology of heterogeneous deposits in the side entrance of Postojna Cave, Slovenia.- *Acta geographica Slovenica*, 2019, 59/1, 103-116.
Filipponi, M., 2009: Spatial Analysis of Karst Conduit Networks and Determination of Parameters Con-trolling the Speleogenesis along Preferential Litho-stratigraphic Horizons.- PhD thesis, École Polyte-chnique Fédérale de Lausanne, pp. 130.
Ford, D.C. & Williams, P.W., 2007. Karst geomorphology and hydrology. 2nd ed. John Wiley & Sons, Chiche-ster, U.K.
Herman, E.K., Toran, L., ite W.B.2012, Clastic sediment transport and storage in fluviokarst aquifers: an essential component of karst hydrogeology.- Carbonates Evaporites, 27, 211-241.
Pruner P., Bosák, P., Zupan Hajna N., Mihevc A. 2009. Cave sediments in Slovenia: results of 10 years of palaeomagnetic research. *Slovenský kras : sbornik slovenske muzeum*, 47/2, 173-186
Šebela S., 1998: Tectonic structure of Postojnska jama cave system. Založba ZRC, 18, pp. 112, Ljubljana.
Šebela S., 2009: Structural geology of the Škocjan Caves (Slovenija) = Strukturna geologija Škocjanskih jam (Slovenija).- Acta Carsologica, 38, 165−177.
Šušteršič, F., 2006: Relationships between deflector faults, collapse dolines and collector channel formation: some examples from Slovenia.- International Jour-nal of Speleology, 35, 1−12.
Šušteršič F., Čar J. & S. Šebela, 2001: Zbirni kanali in zaporni prelomi − Collector channels and deflector faults (In Slovene, English Summary).- Naše jame, 43, 8−22.
Sasowsky I.D., Mylroie J. 2004. Studies of cave sediments, Physical and Chemical records of Paleoclimate.- Kluwer Academic, New York, 392 str.
Zupan Hajna N., Pruner P., Mihevc A., Schnabl P., Bosák P. 2008. Cave sediments from the Postojnska-Planinska cave system (Slovenia) : evidence of multi-phase evolution in epiphreatic zone = Jamski sedimenti iz postojnsko-planinskega jamskega sistema (Slovenija) : priča večfaznega razvoja v epifreatični coni. *Acta carsologica*, 37/1, 63-86.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Predmet predstavlja vsebinsko dopolnjevanje in nadgradnjo osnovnih vsebin predmeta Geologija krasa. Poudarek je na specifičnih bazičnih geoloških raziskovalnih tehnikah. Prvi del poda značilnosti kraških sedimentov in raziskovalne pristope in metode, ki jih le ti zahtevajo. Drugi sklop temelji na spoznavanju metode kartiranja kraških terenov, ki je bila razvita pri nas in predstavlja logično kontinuiteto in razvoj tega raziskovalnega dela. KOMPETENCE: Slušatelji se dodatno usposobijo za delo v kraških terenih in sicer predvsem s stališča bazičnih geoloških ved (sedimentologije in strukturne geologije), katerih prirejeno in specifično znanje je nujno za razumevanje celotnega kraškega sistema.	OBJECTIVES: Subject is an addition and upgrade of the contents of the subject Geology of Karst with great emphasis on specific basic geological research techniques. First part deals with characteristics of karst sediments and consequential research approaches and methods that are related to them. Second part is based on gaining knowledge and experience on method of mapping of karst terrains, which was developed in our department and represents direct continuation and evolution of this research work. COMPETENCES: Student is raises capability of work in karst terrains, mostly from the standing point of basic geological sciences (sedimentology and structural geology), which asks for adopted and specific knowledge is essential for the understanding of the entire karst system.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Slušatelj pridobi poglobljeno znanje o sedimentologiji in strukturni zgradbi kraških terenov in vplivu le te na razvoj celotnega kraškega sistema. Znanje je pomebno za delo v kraških območjih, kot je, recimo, polovica ozemlja današnje Slovenije.	Student gains comprehensive knowledge about sedimentology and geological structure of karstic terrains and their influence on evolution of entire karst system. Knowledge is important for work on karst areas, such as half of present-day Slovenian territory.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminar, terensko delo.	Lectures, seminar, field work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	50,00 %	Written and/or oral exam

Seminar	50,00 %	Seminar work

Reference nosilca/Lecturer's references:

ROŽIČ, Boštjan, POPIT, Tomislav, GALE, Luka, VERBOVŠEK, Timotej, VIDMAR, Ines, DOLENEC, Matej, ŽVAB ROŽIČ, Petra. Origin of the Jezero v Ledvicah lake : a depression in a gutter-shaped karstic aquifer (Julian Alps, NW Slovenia) = Nastanek Jezera v Ledvicah - globel v žlebu podobnem kraškem vodonosniku (Julijske Alpe, SZ Slovenija). *Acta carsologica*. [Tiskana izd.]. 2019, letn. 48, št. 3, str. 265-282.

ŽVAB ROŽIČ, Petra, ČAR, Jože, ROŽIČ, Boštjan. Geological structure of the Divača area and its influence on the speleogenesis and hydrogeology of Kačna jama = Geološka struktura na območju Divače in njen vpliv na speleogenezo ter hidrogeologijo Kačne jame. *Acta carsologica*. [Tiskana izd.]. 2015, letn. 44, št. 2, str. 153-168,

VAUPOTIČ, Janja, ŽVAB ROŽIČ, Petra, BARIŠIĆ, Delko. Environmental aspect of radon potential in terra rossa and eutric cambisol in Slovenia. *Environmental earth sciences*. 2012, vol. 66, no. 1, str. 223-229. ISSN 1866-6280. DOI: 10.1007/s12665-011-1228-0.

ŽVAB ROŽIČ, Petra, VAUPOTIČ, Janja, DOLENEC, Tadej. Reasons for elevated radon levels inside the building in Divača = Vzroki za povišane koncetracije radona v izbranem objektu v Divači. *Geologija*. [Tiskana izd.]. 2006, vol. 49, no. 2, str. 409-415. ISSN 0016-7789.

ŽVAB ROŽIČ, Petra. *Geostructural mapping of karst : approaches and relations with karst features : [predavanje] na Earth and Environmental Sciences Department of the University Aldo Moro in Bari, 16th January 2020*. Bari: University Aldo Moro, 2020.

FERK, Mateja, LIPAR, Matej, ŠMUC, Andrej, DRYSDALE, Russell N., ZHAO, Jian. Chronology of heterogeneous deposits in the side entrance of Postojna Cave, Slovenia. *Acta geographica Slovenica*, ISSN 1581-6613. [Tiskana izd.], 2019, 59, št. 1, str. 103-116.

MENCIN GALE, Eva, JAMŠEK RUPNIK, Petra, TRAJANOVA, Mirka, BAVEC, Miloš, ANSELMETTI, Flavio S., ŠMUC, Andrej. Morphostratigraphy and provenance of Plio-Pleistocene terraces in the south-eastern Alpine foreland : the Mislinja and Upper Savinja valleys, northern Slovenia. *Journal of quaternary science*, ISSN 0267-8179, 2019, str. 1-7.

OZIS, Leni (avtor, prevajalec), ŠMUC, Andrej. Lehnjakasti kapniki v spodmolih v slovenski Istri. *Geografski vestnik : časopis za geografijo in sorodne vede*, ISSN 0350-3895. [Tiskana izd.], 2015, 87, [št.] 2, str. 9-22.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Sedimentologija karbonatov in klastitov
Course title:	Sedimentology of Carbonates and Clastic Sedimentary Rocks
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562380
Koda učne enote na članici/UL Member course code:	752

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	30	0	0	75	5

Nosilec predmeta/Lecturer:	Andrej Šmuc
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Osnovno znanje geologije, sedimentologije, geokemije, geomorfologije strukturne geologije in tektonike pridobljeno na dodiplomskem študiju. Obveznosti študenta: Študent mora redno obiskovati vaje, oddati vse zahtevane samostojne naloge ter opraviti preizkus teoretičnega in praktičnega znanja.	Basic knowledge of geology, sedimentology, geochemistry, geomorphology, structural geology and tectonics acquired at the undergraduate level Methods: The student must regularly attend work, submit all required separate tasks and pass the test of theoretical and practical knowledge.

Vsebina:	**Content (Syllabus outline):**
Karbonatni sedimenti in kamnine: osnove	Carbonates: the basics
Geološko ozadje sedimentacije karbonatov	Geological background sedimentation of carbonates
Moderna karbonatna okolja	Modern carbonate environment
Nekdanja karbonatna okolja	Former carbonate environment
Mineralogija in kemija karbonatov	Mineralogy and chemistry of carbonates
Diageneza karbonatov	Diagenesis of carbonates
Dolomitizacija in dolomitizacijski modeli	Dolomitization
Karbonati v sedimetnih zapisih	Carbonate sedimentary records
Klastični sedimenti in kamnine: osnove	Clastic sediments and rocks: the basics
Geološko ozadje sedimentacije klastitov	Geological background of clastics sedimentation
Moderna klastična okolja	Modern clastic environment
Nekdanja klastična okolja	Former clastic environment
Mineralogija in kemija klastitov	Mineralogy and chemistry of clastics
Diageneza klastitov	Diagenesis
Klastiti v sedimentnih zapisih	Clastic rocks in clastic sedimentary records

Temeljna literatura in viri/Readings:

FLÜGEL E.,2004, Microfaceis of carbonate rocks, Analysis, Interpretation and Aplication, Springer, 976pp.
LEGGER, J.K. 2005, Marine Clastic Sedimentology, Concepts and Case Studies,Springer, 304pp.

McLAINE, M., 1995, Sedimentology, Oxford University Press, 448 pp. TUCKER, M.E. & WRIGHT, P., 1991, Carbonate sedimentology, Blackwell Science, 496 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Cilj predmeta je študente poglobljeno seznaniti z različnimi karbonatnimi in klastičnimi sedimenti. Predmet pa je predvsem usmerjen v spoznavanje in razumevanje procesov, ki delujejo pred, med in po sedimentaciji in povzročijo nastanek karbonatnih in klastičnih kamnin. Procesi so odvisni od množine vplivnih faktorjev, ki jih bodo slušatelji spoznali. KOMPETENCE: Sedimentne kamnine predstavljajo najpogostejše kamnine, ki jih najdemo na zemljinem površju, med njimi pa so daleč najpogostejši prav karbonati in klastiti. Predmet se ukvarja z poznavanjem sestave in geneze karbonatnih in klastičnih sedimentov in sedimentnih kamnin in izdelavo modelov sedimentacije. Omenjene kamine so izredno pestre in so nastajale v najrazličnejših okoljih prav tako pa na njihov nastanek vpliva tako tektonika, fizikalno-kemični pogoji, ekološki pogoji, astronomski faktorji, klima in drugi. Sedimentacija v določenem okolju se namreč pojavi kot posledica interakcije med dotokom sedimenta, njegove predelave in modificiranje preko fizikalnih, kemičnih in bioloških procesov ter akomodacijskega prostora.	OBJECTIVES: The aim of the course is an in-depth aquintance with different carbonate and clastic sediments. Object is primarily focused on learning about and understanding of the processes that run before, during and after the sedimentation and lead to the formation of carbonate and clastic rocks. The processes are dependent on the amount of influence factors which students will learn. COMPETENCES: Sedimentary rocks represent the most common rocks, which can be found on the Earth's surface. The course deals with the knowledge of the structure and genesis of carbonate and clastic sediments and sedimentary rocks and making models of sedimentation. These rocks are extremely diverse and are made in a variety of settings as well as their sedimentation is affected by tectonic, physico-chemical conditions, ecological conditions, astronomical factors, and others. Sedimentation in a particular environment does occur as a result of interaction between the sediment, its reworking through physical, chemical and biological processes and accommodation space.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent spozna različna karbonatne in klastične sedimente ter sedimentne kamnine in razume procese, ki so botrovali njihovemu nastanku. Na podlagi pridobljenega znanja zna interpretirati okolje nastanka, dinamiko sedimentacije. Spremembe v sedimentaciji zna povezati z regionalnimi in lokalnimi geološkimi procesi in stanji.	Student learns different carbonate and clastic sediments and sedimentary rocks and understand processes that leads to their deposition. Based on the acquired knowledge she-he can interpret environmental occurrence, the dynamics of sedimentation. It is able to link changes in sedimentation with regional and local geological processes and conditions.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z uporabo prezentacij. Vaje potekajo kot vodene seminarske laboratorijske vaje.	Lectures using presentations. Tutorials take place as guided seminar lab work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	100,00 %	Written and/or oral exam
Pisni izpit: Za pozitivno oceno mora biti pravilno rešenih najmanj 50% teoretičnih vprašanj.		Written exam: The positive assessment must be properly resolved, at least 50% of the theoretical issues.

Reference nosilca/Lecturer's references:

ŠMUC, Andrej, ROŽIČ, Boštjan. The Jurassic Prehodavci Formation of the Julian Alps: easternmost outcrops of Rosso Ammonitico in the Southern Alps (NW Slovenia). Swiss journal of geosciences, ISSN 1661-8726, 2010, vol.103, issue 2, str. 241-255, doi:10.1007/s00015-010-0015-3.
ŠMUC, Andrej, DOLENEC, Matej, KIKELJ, Martina L., LUX, Judita, PFLAUM, Miran, ŠEME, Blaž, ŽUPANEK, Bernarda, GALE, Luka, KRAMAR, Sabina. Variety of black and white limestone tesserae used in ancient mosaics in Slovenia.Archaeometry, ISSN 0003-813X. [Tiskana izd.], 2016, 17 str., doi: 10.1111/arcm.12250.
ŠMUC, Andrej. Jurassic and cretaceous stratigraphy and sedimentary evolution of the Julian Alps, NW Slovenia. Ljubljana: Založba ZRC, ZRC SAZU, 2005. 98 str.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Specialna mineralogija
Course title:	Advanced Mineralogy
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562422
Koda učne enote na članici/UL Member course code:	738

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	30	0	0	0	75	5

Nosilec predmeta/Lecturer:	Mirijam Vrabec, Sašo Šturm
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Ni pogojev.	No prerequisites.

Vsebina:	Content (Syllabus outline):
• Strukturna kristalografija – periodičnost zgradbe, simetrijske operacije (notranje in zunanje), polimorfizem, politipija, klasifikacija struktur • Morfologija kristala – morfogeneza glavnih kamninotvornih mineralov • Kristalna kemija – osnove zgradbe mineralov: sistematika od mineralov prvin do silikatov • Lastnosti mineralov kot posledica strukturnih značilnosti • Dvojčenje, politipi, omejena topnost, trdna raztopina, rekristalizacija, korozija, delno taljenje • Vključki: trdni, tekoči, plinasti. Geneza vključkov. • Določanje pogojev kristalizacije in kemične sestave izvorne raztopine	• Structural crystallography – periodicity of the structure, symmetry operations (internal and external), polymorphism, polytypism, classification of structures • Morphology of crystals – morphogenesis of major rocky minerals • Crystal chemistry – the basis of the mineral structure: systematics from mineral elements to silicates • Characteristics of minerals as a result of a structure • Twinning, polytypes, limited solubility, solid solution, recrystallization, corrosion, partial melting • Inclusions: solid, liquid, gaseous. Genesis inclusions. • Determination of the conditions of crystallization and chemical composition of the source solution

Temeljna literatura in viri/Readings:

NESSE 2004: Introduction to mineralogy, 348pp.
KLEIN, HURLBUT 1999: Manual of mineralogy, 681 pp.
DEER, HOWIE, ZUSSMAN: Rock-Forming Minerals. Book Series. The Geological Society.

Cilji in kompetence: **Objectives and competences:**

CILJI: Prepoznavanje kristalov glede na njihove morfološke in strukturne lastnosti, ki se jih bo študent naučil prepoznati z aktualnimi preiskovalnimi tehnikami. KOMPETENCE: Sposobnost risanja kristalov v projekciji, makroskopsko in mikroskopsko prepoznavanje mineralov, karakterizacija morfogeneze, strukturnih značilnosti mineralov in korelacija s fizikalnimi ter kemičnimi lastnostmi.	OBJECTIVES: Recognizing the crystals according to their morphological and structural properties, which the student will learn to identify with modern investigative techniques. COMPETENCES: Capability of drawing crystals in projection, macroscopic and microscopic recognition of minerals, characterization of morphogenesis, structural characteristics of minerals and correlation with physical and chemical properties.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Razumevanje korelacije med morfologijo in genezo nastanka minerala. Razumevanje koralcije med strukturo in fizikalnimi lastnostmi minerala. Poznavanje temeljnih zakonitosti kristalizacije in rasti kristala. Študent mora biti sposoben iz morfoloških in strurkturnih karakteristik minerala prepoznati razmere ob njegovem nastanku, prepoznati vzroke za njegovo kristalizacijo in rast. Povezava med struturnimi in fizikalnimi lastnostmi minerala ter petrologijo in sedimentologijo kamnin. Sposobnost izbire in uporabe ustrezne tuje in domače literature. Sposobnost komunikacije z drugimi strokami, sposobnost analize podatkov in sinteze.	Understanding the correlation between morphology and the origin of the mineral. Understanding the correlation between the structure and the physical properties of the minerals. Knowledge of the basic laws of crystallization and crystal growth. The student must be able to recognize the conditions at the time of the formation of the mineral based on its morphological and structural characteristics and to identify the causes of its crystallization and growth. Connection between strutural and physical properties of minerals and petrology and sedimentology of rocks. Ability to choose and use appropriate foreign and domestic literature. Ability to communicate with other disciplines, ability to analyze data and synthesis.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in vaje v mikroskopirnici, različnih laboratorijih ter mineraloški zbirki.	Lectures and exercises in a microscope, various laboratories and a mineralogical collection.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
pisni ali ustni izpit	40,00 %	written or oral examination
seminarska naloga	30,00 %	seminar work
ocena iz vaj	30,00 %	assessment from exercises
Ocene: 6-10 (pozitivno;) ob upoštevanju Statuta UL in fakultetnih pravil.		Grades: 6-10 (positive) according to the UL Statute and faculty rules.

Reference nosilca/Lecturer's references:

JANÁK, Marian, UHER, Pavel, KROGH RAVNA, Erling J., KULLERUD, Kåre, VRABEC, Mirijam. Chromium-rich kyanite, magnesiostaurolite and corundum in ultrahigh-pressure eclogites (examples from Pohorje Mountains, Slovenia and Tromsø Nappe, Norway). European journal of mineralogy, 2015, vol. 27, no. 3, str. 377-392, doi: 10.1127/ejm/2015/0027-2436.

ROGAN ŠMUC, Nastja, SERAFIMOVSKI, Todor, DOLENEC, Tadej, DOLENEC, Matej, VRHOVNIK, Petra, VRABEC, Mirijam, JAĆIMOVIĆ, Radojko, LOGAR ZORN, Vesna, KOMAR, Darja. Mineralogical and geochemical study of Lake Dojran sediments (Republic of Macedonia). Journal of geochemical exploration, ISSN 0375-6742. [Print ed.], 2015, vol. 150, str. 73-83, doi: 10.1016/j.gexplo.2014.12.019.

JANÁK, Marian, FROITZHEIM, Nikolaus, YOSHIDA, Kenta, SASINKOVÁ, V., NOSKO, Martin, KOBAYASHI, Tomoyuki, HIRAJIMA, Takao, VRABEC, Mirijam. Diamond in metasedimentary crustal rocks from Pohorje, Eastern Alps: a window to deep continental subduction. Journal of metamorphic geology, ISSN 0263-4929, 2015, vol. 33, str. 495-512, doi: 10.1111/jmg.12130.

YILDIZHAN, Melike Melike, ŠTURM, Sašo, GÜLGÜN, Mehmet Ali. Structural and electronic modifications on TiO[sub]2 anatase by Li, K or Nb doping below and above the solubility limit. Journal of Materials Science, ISSN 0022-2461, 2016, vol. 51, no. 12, str. 5912-5923, doi: 10.1007/s10853-016-9893-8.

MILER, Miloš, AMBROŽIČ, Bojan, MIRTIČ, Breda, GOSAR, Mateja, ŠTURM, Sašo, DOLENEC, Matej, JERŠEK, Miha. Mineral and chemical composition of the Jezersko meteorite - a new chondrite from Slovenia. Meteoritics & planetary science, ISSN 1086-9379, 2014, vol. 49, no. 10, str. 1875-1887, doi: 10.1111/maps.12365.

PEITEADO, Marco, ŠTURM, Sašo, CABALLERO, Amador C., MAKOVEC, Darko. Mn3−xZnxO4 spinel phase in the Zn-Mn-O system. Acta materialia, ISSN 1359-6454. [Print ed.], sep. 2008, vol. 56, iss. 15, str. 4028-4035, ilustr., doi: 10.1016/j.actamat.2008.04.024.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Statistika v geologiji 2
Course title:	Statistics in Geology 2
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0596430
Koda učne enote na članici/UL Member course code:	11409

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
20	40	0	0	0	60	4

Nosilec predmeta/Lecturer:	Nina Zupančič
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Zaključen dodiplomski študij, osnovna računalniška pismenost.	Completed undergraduate study, basic computer literacy.

Vsebina:	Content (Syllabus outline):
Ponovite osnovnih statističnih metod Analiza časovnih vrst Analiza prostorskih podatkov – krigiranje Multivariatne metode: - multivartiatna analiza variance - multivariatna regresija - Anlaiza glavnih osi (PCA) in faktorska analiza tipa R in Q - diskriminantna analiza - clusteraske analize (hierarhična, k-mean) - grafične predstavitve multivariatnih podatkov Izbrane numerične metode – nekateri sodobni pristopi (nevronske mreže, fuzzy logic, umetna inteligenca, rudarjenje podatkov)	Repetition of basic statistocal methods Time series analyses Analyses of spatial data – kriging Multivariate methods: - Multivariate analysis of variance -Multivariate regression - Principal components analysisPCA and Factor analysis of R and Q mode - Discriminant analysis - Cluster analysis (hierarchical, k-mean) - Graphical presentation of multivariate data Selected numerical methods – some up-to-date methods (neuron networks, fuzzy logic, data mining)

Temeljna literatura in viri/Readings:

Izbrana poglavja iz knjig:

DAVIES, J. C. 2002: Statistics and Data Analysis in Geology. Wiley, 656 pp., ZDA.

SWAN, A. R. H. & SANDILANDS, M. 1995: Introduction to geological data analysis. Blackwell Science, 446 pp., Oxford.

de SA, M. & JOAQUIM P. 2007: Applied Statistics Using SPSS, STATISTICA, MATLAB and R. Springer, 506 pp.

Cilji in kompetence: **Objectives and competences:**

CILJI: Študent pridobi znanje statističnih metod, potrebnih za analizo geoloških materialov in prostora. Številčno obsežne multivariatne podatke z različnih področij geologije zna obravnavati z ustreznimi statističnimi in numeričnimi metodami. KOMPETENCE: Za reševanjegeoloških problemov zna izbrati in pri interpretaciji uporabiti statistične tehnike.	OBJECTIVES: Student acquires knowledge of statistical methods, necessary to analyse geological materials and environment. He can deal with large multivariate data from different fields of geology with appropriate statistical and numerical methods. COMPETENCES: Student can select and use statistical techniques for interpretation of geological problems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Zna pridobiti numerične multivariatne podatke, razume sistem njihovega zajema, obdelave in interpretacije. Statistične analize zna izvesti z računalniškimi programi (Excel, Statistica, Surfer,...).	Knows how to obtain a numerical multivariate data, understands systems of their sampling, processing and interpretation. He can perform statistical analyzes with computer programs (Excel, Statistica, Surfer, ...).

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, vaje v računalniški učilnici, samostojno reševanje problema v obliki seminarske naloge.	Lectures, excercises in computer room, independent resolving of the problem in the form of the seminar work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Praktični izpit z uporabo statističnega računališkega programa.	100,00 %	Practical exam with selected statistical computer program.

Reference nosilca/Lecturer's references:

ZUPANČIČ, Nina. Influence of climate factors on soil heavy metal content in Slovenia. Journal of soils and sediments : protection, risk assessment and remediation, 2017, vol. 17, iss. 4, str. 1073-1083.
ZUPANČIČ, Nina, HORVAT, Aleksander, JARC, Simona. Environmental impact of dusting from the Koper port bulk cargo terminal on the agricultural soils. Acta geographica Slovenica, 2015, 55, št. 1, str. 139-158.
ZUPANČIČ, Nina. Influence of climate factors on soil heavy metal content in Slovenia. Journal of soils and sediments : protection, risk assessment and remediation, 2017, vol. 17, iss. 4, str. 1073-1083.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Stratigrafija 2
Course title:	Stratigraphy 2
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0596367
Koda učne enote na članici/UL Member course code:	11416

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
20	25	0	0	0	45	3

Nosilec predmeta/Lecturer:	Boštjan Rožič
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Vpis v 1. letnik študija 2. stopnje.	Entering the 1st year of 2nd grade program.

Vsebina:	Content (Syllabus outline):
• Korelacija kot ključno stratigrafsko orodje: načini, faktorji, pomen. • Predstavitev izbranih detailnih sedimentarno stratigrafskih raziskav iz območja Slovenije: obsega večji del predmetav in temelji na projektnemu delu na izbranem stratigrafskem problemu: pregled formacijske razdelitve po posameznih kronostratigrafskih erah, paleogeografska rekonstrukcija in evolucija ter korelacija s sosednjimi območji. • Detailen pregled paleogeografskega razvoja širšega prostora v luči novo pridobljenega znanja.	• Correlation as crucial stratigraphic tool: means, factors, validity. • Presentation of selected detailed Sedimentary – stratigraphic reserches from area of Slovenia: it represents major part of the subject and is based on a project-work on a chosen stratigraphic problematics: overview of formational subdivision within individual chronostratigraphic eras, paleogeographic reconstruction and evolution, correlation with surrounding regions. • Detailed overview of the regional paleogeographic evolution in the light of newly contributed knowledge.

Temeljna literatura in viri/Readings:

- Buser, S. 1989: Development of the Dinaric and the Julian Carbonate Platforms and of the intermediate Slovenian Basin. Memor. Soc. Geol. Italiana, 40, 313-320.
- Jurkovšek, B. et al.1996: Formacijska geološka karta južnega dela Tržaško-Komenske planote, kredne in paleogenske karbonatne kamnine. Inštitut za geologijo, geotehniko in geofiziko, 143 pp., ISBN: 961-90403-0-9.
- Doyle, P. & Bennett, M.R.: Unlocking the stratigraphical record. Advances in modern stratigraphy. J. Wiley & Sons, 1998, 532 pp, ISBN: 0-471-97463-3.
- Gradstein, F., Ogg, J. & Smith, A.: A geologic time scale. Cambridge Uni. Press, 2004, 589 pp., ISBN: 0-521-78142-6.

- Pleničar, M., Ogorelec, B. & Novak, M.: Geologija Slovenije. Geološki zavod Slovenije, 612pp., ISBN: 978-961-6498-24-1.
- Šmuc, A.: Jurassic and Cretaceous stratigraphy and sedimentary evolution of the Julian Alps, NW Slovenia. Založba ZRC/ZRC Publishing, 2005, 98 pp.
- Turnšek, D.: Mesozoic Corals of Slovenia. Založba ZRC/ZRC Publishing, 1997, 512pp., ISBN: 961-6182-44-7.
- Izbrani doktorati in druga zaključna dela iz področja Stratigrafije in Sedimentarne geologije (Skabrne, Čar, Otoničar, Novak, Celarc, Jež, Šmuc, Gale, Rožič, itd).

Cilji in kompetence:	**Objectives and competences:**
CILJI: Predmet predstavlja vsebinsko dopolnjevanje in nadgradnjo osnovnih vsebin pri predmetu Stratigrafija. Predmet zajema metode časovnih korelacij različnih sedimentacijskih bazenov, interpretacijo podatkov in genezo litoloških enot. Delo temelji na analizi slovenskih stratotipnih razvojev. Cilj predmeta je tako nadgradnja in sinteza znanj pridobljenih v predhodnih semestrih teoretičnega usposabljanja z nanovo pridobljenimi znanji, ki so bistvena za operativno delo geologa, sploh če bo v svoji profesionalni karieri delal na slovenskem območju. KOMPETENCE: Slušatelji so usposobljeni za samostojno prepoznavanje in interpretacijo stratigrafskih podatkov, časovno korelacijo stratigrafskih dogodkov ter njihovo uporabo pri drugih segmentih geološke stroke.	OBJECTIVES: Subject is an addition and upgrade of the contents of the subject Stratigraphy. The subject deals with methods of correlations between sedimentary basins, data interpretation and genesis of lithological units. Work is based on the analysis of Slovenian stratotype successions. Objectives of the subject are though the upgrade and synthesis of knowledge gained in previous, more theoretically focused semesters with newly attributed knowledge, that are essential for operative geologists work, especially if he/she will work in professional career on the Slovenian territory. COMPETENCES: Student is capable of recognition and interpretation of stratigraphic data, correlation of stratigraphic events and their use at other segments of geological science.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Slušatelj pridobi poglobljeno znanje o sedimentarni evoluciji ozemlja današnje Sloveniji tokom izbranega kronostratigrafskega intervala. Spozna tehnike stratigrafski analiz in časovne korelacije različnih geoloških informacij ter pridobi na prepoznavanju in razumevanju velikih geodinamskih sprememb. Usposabljanje predstavlja sintezo osnovnih geoloških predmetov, od temeljnih znanj, do specialnih znanj pri reševanju konkretnih problemov. Študent mora biti usposobljen za pripravo različnih rešitev in interpretacij in se na podlagi izkušenj odločiti za najboljšo (najbolj verjetno). Praktično poznavanje stratigrafskih znanstvenih pristopov in empirična izkušnja s stratigrafskimi tehnikami omogoča slušatelju kritično ovrednotenje obstoječih stratigrafskih podatkov, ki se uporabljajo v ostalih vejah geologije ter sorodnih znanosti.	Student gains comprehensive knowledge about sedimentary evolution of the present-day Slovenian territory during the chosen chronostratigraphic interval. Student encounters techniques of stratigraphic analysis and correlations of various geological information, gains onto recognition and understanding of large-scale geodynamic changes. Learning represents synthesis of basic geological subjects: from basic to more specialized knowledge with goal of solving the direct geological problems. Student is prepared for establishment of diverse solution and interpretations and is able to make experience-based proper decision. Practical knowledge of stratigraphic scientific approaches and empirical experience with stratigraphic techniques enables students critical evaluation of existing strattigraphic data that are used in other geological branches or related sciences.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminar.	Lectures, seminar.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	50,00 %	Written and/or oral exam
Seminar work	50,00 %	Seminar work

Reference nosilca/Lecturer's references:

ROŽIČ, Boštjan, POPIT, Tomislav, GALE, Luka, VERBOVŠEK, Timotej, VIDMAR, Ines, DOLENEC, Matej, ŽVAB ROŽIČ, Petra. Origin of the Jezero v Ledvicah lake : a depression in a gutter-shaped karstic aquifer (Julian Alps, NW Slovenia) = Nastanek Jezera v Ledvicah - globel v žlebu podobnem kraškem vodonosniku (Julijske Alpe, SZ Slovenija). *Acta carsologica*. [Tiskana izd.]. 2019, letn. 48, št. 3, str. 265-282.

GALE, Luka, KOLAR-JURKOVŠEK, Tea, KARNIČNIK, Barbara, CELARC, Bogomir, GORIČAN, Špela, ROŽIČ, Boštjan. Triassic deep-water sedimentation in the Bled Basin, eastern Julian Alps, Slovenia = Triasna globljevodna sedimentacija v Blejskem bazenu, vzhodne Julijske Alpe, Slovenija. *Geologija*. [Tiskana izd.]. 2019, vol. 62, no .2, str. 153-173. ISSN 0016-7789. DOI: 10.5474/geologija.2019.007.
ROŽIČ, Boštjan. Albian - Cenomanian resedimented limestone in the Lower flyschoid Formation of the Mt. Mrzli Vrh Area (Tolmin region, NW Slovenia) = Albijsko cenomanijski presedimentirani apnenci spodnje flišoidne formacije z območja Mrzlega vrha severno od Tolmina (SZ Slovenija). Geologija, 2005, vol. 48, 2, str. 193-210.
ROŽIČ, Boštjan, POPIT, Tomislav. Resedimented limestones in Middle and Upper Jurassic succession of the Slovenian Basin = Presedimentirani apnenci v srednje in zgornjejurskem zaporedju Slovenskega bazena. Geologija, 2006, knj. 49, 2, str. 219-234.
GALE, Luka, RETTORI, Roberto, MARTINI, Rossana, KASTELIC, Aleksander, PRAPROTNIK, Jerca, JAMNIK, Maša, ŠMUC, Andrej, ROŽIČ, Boštjan. Miliolipora species (Foraminifera, Miliolina) from the Rhaetian Dachstein Limestone of Karavanke Mts (Slovenia): Palaeoecological and palaeobiogeographic implications = Les espèces de Miliolipora du Calcaire de Dachstein (Rhétien) des Monts de Karavanke (Slovénie) : implications paléoécologiques et paléobiogéographiques. Rev. micropaléontol., 2012, vol. 55, iss. 3, str. 99-112.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Stratigrafska orodja
Course title:	Stratigraphic Tools
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562381
Koda učne enote na članici/UL Member course code:	753

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	30	0	0	0	75	5

Nosilec predmeta/Lecturer:	Boštjan Rožič
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Ni pogojev.	No prerequisites.

Vsebina:	Content (Syllabus outline):
Sekvenčna stratigrafija: Koncepti in principi sekvenčne stratigrafije Orodja sekvenčne stratigrafije Sekvenčna stratigrafija sedimentacijskih sistemov Kemostratigrafija: Definicija, uporabnost, omejitve, Kemostratigrafski in sedimentološki indici globalnih okoljskih spremembe ter njihov geološki zapis, Anoksični oceani: vzroki in posledice, geološki zapis anoksičnih dogodkov, Kemostratigrafska orodja (kisikovi in ogljikovi izotopi, biomarkerji, stroncijevi izotopi, redoks-občutljivi elementi, kalcijevi izotopi), Kemostratigrafske korelacije in interpretacije.	Sequence stratigraphy: Concepts and Principles of sequence stratigraphy Tools of sequence stratigraphy Sequence stratigraphy of sedimentary systems Chemostratigraphy: definition, usability, restrictions, Chemostratigraphic and sedimentological evidence of global environmental changes and their geological record, Anoxic oceans: the causes and consequences, the geological record of anoxic events Chemostratigraphic tools (oxygen and carbon isotopes, biomarkers, strontium isotopes, redox-sensitive elements, calcium isotopes) Chemostratigraphic correlation and interpretation.

Temeljna literatura in viri/Readings:

Izbrana poglavja iz / Selected chapters from:

CATUNEANU O. 2006: Principles of Sequence Stratigraphy. Elsevier, 374 pp.
EMERY D. & MYERS K.: Sequence stratigraphy, Willey Blackwell, 304 pp.
JENKYNS, H. 2008: Chemostratigraphy: applications, limitations and implications for environmental global change. Lecture-Exercises Book.
OGG, J. G. OGG, G. & GRADSTEIN, F. M. 2008: The consise geologic time scale. Cambridge Uni. Press, 177 pp.
WIGNALL, P. B. 1994: Black Shales. Clarendon Press, 127 pp.

WEISSERT, H., JOACHIMSKI, M, SARNTHEIN M. 2008: Chemostratigraphy. Newsl. Stratigr., 42/3, 145-179. Dodatna literatura je izbor relevantnih člankov iz znanstvene periodike, ki ga vzdržuje in dopolnuje nosilec predmeta / Additional readings is the selection of relevant articles from the scientific journals, which is maintained and complemented by the lecturer

Cilji in kompetence:	**Objectives and competences:**
CILJI: Poznavanje sodobnih stratigrafskih orodji med katerimi sta najpomembnejši sekvenčna stratigrafija in kemostratigrafija. Izbrani metodi predstavljata najsodobnejši stratigrafski metodi, ki sta bili prvotno razviti za potrebe naftne geologije in se nato naglo razširili tudi na vse ostale smeri geologije. KOMPETENCE: Slušatelji bodo usposobljeni samostojnega strokovnega in raziskovalnega dela pri uporabi modernih stratigrafskih orodij za stratigrafske korelacije globalnih geoloških dogodkov in globalnih okoljskih sprememb v različnih obdobjih Zemljine zgodovine.	OBJECTIVES: Knowledge of modern stratigraphic tools, among which the most important are sequence stratigraphy and chemostratigraphy. Selected methods represents the modern-most stratigraphic methods that were originally developed for the needs of the petroleum geology and then rapidly spread to all other branches of geology. COMPETENCES: Students will gain independent professional and research work in applying modern stratigraphic tools for stratigraphic correlations of global geological events and global environmental changes at different times in the Earth's history.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent obvlada in razume različne procese, ki privedejo do razlik, s katerimi se ukvarjata sekvenčna in kemostratigrafija. Prepozna različne sekvence in sekvenčne meje ter zna izdelati sekvenčni model. Prepozna markeje v sedimentnih zapisih, ki so značilni za globalne okoljske spremembe in jih zna ustrezno interpretirati.	The student will learn and understand the diverse processes that lead to differences, with which sequence stratigraphy and chemostratigraphy deal . He/she recognizes different sequences and sequence boundaries and knows how to create a sequence model, and identifies markeje in sedimentary records that are characteristic of global environmental changes and knows how to properly interpret them.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarsko delo v obliki branja in skupne diskusije člankov iz znanstvene periodike.	Lectures, seminar work in the form of reading and Joint discussion of articles from scientific journals.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	75,00 %	Written and/or oral exam
Seminar	25,00 %	Seminar work
Ocenjevalna lestvica: (6-10) pozitivno, ob upoštevanju Statuta UL in fakultetnih pravil.		Grades: (6-10) positive assessment, according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

ROŽIČ, Boštjan, GORIČAN, Špela, ŠVARA, Astrid, ŠMUC, Andrej. The Middle Jurassic to Lower Cretaceous succession of the Ponikve klippe: the Southernmost outcrops of the Slovenian Basin in Western Slovenia. Rivista italiana di paleontologia e stratigrafia, ISSN 0035-6883, 2014, vol. 120, no. 1, str. 83-102.

GALE, Luka, ROŽIČ, Boštjan, MENCIN GALE, Eva, KOLAR-JURKOVŠEK, Tea. First evidence for late Norian progradation of Julian Platform towards Slovenian Basin, eastern Southern Alps. Rivista italiana di paleontologia e stratigrafia, ISSN 0035-6883, July 2014, vol. 120, no. 2, str. 191-214.

ROŽIČ, Boštjan, ŠMUC, Andrej. Gravity-flow deposits in the Toarcian Perbla formation (Slovenian basin, NW Slovenia). Rivista italiana di paleontologia e stratigrafia, ISSN 0035-6883, 2011, vol. 117, no. 2, str. 283-294.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Tehnična mineralogija
Course title:	Technical Mineralogy
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0067847
Koda učne enote na članici/UL Member course code:	728

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	45	0	0	0	75	5

Nosilec predmeta/Lecturer:	Mirijam Vrabec, Sabina Kramar
Vrsta predmeta/Course type:	Obvezni / Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Ni pogojev.	No prerequisites.

Vsebina:	Content (Syllabus outline):
OGNJEVZDRŽNI IN IZOLACIJSKI MATERIALI (4h) Delitev, uporaba, pridobivanje. Kisle, bazične, specialne. Mineraloške, kemične in fizikalne karakteristike. Surovine, tehnologija izdelave, kakovost izdelka. Oblikovane vrste gradiva, vlaknati materiali. STEKLO (2h) Tehnologija pridobivanja. Klasifikacija surovin, klasifikacija izdelkov. Vodno steklo. Glazure, emajli. KERAMIKA (2h) Kakovost surovine, tehnologija izdelovanja, klasifikacija in kakovost izdelkov. Mineraloške, kemične in fizikalne karakteristike. Gradbena keramika, gospodinjska keramika, porcelan. NARAVNI KAMEN IN AGREGAT (4h) Delitev, mineraloške in fizikalne karakteristike, degradacijski produkti. CEMENTI IN OSTALA VEZIVA TER PIGMENTI (4h) Surovine, pridobivanje, kakovost izdelka. Mineraloške, kemične in fizikalne karakteristike. BETONI IN MALTE (4h) Mineraloške, kemične in fizikalne karakteristike. Hidratacija, kalcijevi silikat hidrati. SEKUNDARNE SUROVINE IN RECIKLAŽA (4h) Delitev, sestava, uporabna vrednost. Elektrofiltrski pepel, žlindra, mikrosilika, mulji.	REFRACTORY AND INSULATING MATERIALS (4h) Classification, use, extraction. Acid, basic, special. Mineral, chemical and physical characteristics. Raw materials, production technology, product quality. Designed types of materials, fibrous materials. GLASS (2h) Technology of extraction. Classification of raw materials, product classification. Water glass. Glazings, enamels. CERAMICS (2h) Quality of raw materials, production technology, classification and product quality. Mineral, chemical and physical characteristics. Construction ceramics, household ceramics, porcelain. NATURAL STONE AND AGGREGATE (4h) Classification, mineralogical and physical characteristics, degradation products. CEMENTS AND OTHER BINDERS AND PIGMENTS (4h) Raw materials, extraction, product quality. Mineral, chemical and physical characteristics. CONCRETE AND MORTAR (4h) Mineral, chemical and physical characteristics. Hydration, calcium silicate hydrates. SECONDARY RAW MATERIALS AND RECYCLING (4h) Classification, composition, usable value. Fly ash, slag, microsilica, sludges.

ALTERNATIVNI MATERIALI, NANOMATERIALI (2h) Tehnologije izdelave, mineraloške karakteristike. ABRAZIVI IN BRUSILA (1h) Delitev, uporabna vrednost, pridobivanje. Naravna in umetna. ARHEOMETRIJA IN KULTURNA DEDIŠČINA (3h) Mineralni materiali (steklo, žlindra, dragi kamni, keramika, kamen, stenske poslikave, mozaiki), degradacijski produkti, zaščitni premazi in utrjevalci.	ALTERNATIVE MATERIALS, NANOMATERIALS (2h) Production technologies, mineralogical characteristics. ABRASIVES AND GRINDERS (1h) Classification, usable value, extraction. Natural and artificial. ARCHAEOMETRY AND CULTURAL HERITAGE (3h) Mineral materials (glass, slag, precious stones, ceramics, stone, wall paintings, mosaics), degradation products, protective coatings and hardeners.

Temeljna literatura in viri/Readings:

BILBIJA, N., MATOVIĆ, V., 2009, Primenjena petrografija : svojstva i primene kamena, 417 str.
BROEKMANS, M.A.T.M, Pöllman, H., 2012, Applied Mineralogy of Cement & Concrete, MSA ,364 str.
CARTER, C.B., NORTON, M.G., 2013, Ceramic Materials, 88 str.
HEWLETT, P.C., 2004, Lea's chemistry of cement and concrete, Elsevier Butterworth-Heinmann, 1075 str.
INGHAM, J.P.,2001, Geomaterials under the microscope : a colour guide : building stone, roofing slate, aggregate, concrete, mortar, plaster, bricks, ceramics, and bituminous mixtures; London: Manosn, 192 str.
MUKHERJEE, S., 2012, Applied Mineralogy: Applications in Industry and Environment, Springer, 562 str.
RICE, P.M., 1987, Pottery analyses: a sourcebook, Chicago; London : The University of Chicago Press, 559 str.
SIDDIQUE,R., KHAN, M. I., 2011, Supplementary Cementing Materials, Springer, 287 str.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Spoznavanje mineraloških, strukturnih in teksturnih značilnosti naravnih in umetnih mineralnih in amorfnih materialov. Spoznati najpomembnejše industrijske minerale. KOMPETENCE: Določanje uporabne vrednosti surovin in postopkov pridobivanja naravnih in umetnih mineralnih materialov. Preverjanje in ocena njihove kakovosti, ter možnosti za izboljšavo. Prepoznavanje sekundarnih surovin in njihove uporabne vrednosti.	OBJECTIVES: To get familiar with mineralogical, structural and textural characteristics of natural and artificial mineral and amorphous materials. To learn the most important industrial minerals. COMPETENCES: Determining the usable value of raw materials and the processes of obtaining natural and artificial mineral materials. Checking and evaluating their quality, and options for improvement. Recognition of secondary raw materials and their useful value.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Razumevanje reakcij, ki potečejo med termično in/ali hidrotermalno predelavo mineralnega materiala. Razumevanje parametrov, ki definirajo obnašanje mineralnega materiala med termično in /ali hidrotermalno predelavo. Študent mora biti sposoben sinteze znanja o mineralogiji vhodnega mineralnega materiala, ter uporabno vrednostjo oz. kakovostjo mineralnega izdelka. Povezava med mineraloškimi karakteristikami surovine, tehnološkim postopkom predelave in uporabno vrednostjo končnega izdelka.	Understanding the reactions that occur between thermal and/or hydrothermal processing of mineral material. Understanding the parameters that define the behavior of mineral material during thermal and/or hydrothermal processing. The student must be able to synthesize knowledge about the mineralogy of the input mineral material, and the useful value or the quality of the mineral product. The link between the mineralogical characteristics of the raw material, the technological process of processing and the useful value of the finished product.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z uporabo prezentacij. Vaje potekajo kot vodene seminarske vaje.	Lectures using presentations. Exercises take place as guided tutorials.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
ustni ali pisni kolokvij	30,00 %	oral or written colloquium
seminarska naloga	20,00 %	seminar work
ustni ali pisni izpit	50,00 %	oral or written exam
Ocene: 6-10 (pozitivno) ob upoštevanju Statuta UL in fakultetnih pravil.		Grades: 6-10 (positive) according to the UL Statute and faculty rules.

Reference nosilca/Lecturer's references:

VAVRIČUK, Anja, BOKAN-BOSILJKOV, Violeta, KRAMAR, Sabina. The influence of metakaolin on the properties of natural hydraulic lime-based grouts for historic masonry repair. Construction & building materials, ISSN 0950-0618. [Print ed.], May 2018, vol. 172, str. 706-716, ilustr., doi: 10.1016/j.conbuildmat.2018.04.007.
ŠMUC, Andrej, DOLENEC, Matej, KIKELJ, Martina L., LUX, Judita, PFLAUM, Miran, ŠEME, Blaž, ŽUPANEK, Bernarda, GALE, Luka, KRAMAR, Sabina. Variety of black and white limestone tesserae used in ancient mosaics in Slovenia. Archaeometry, ISSN 0003-813X. [Tiskana izd.], 2017, vol. 59, iss. 2, str. 205-221, doi: 10.1111/arcm.12250.
KRAMAR, Sabina, ŠAJNA, Aljoša, DUCMAN, Vilma. Assessment of alkali activated mortars based on different precursors with regard to their suitability for concrete repair. Construction & building materials, ISSN 0950-0618. [Print ed.], Oct. 2016, vol. 124, str. 937-944, ilustr. http://www.sciencedirect.com/science/article/pii/S0950061816312818, doi: 10.1016/j.conbuildmat.2016.08.018.
VRABEC, Mirijam, JANÁK, M., FROITZHEIM, N. Phase relations during peak metamorphism and decompression of the UHP kyanite eclogites, Pohorje Mountains (Eastern Alps, Slovenia). Lithos, 2012, vol. 144-145, str. 40-55, doi: dx.doi.org/10.1016/j.lithos.2012.04.004.

LESKOVAR, Blaž, VRABEC, Mirijam, DOLENEC, Matej, NAGLIČ, Iztok, DOLENEC, Tadej, DERVARIČ, Evgen, MARKOLI, Boštjan. Temperature-initiated structural changes in FeS[sub]2 pyrite from Pohorje, Eastern Alps, North-Eastern Slovenia = S temperaturo povzročene strukturne spremembe FeS[spodaj]2 pirita iz Pohorja, vzhodne Alpe, severovzhodna Slovenija. Materiali in tehnologije, ISSN 1580-2949. [Tiskana izd.], 2017, letn. 51, št. 2, str. 259-265, ilustr. http://mit.imt.si/Revija/izvodi/mit172/leskovar.pdf, doi: 10.17222/mit.2015.328.

ROGAN ŠMUC, Nastja, SERAFIMOVSKI, Todor, DOLENEC, Tadej, DOLENEC, Matej, VRHOVNIK, Petra, VRABEC, Mirijam, JAĆIMOVIĆ, Radojko, LOGAR ZORN, Vesna, KOMAR, Darja. Mineralogical and geochemical study of Lake Dojran sediments (Republic of Macedonia). Journal of geochemical exploration, ISSN 0375-6742. [Print ed.], 2015, vol. 150, str. 73-83, doi: 10.1016/j.gexplo.2014.12.019.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Tektonika
Course title:	Tectonics
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0067738
Koda učne enote na članici/UL Member course code:	741

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	15	0	0	15	75	5

Nosilec predmeta/Lecturer:	Marko Vrabec
Vrsta predmeta/Course type:	Obvezni / Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Ni pogojev.	No prerequisites.

Vsebina:	Content (Syllabus outline):
Tektonika plošč: zgradba litosfere, litosferske plošče, geološki dokazi za premikanje plošč, kinematika plošč na sferični Zemlji, absolutni in relativni premiki plošč, vrste stikov, trojne točke, gonilni mehanizmi premikanja plošč. Glavna tektonska okolja na Zemlji: sredoceanski hrbti in transformni prelomi, kontinentalna ekstenzijska območja (rifti), kontinentalni transformni in zmični prelomi, subdukcijske cone, kolizijske cone in orogeni. Litosferska mehanika: reologija Zemljine skorje in plašča, deformacijski mehanizmi v kamninah, lomne in duktilne deformacije kamnin, sile in napetostna stanja v litosferi, toplotni tok, prevajanje toplote v litosferi, geoterme v litosferi, P-T pogoji v litosferi, metamorfizem. Dinamični procesi v litosferi: mehanika prelomov, litosferska ekstenzija, fleksura litosfere, nastanek sedimetnih bazenov, kontinentalna kolizija, orogenski kolaps.	Plate tectonics theory: composition of the lithosphere, lithospheric plates, geological evidence for plate motion, plate kinematic on spherical Earth, absolute and relative plate motions, plate boundaries, triple junctions, mechanisms of plate motion. Principal tectonic environments on Earth: oceanic ridges and transform faults, continental extensional provinces (rifts), continental transform and strike-slip faults, subduction zones, collisional zones and orogens. Lithosphere mechanics: crustal and mantle rheology, deformational mechanisms in rocks, brittle and ductile deformation, forces and stress strates in the lithosphere, heat flow, transfer of heat in the lithosphere, geotherms, P-T conditions in the lithosphere, metamorphism. Dynamical processes in the lithosphere: fault mechanics, lithospheric extension, lithospheric flexure, formation of sedimentary basins, continental collision, orogenic collapse.

Temeljna literatura in viri/Readings:

STÜWE, K., 2007, Geodynamics of the Lithosphere, 2nd ed., Springer Verlag, 493 str.
KEAREY, P., KLEPEIS, K.A., VINE, F.J., 2009, Global Tectonics, 3rd ed., Wiley-Blackwell, 496 str.

ALLEN, P.A., ALLEN, J.R., 2005: Basin Analysis, 2nd ed., Wiley-Blackwell, 560 str. MOORES, E.M., TWISS, R.J., 1995, Tectonics, W. H. Freeman, 415 str.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študenti se spoznajo z geometrijo, nastankom in kinematiko regionalnih strukturnih sistemov v glavnih tektonskih okoljih Zemlje. S poglobljeno obravnavo teorije tektonike plošč nadgradijo znanje iz prve stopnje študija. Seznanijo se s fizikalnimi koncepti in procesi v geodinamiki litosfere, s poudarkom na mehanskem, reološkem in termičnem odzivu litosfere pri deformacijah. KOMPETENCE: - Sposobnost raziskovanja in interpretacije fosilnih in aktivnih tektonskih sistemov. - Sposobnost interpretacije tektonskega razvoja ozemlja in fizikalnih pogojev deformiranja. - Sposobnost kvantitavne obravnave procesov in mehanizmov deformacij v litosferi.	OBJECTIVES: Students get acquainted with geometry, evolution and kinematics of regional-scale structural systems in the principal tectonic environments on Earth. They extend and deepen their understanding of the Plate tectonics theory. They get familiar with physical concepts and processes in litosphere geodynamics, with emphasis on mechanical, rheological and thermal response of the litosphere to deformation. COMPETENCES: - Ability to investigate and interpret past and modern tectonic systems. - Ability to interpret tectonic evolution of a given region and the physical conditions during deformation. - Ability to quantitatively assess processes and mechanisms of lithospheric deformation.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Razumevanje tektonskega razvoja strukturnih sistemov v ekstenzijskih, konvergentnih in zmičnih območjih. Poznavanje nastanka in razvoja sedimetnih bazenov. Osvojene spretnosti za zbiranje, prikaz, analizo in interpretacijo geofizikalnih podatkov.	Understanding of structural systems evolution in extensional, convergent and strike-slip environments. Knowledge of the origin and evolution of sedimentary basins. Acquired skills in data collection, analysis, presentation and interpretation.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja. Vaje potekajo v obliki vodenih seminarskih vaj. Terenske vaje obsegajo 3 dni dela na terenu.	Lectures. Guided seminar tutorials. Course includes 3 days of fieldwork and field trips.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit.	100,00 %	Written and/or oral examination.
Za pozitivno oceno mora biti pravilnih vsaj 50% odgovorov. Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		A score of at least 50% is required to pass the exam. Grading: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) according to the UL Statute and faculty rules.

Reference nosilca/Lecturer's references:

FODOR, Laszlo, JELEN, Bogomir, MARTON, Emö, SKABERNE, Dragomir, ČAR, Jože, VRABEC, Marko. Miocene - Pliocene tectonic evolution of the Slovenian Periadriatic fault: implications for Alpine - Carpathian extrusion models. Tectonics, 1998, vol. 17, str. 690-709. VRABEC Marko, PAVLOVČIČ PREŠEREN Polona, STOPAR Bojan. GPS study (1996-2002) of active deformation along the Periadriatic fault system in northeastern Slovenia: tectonic model. Geol. Carpath., 2006, vol. 57, str. 57-65. WEBER, John, VRABEC, Marko, PAVLOVČIČ PREŠEREN, Polona, DIXON, Tim, JIANG, Yan, STOPAR, Bojan. GPS-derived motion of the Adriatic microplate from Istria Peninsula and Po Plain sites and geodynamic implications. Tectonophysics, 2010, vol. 483, str. 214-222.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Termogeologija
Course title:	Termogeology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	1. semester 2. semester

Univerzitetna koda predmeta/University course code:	0615347
Koda učne enote na članici/UL Member course code:	11422

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
15	5	17	0	8	45	3

Nosilec predmeta/Lecturer:	Mihael Brenčič
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:

Vsebina:	Content (Syllabus outline):
PREDAVANJA 1. Tla in kamnine kot vir toplote 2. Fizika prenosa toplote v kamninah in sedimentih • Prenos toplote v suhem mediju • Prenos toplote v omočenem mediju • Regionalni sistemi prenosa toplote • Geotermometrija • Ocena geotermalnega potenciala 3. Metode raziskav 4. Sistemi za zajem toplote v tleh • Toplotne črpalke • Sistemi voda - voda • Kombinirani sistemi • Suhi sistemi – geosonde • Visokoentalpijski sistemi • Reinjektiranje izrabljene vode • Geokemijsko stanje vode med proizvodnjo 5. Vpliv rabe geotermalne energije na okolje **VAJE** Računski primeri iz fizike in kemije toplotnega toka v geotermalnih sistemih. Obdelava in interpretacija laboratorijskih in terenskih poizkusov za določanje toplotne kapacitete kamnin in sedimentov.	**LECTURES** 1. Soil and rocks as a source of heat 2. Physics of heat processes in rocks and sediments • Processes of heat transfer in dry media • Proceses of heat transfer in saturated media • Regional heat transfer • Geothermometers • Estimation of geothermal potential 3. Research methods 4. Geotermal ground systems • Heat pumps • Systems water – water • Combined systems • Dry systems • High entalpy systems • Reinjection of used water • Geochemical status of used water during production 5. Environmental impact of geothermal energy **EXERCISES** Practical excersises in physics and chemistry of geothermal systems. Processing and interpretation of laboratory and field experiments to determine the thermal capacity of rocks and sediments.

Osnove izračunov za načrtovanje in izvedbo geotermalnih sistemov. **TERENSKE VAJE** V okviru terenskih vaj se se izvede ogled lokacije na kateri že uspešno deluje sistem za rabo plitve in globoke geotermalne energije. Študentje na podlagi podatkov, ki so jih pridobili na terenu, izdelajo poročilo in se v njem opredelijo do zbranih podatkov.	Calculation basics for the design and implementation of geothermal systems. **FIELD EXERCISES** During the field exercises, a site where the system for the use of shallow and deep geothermal energy is already operating will be visited. Students produce a report based on the information they have obtained in the field and interprete data collected.

Temeljna literatura in viri/Readings:

BANKS, D., 2008: An Introduction to Thermogeology – Ground Source Heating and Cooling.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Moderna hidrogeološka stroka zahteva od diplomantov geologije, da se vedno bolj in bolj vključujejo v prizadevanja za rabo obnovljivih in nizkoogljičnih virov energije. Seznanitev študentov z osnovami termogeologije, to je prenosa toplote v kamninah in sedimentih sledi prav tem ciljem. KOMPETENCE: Sposobnost ocenjevanja geotermalnega potenciala tal (sedimentov in kamnin) in sodelovanje pri trajnostnem izkoriščanju geotermalne energije kot obnovljivega vira.	OBJECTIVES: The modern hydrogeology profession requires geology graduates to become more and more involved in the pursuit of renewable and low-carbon energy. Introducing students to the basics of thermogeology, that is, heat transfer in rocks and sediments, follows precisely these goals. COMPETENCES: Ability to evaluate the geothermal potential of ground (sediments and rocks) and participate in the sustainable use of geothermal energy as a renewable resource.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobljeno poglobljeno znanje o toplotnem polju Zemlje, fizikalnih značilnostih prenosa toplote v sedimentih in kamninah, razumevanje sistemov za izkoriščanje geotermalne energije. Možnost uporabe pri izkoriščanju geotermalne energije kot trajnostnega vira energije. Sodelovanje z ostalimi inženirskimi panogami, ki se ukvarjajo s pridobivanjem energije (npr. elektroenergetika, strojništvo, rudarstvo, gradbeništvo). Vloga in pomen izkoriščanja geotermalne energije v vsakdanjem življenu in praksi. Sposobnost izbire in uporabe ustrezne tuje in domače literature. Sposobnost komunikacije z drugimi strokami, sposobnost analize podatkov in sinteze. Uporaba različnih računalniških programov. Načrtovanje naprav za izkoriščanje energije.	Acquired knowledge of Earth's thermal field, physical characteristics of heat transfer in sediments and rocks, understanding of geothermal energy utilization systems. Possibility of using geothermal energy as a sustainable energy source. Collaboration with other engineering industries engaged in energy production (e.g. electricity, mechanical engineering, mining, construction). The role and importance of utilizing geothermal energy in everyday life and practice. Ability to choose and use relevant domestic and foreign literature. The ability to communicate with other professions, the ability to analyze and synthesize information. Using a variety of computer programs, and the transition from qualitative to quantitative data processing.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, kabinetne in terenske vaje.	Lectures, laboratory exercises and field work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
snov predavanj (pisni in/ali ustni izpit)	60,00 %	knowledge from the lectures (written and/or oral exam)
snov vaj (pisni in/ali ustni izpit)	40,00 %	knowledge from exercises (written and/or oral exam)
Ocene: 6-10 (pozitivno) ob upoštevanju Statuta UL in fakultetnih pravil.		Marks: 6-10 (positive) according to the UL Statute and faculty rules.

Reference nosilca/Lecturer's references:

TANG, A.M., HUGHES, P. N., DIJKSTRA, T. A., ASKARINEJAD, A., BRENČIČ, M., CUI, Y. J., DIEZ, J. J., FIRGI, T., GAJEWSKA, B., GENTILE, F., GROSSI, G., JOMMI, C., KEHAGIA, F., KODA, E., MAAT, H. W., LENART, S., LOURENCO, S., OLIVEIRA, M., OSINSKI, P., SPRINGMAN, S., STIRLING, R., TOLL, D. G., VAN BEEK, U. J., 2018: Atmosphere -

vegetation - soil interactions in a climate change context; impact of changing conditions on engineered transport infrastructure slopes in Europe. Quarterly Journal of Engineering Geology and Hydrogeology. 51/2, 156-168.
CHARLIER, R., LALOUI, L., BRENČIČ, M., ERLINGSSON, S., HANSSON, K., HORNYCH, P., 2008: Modelling coupled mechanics, moisture and heat in pavement structures. V: DAWSON, Andrew (ur.). Water in road structures : movement, drainage & effects. Springer, str. 243-281.
STRITIH, U., STUDEN, S., BRENČIČ, M., LAPANJE, A., 2002: The analysis of thermal energy storage in aquifers - the possibility of application in Slovenia. Strojniški vestnik. 48/10, 541-556.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Uporaba geologije v arheologiji
Course title:	Application of Geology in Archaeology
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik, 2. letnik	1. semester
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562382
Koda učne enote na članici/UL Member course code:	739

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	0	30	0	0	75	5

Nosilec predmeta/Lecturer:	Simona Jarc
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Osnovno poznavanje geologije in/ali arheologije.	Basic knowledge of geology and archaeology.

Vsebina:	Content (Syllabus outline):
Teoretična izhodišča Sedimenti in tla: preperevanje, transport, postdepozicijske spremembe, arheološki sedimenti, klasifikacija sedimentov in tal; Geomorfologija: geološke spremememebe površja, geološko kartiranje, preperevanje, erozija, depozicija, pobočni procesi; Sedimentne značilnosti geoloških okolij: rečna okolja, jezerska okolja, močvirska okolja, eolska okolja, glacigena okolja, jamska okolja, rekonstrukcija okolij; Paleoekološka in paleookoljska rekonstrukcija arheoloških najdišč: fosili in sedimenti kot pokazatelji ekoloških in okoljskih sprememb; Arheološki materiali: sestava arheoloških artefaktov, tehnologija izdelave in provenienca.	Theoretical background Sediments and soils: weathering, transportation, postdepositial changes, archaeological sediments, classification of sediments and soils; Geomorphology: geological terrain changes, geological mapping, weathering, erosion, deposition, slope processes; Sedimentary characteristics of geological environments: fluvial environment, lake environments, swamp environment, eolian environmental, glacial environment, cave environment, reconstruction of environments; Palaeoecological and paleoenvironmental reconstruction of archaeological sites: the fossils and sediments as indicators of ecological and environmental changes; Archaeological materials: composition of archaeological artefacts, manufacturing technology and provenance.

Temeljna literatura in viri/Readings:

Izbrana poglavja iz/Selected chapters from:
GARRISON, E. G., 2003: Techniques in archaeological geology. Springer Verl., 304 pp.

NORMAN HERZ, N. & GARRISON, E. G.,1998: Geological methods for archaeology. Oxford Uni. Press, 343 pp.
RIPP, G. ,1998: Geoarchaeology. The Earth-Sicence Approach to Archaeological interpretation. Yale Uni. Press, 274 pp.
GOLDBERG, P., HOLLIDAY, V. T. & REID FERRING, C., 2001: Earth Science in Archaeology. Kluwer Acad. Publ., 513 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Seznaniti slušatelje z osnovnimi znanji, tehnikami in metodami geoloških orodij za podrobnejše razumevanje in interpretacijo arheološkega zapisa tako arheoloških najdišč kot artefaktov. KOMPETENCE: Slušatelj bo sposoben razumeti geološki, ekološki in okoljski kontekst arheoloških najdišč, način izdelave in izvor materiala za arheološke artefakte.	OBJECTIVES: To acquaint students with basic skills, techniques and methods of geological tools for further understanding and interpretation of the archaeological records, both of archaeological sites and artifacts. COMPETENCES: The student will be able to understand the geological, ecological and environmental context of archaeological sites, methods of manufacturing and source of material for archaeological artifacts.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Slušatelji osvojijo osnovna znanja iz sedimentne geologije, geomorfologije, mineralogije, petrologije, geokemije, paleontologije in paleoekologije, potrebna za celostno obravnavo arheološke problematike. Razume pomen naravoslovnega pristopa pri reševanju arheoloških problemov.	Students will acquire basic knowledge of sedimentary geology, geomorphology, mineralogy, petrology, geochemistry, paleontology and paleoecology required for full consideration of archaeological problems. He understands the importance of natural science approach for solving archaeological problems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, vaje.	Lectures, exercises.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	100,00 %	Written and/or oral exam

Reference nosilca/Lecturer's references:

MILETIĆ, Snježana, KRAMAR, Sabina, LUX, Judita, ŠMUC, Andrej, ZUPANČIČ, Nina. Provenance analysis of Roman stone artefacts from sedimentary rocks from the archaeological site near Mošnje, NW Slovenia = Določanje izvora rimskih kamnitih artefaktov iz sedimentnih kamnin z arheološkega najdišča pri Mošnjah, SZ Slovenija. Geologija, ISSN 0016-7789. [Tiskana izd.], 2016, vol. 59, no. 1, str. 35-53, doi: 10.5474/geologija.2016.003.
JARC, Simona, MANIATIS, Yannis, DOTSIKA, E., TAMBAKOPOULOS, D., ZUPANČIČ, Nina. Scientific charaterization of the Pohorje marbles, Slovenia. Archaeometry, ISSN 0003-813X. [Tiskana izd.], 2010, vol. 52, issue 2, str. 177-190, doi: 10.1111/j.1475-4754.2009.00476.x.
ZUPANČIČ, Nina, JARC, Simona, MILER, Miloš, MIHOVILIĆ, Kristina, HÄNSEL, Bernhard, TERŽAN, Biba. Porijeklo ranobrončanodobnih sjekira od zelenog kamena iz Monkodonje = provenance of the Early Bronze Age greenstone axes from Monkodonja. Histria archaeologica, ISSN 0350-6320, 2012, god. 43, str. 5-17.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Uporabna geokemija
Course title:	Applied Geochemistry
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	1. letnik	2. semester

Univerzitetna koda predmeta/University course code:	0067851
Koda učne enote na članici/UL Member course code:	847

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	45	0	0	0	75	5

Nosilec predmeta/Lecturer:	Nastja Rogan Šmuc
Vrsta predmeta/Course type:	Obvezni / Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Ni pogojev.	No prerequisites.

Vsebina:	Content (Syllabus outline):
Sledni elementi kot geokemični sistem v oceanih, sedimentih, tleh in rastlinah Sledni elementi: geokemični pristop in uporaba Analitični postopki Biogeokemični procesi, ki nadzirajo/definirajo mobilnost slednih elementov Ekotoksikološki vplivi slednih elementov Individualno obnašanje/vedenje izbranih slednih elementov Odgovorno rudarjenje elementov redkih zemelj (REE): uvod, geokemija in uporaba Organska snov in biomarkerji Iz geokemije v biokemijo... Osnove geobiokemije Skrite povezave med biogeokemičnimi cikli Na obrobju geomikrobiologije Geomikrobiologija in mikrobna geokemija Socialni in ekonomski vplivi geokemije Vpliv geokemije Uporabna geokemija na področju mineralnega raziskovanja in rudarjenje Okoljska mineralogija: novi izzivi, novi materiali Geokemične rešitve v urbanih družbah: velika mesta Stabilni izotopi kovin v človeškem telesu	Trace elements as a geochemical system in oceans, sediments, soils and plants Trace elements: a geochemical approach and applications Analytical procedures Biogeochemical processes regulating Trace elements mobility Ecotoxicological effects of Trace elements Individual behaviour of selected Trace elements Responsible sourcing of REEs: Introduction, geochemistry and applications Organic matter and biomarkers Transition from geochemistry to biochemistry Principles of Geobiochemistry Cryptic cross-linkages among biogeochemical cycles Emerging frontiers in geomicrobiology Geomicrobiology and microbial geochemistry Omic approaches to microbial geochemistry Social and economic impact of geochemistry The impact of geochemistry Applied geochemistry in mineral exploration and mining Environmental mineralogy: new challenges, new materials Geochemically based solutions for urban society: big cities, case studies

	Metal stable isotopes in human body: a tribute a geochemistry to medicine

Temeljna literatura in viri/Readings:

Učbeniki / Textboks:
H.B. BRADL, 2005, Heavy metals in the environment, 269 pp.
A. KABATA PENDIAS, 2001, Trace elements in soils and plants, 331 pp.
H.Y. MCSWEEN Jr., S.M. RICHARDSON, and M.E. UHLE, 2003, Geochemistry: pathways and processes, 363 pp.
R. CHESTER, 2003, Marine Geochemistry, 506 pp.
J.H.L.VONCKEN, 2016, The Rare Earth Elements (An Introduction), 127 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Slušatelj se nauči zbirati, analizirati, obdelovati, vrednotiti in interpretirati kemijske podatke različnih medijev (kamnine, tla, voda) ter izdelati osnoven model ali več modelov za konkreten geokemični primer. Seznani se z analitskimi metodami in računalniškimi programi (GWB Pro 7.0, WEKA, Igpet, Surfer, Didger, Statistica, PHREEQC, AquaChem, ArcGIS) za obdelavo podatkov. Študent razume potrebo po ločevanju sprememb, ki jih povzroča človek od sprememb, ki jih povzroči narava ter zna predvideti posledice obeh. KOMPETENCE: Uporaba različnih kemijskih metod na različnih geoloških materialov ter nadaljna obdelava in interpretacija rezultatov.	OBJECTIVES:Student acquires knowledge about collecting, analysing, evaluating and interpreting chemical data from different geological medias and about designing basic model/models for actual geochemical case. Student introduces with analytical methods and computer programmes (GWB Pro 7.0, WEKA, Igpet, Surfer, Didger, Statistica, PHREEQC, AquaChem, ArcGIS) for data processing. Student understands the necessity for dividing the anthropogenic/geogenic changes and knows to predict the abovementioned changes. COMPETENCES: Student is able to apply different chemical methods on various geological materials and subsequent processing and interpreting the results.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent zna s pomočjo kemijskih podatkov interpretirati geološke in okoljske procese. Zna izbrati in uporabiti ustrezne tehnike analitike in obdelave podatkov. Razume povezavo med kemijskimi značilnostmi materiala in procesi, ki so vodili do njihovega nastanka. Vključevanje kemičnih podatkov pri razlagi in razumevanju geoloških procesov. Aplikacija geokemije na okoljsko problematiko. Geološke procese razume s kemičnega vidika in zna znanje geokemije uporabiti na ostalih področjih geologije in v povezavi z drugimi strokami. Analitično razmišljanje, uporaba različnih analitskih in računalniških tehnik, uporaba tuje strokovne literature, timsko delo.	Student understands geochemical story of trace and rare earth elements in different geochemical systems and geogene/anthropogenic factors influencing on the defined elements. Student understands the association between chemical characteristics of different geological materials and processes indicating their origin. Student can acquire and detailed interpret the gained results in the frame of applied geochemistry and its related disciplines. Intense use of Slovene and international literature, working with computer programs, team work, communication with representatives of other disciplines.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminarske vaje, skupinsko delo, domače naloge.	Lectures, seminar work, group work, homework's.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
teoretični izpit	50,00 %	theoretical exam
seminar	50,00 %	seminar

Reference nosilca/Lecturer's references:

GLAVAŠ, Neli, MOURELLE, Lourdes Maria, GÓMEZ, Carmen P., LEGIDO, José Luis, ROGAN ŠMUC, Nastja, DOLENEC, Matej, KOVAČ, Nives. The mineralogical, geochemical, and thermophysical characterization of healing saline mud for use in pelotherapy. Applied clay science, ISSN 0169-1317. [Print ed.], 2017, vol. 135, str. 119-128, ilustr., doi: 10.1016/j.clay.2016.09.013.

KRAMAR, Sabina, TRATNIK, Vesna, HROVATIN, Ivan Marija, MLADENOVIČ, Ana, PRISTACZ, Helmut, ROGAN ŠMUC, Nastja. Mineralogical and chemical characterization of Roman slag from the archaeological site of Castra (Ajdovščina, Slovenia). Archaeometry, ISSN 0003-813X. [Tiskana izd.], 2015, vol. 57, iss. 4, str. 704-719, doi: 10.1111/arcm.12116.
ROGAN ŠMUC, Nastja, SERAFIMOVSKI, Todor, DOLENEC, Tadej, DOLENEC, Matej, VRHOVNIK, Petra, VRABEC, Mirijam, JAĆIMOVIĆ, Radojko, LOGAR ZORN, Vesna, KOMAR, Darja. Mineralogical and geochemical study of Lake Dojran sediments (Republic of Macedonia). Journal of geochemical exploration, ISSN 0375-6742. [Print ed.], 2015, vol. 150, str. 73-83, doi: 10.1016/j.gexplo.2014.12.019.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Uvod v keramične materiale
Course title:	Introduction to Ceramic Materials
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Geookolje in geomateriali (modul)	2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0596418
Koda učne enote na članici/UL Member course code:	11402

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
25	20	0	0	0	45	3

Nosilec predmeta/Lecturer:	Mirijam Vrabec, Sašo Šturm
Vrsta predmeta/Course type:	Obvezni/Compulsory

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Vpisan izbirni predmet.	Inscription to the Course.

Vsebina:	Content (Syllabus outline):
Tehnološki razvoj naprednih keramičnih materialov: zgodovina razvoja funkcijske keramike, osnovne značilnosti keramičnih materialov, področja uporabe v sodobnem svetu. Razvoj mikrostrukture v polikristalni keramiki: procesi sintranja, mikrostruktura, fazna ravnotežja, difuzija, sintranje, rast zrn, vloga notranjih mej v mikrostrukturi, strukturne napake v kristalih in lastnosti mej med zrni, razumevanje povezave med mikrostrukturo, procesiranjem in končnimi fizikalnimi lastnostmi. Uporabne lastnosti sodobnih keramičnih materialov: inženirska keramika, feroelektrična keramika, termoelektriki, varistorji, polprevodniki, superprevodniki, gorilne celice, baterije, fluorescenčna keramika, diamagnetna in feromagnetna keramika, biokeramika. Procesne tehnike: peči za sintranje, procesiranje prahov, sol-gel postopki, suspenzije, debelo in tanko plastne tehnologije, nanašanje iz parne faze, rast	Technological development of advanced ceramic materials: a history of the development of functional ceramics, basic characteristics of ceramic materials, areas of use in the modern world. Development of microstructure in polycrystalline ceramics: sintering processes, microstructure, phase equilibria, diffusion, sintering, grain growth, the role of internal boundaries in the microstructure, structural defects in crystals and properties of grain boundaries, understanding of the connection between microstructure, processing and final physical properties. Application of contemporary ceramic materials: engineering ceramics, ferroelectric ceramics, thermoelectrics, varistors, semiconductors, superconductors, fuel cells, batteries, fluorescence ceramics, diamagnetic and ferromagnetic ceramics, bioceramics. Processing techniques: sintering furnaces, powder processing, sol-gel processes, suspensions, thick and thin film technologies, physical vapour deposition, monocrystal growth, additive technology (3D complex ceramic printing).

mono kristalov, dodajalne tehnologije (3D tiskanje keramike kompleksnih oblik).	

Temeljna literatura in viri/Readings:

Barry, C. & Norton, M. G., 2007. Ceramic Materials: Science and Engineering. 2 nd Ed. Springer.
Boch, P. & Niepce, J. C., 2007: Ceramic Materials: Processes, Properties and Applications. Wiley.
Kingery, W. D., 2013: Introduction to Ceramics. Wiley.
Shackelford, J. F., 2015: Introduction to Materials Science for Engineers, 8th Ed. Pearson.
Aktualni znanstveni članki predvsem znotraj revij Journal of American Ceramic Society, Journal of European Ceramic Society in Ceramic International. / Relevant up to date scientific articles mainly related to Journal of American Ceramic Society, Journal of European Ceramic Society and Ceramic International.

Cilji in kompetence:	**Objectives and competences:**
Cilji: Slušatelj pridobi znanje s področja razvoja funkcijske keramike, sinteznih metod, s poudarkom na povezavi med procesi sintranja in razvojem mikrostrukture. Slušatelj razume povezavo med mikrostrukturo in končnimi tehnološkimi lastnostmi keramike. Kompetence: • Obvladovanje metod sinteze polikristalne keramike. • Razumevanje povezave med mikrostrukturo in končnimi uporabnimi lastnostmi funkcijske keramike. • Sposobnost uporabe različnih karakterizacijskih metod za interpretacijo mikrostrukturnih značilnosti tehnološko relevantne keramike. • Samostojno raziskovalno delo in uporaba znanj v praksi ter sposobnosti razumevanja najnovejših izsledkov na področju keramičnih materialov znotraj relevantnih znanstvenih publikacij.	Objectives: The student acquires knowledge in the field of functional ceramics, processing techniques, with the emphasis on the sintering procedure and the resulting microstructure evolution. The student understands the correlation between the ceramics microstructure and the resulting functional properties. Competencies: • Understanding of basic principles of polycrystalline ceramic synthesis. • Ability to correlate microstructure and final functional properties of polycrystalline ceramics. • Ability to use different characterization methods for interpreting the microstructural characteristics of technologically relevant ceramic materials. • Independent research work and the use of knowledge in practice and the ability to understand the latest findings in the field of ceramic materials within the relevant scientific publications.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent razume osnovne procesne tehnike keramičnih materialov, pridobi znanja, ki omogočajo razumevanje nastanka mikrostrukture v odvisnosti od izbrane sintezne tehnike. Študent zna povezati specifične fizikalno-kemijske lastnosti keramičnih materialov z njihovo ciljno tehnološko aplikacijo. Pridobi osnovna znanja za načrtovanje keramične komponente s sposobnostjo optimiranja procesnih parametrov na osnovi rezultirajoče mikrostrukture in končnih funkcijskih lastnosti.	The student understands the basic processing techniques of ceramic materials, acquires knowledge that enables understanding of the microstructure evolution, depending on the chosen processing techniques. The student can connect the specific physicochemical properties of ceramic materials with their target technological application. The student acquires basic knowledge for designing a ceramic component with the ability to optimise processing parameters, based on the resulting microstructure and final functional properties.

Metode poučevanja in učenja: **Learning and teaching methods:**

Predavanja, seminarske vaje in obisk relevantnega podjetja in raziskovalnih skupin, ki se ukvarjajo z razvojem sodobnih keramičnih materialov. Delo v laboratoriju in računalniški učilnici. V okviru predavanj študentje izdelajo seminarsko nalogo, ki jo javno predstavijo.	Lectures, practicals and visits to the relevant company and research groups engaged in the development of modern ceramic materials. Work in a laboratory and in a computer classroom. In the framework of lectures, students prepare a seminar work, which they publicly present.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit	75,00 %	Written and/or oral examination
Seminarska naloga	25,00 %	Seminar work

Reference nosilca/Lecturer's references:

- AKMEHMET, Guliz Inan, **ŠTURM, Sašo**, BOCHER, Laura, KOCIAK, Mathhieu, AMBROŽIČ, Bojan, OW-YANG, Cleva. Structure and luminescence in long persistence Eu, Dy, and B codoped strontium aluminate phosphors : the boron effect. *Journal of the American Ceramic Society*, ISSN 0002-7820, 2016, vol. 99, iss. 6, str. 2175-2180, doi: 10.1111/jace.14188. [COBISS.SI-ID 29341479].
- CORAPCIOGLU, Gulcan, GÜLGÜN, Mehmet Ali, KISSLINGER, Kim, **ŠTURM, Sašo**, JHA, Shikhar K., RAJ, Rishi. Microstructure and microchemistry of flash sintered K0.5Na0.5NbO3K0.5Na0.5NbO3. *Journal of the Ceramic Society of Japan*, ISSN 1882-0743, 2016, vol. 124, no. 4, str. 321-328, doi: 10.2109/jcersj2.15290. [COBISS.SI-ID 29474855].
- **ŠTURM, Sašo**, BENČAN, Andreja, GÜLGÜN, Mehmet Ali, MALIČ, Barbara, KOSEC, Marija. Determining the stoichiometry of (K,Na)NbO3(K,Na)NbO3 using optimized energy-dispersive X-ray spectroscopy and electron energy-loss spectroscopy analyses in a transmission electron microscope. *Journal of the American Ceramic Society*, ISSN 0002-7820, 2011, vol. 94, issue 8, str. 2633-2639, doi: 10.1111/j.1551-2916.2011.04389.x. [COBISS.SI-ID 24733735].
- GAJOVIĆ, Andreja, **ŠTURM, Sašo**, JANČAR, Boštjan, ŠANTIĆ, Ana, ŽAGAR, Kristina, ČEH, Miran. The synthesis of pure-phase bismuth ferrite in the Bi-Fe-O system under hydrothermal conditions without a mineralizer. *Journal of the American Ceramic Society*, ISSN 0002-7820, 2010, vol. 93, no. 10, str. 3173-3179. [COBISS.SI-ID 24234791].
- **ŠTURM, Sašo**, ČEH, Miran. Atomic-scale structural and compositional analyses of Ruddlesden-Popper planarfaults in AO-excess SrTiO3SrTiO3 (A=Sr2+(A=Sr2+, Ca2+Ca2+, Ba2+)Ba2+) ceramics. *Journal of materials research*, ISSN 0884-2914, 2009, vol. 24, no. 8, str. 2596-2604. [COBISS.SI-ID 22789927].
- SKRLJ GOLOB, Barbara, OLIVI, Giovanni, **VRABEC, Mirijam**, EL FEGHALI, Rita, PARKER, Steven, BENEDICENTI, Stefano. Efficacy of photon-induced photoacoustic streaming in the reduction of Enterococcus faecalis within the root canal : different settings and different sodium hypochlorite concentrations. *Journal of endodontics*, ISSN 0099-2399, 2017, vol. 43, iss. 10, str. 1730-1735, doi: 10.1016/j.joen.2017.05.019. [COBISS.SI-ID 1350238].
- LESKOVAR, Blaž, **VRABEC, Mirijam**, DOLENEC, Matej, NAGLIČ, Iztok, DOLENEC, Tadej, DERVARIČ, Evgen, MARKOLI, Boštjan. Temperature-initiated structural changes in FeS[sub]2 pyrite from Pohorje, Eastern Alps, North-Eastern Slovenia = S temperaturo povzročene strukturne spremembe FeS[spodaj]2 pirita iz Pohorja, vzhodne Alpe, severovzhodna Slovenija. *Materiali in tehnologije*, ISSN 1580-2949. [Tiskana izd.], 2017, letn. 51, št. 2, str. 259-265, ilustr. http://mit.imt.si/Revija/izvodi/mit172/leskovar.pdf, doi: 10.17222/mit.2015.328. [COBISS.SI-ID 1298602].
- **VRABEC, Mirijam**, JANÁK, Marian, FROITZHEIM, Nikolaus, DE HOOG, J.C.M. Phase relations during peak metamorphism and decompression of the UHP kyanite eclogites, Pohorje Mountains (Eastern Alps, Slovenia). *Lithos*, ISSN 0024-4937, 2012, vol. 144-145, str. 40-55, doi: dx.doi.org/10.1016/j.lithos.2012.04.004. [COBISS.SI-ID 962142].

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Zaščita in upravljanje podzemnih voda
Course title:	Protection and Management of Groundwater Resources
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Aplikativna geologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562403
Koda učne enote na članici/UL Member course code:	722

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	45	0	0	0	75	5

Nosilec predmeta/Lecturer:	Barbara Čenčur Curk
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Znanje hidrogeologije.	Knowledge of Hydrogeology.

Vsebina:	Content (Syllabus outline):
Uvod: vodni viri in podzemne vode Pregled evropske in slovenske zakonodaje s področja zaščite in upravljanja podzemnih voda Upravljanje s podzemno vodo (okoljski cilji, varstvo voda, tveganje, raba voda, urejanje voda, načrt upravljanja, program ukrepov) Onesnaženje podzemne vode (specifični viri, vrste onesnaževal) Metodologija ocenjevanja vplivov na podzemne vode Ranljivost in ogroženost podzemne vode Zaščita vodnih virov Zaščita virov pitne vode - vodovarstvena območja Zaščita podzemne vode pri umetnem bogatenju Zaščita podzemne vode pri posebnih rabah (proizvodnja mineralnih vod, geotermalna raba) Analiza tveganja za onesnaženje podzemne vode z nevarnimi snovmi Načrtovanje ukrepov za zaščito podzemne vode Nadzor stanja okolja (monitoring podzemnih voda) Postopki sanacije	Introduction: water resources and groundwater Review of the European and Slovenian legislation in the field of groundwater protection and management The management of groundwater (environmental objectives, water protection, risk, use of water, water management, management plan, program of measures) Pollution of groundwater (specific sources, types of pollutants) Methodology for Assessing Impacts on groundwater Vulnerability and threat to groundwater Protection of water resources Protection of drinking water - water protection areas Protection of groundwater for artificial recharge Protection of groundwater for special uses (production of mineral water, geothermal use) Analysis of the risk of groundwater polution with dangerous substances Design of measures to protect groundwater Monitoring of the environment (groundwater monitoring) Procedures for remediation

Temeljna literatura in viri/Readings:

LOUCKS, D. P., van BEEKWATER, E., 2005, Water Resources Systems Planning and Management, An Introduction to Methods, Models and Applications, UNESCO Publishing, 676 p.
USDA, 2007, Technical Guide to Managing Ground Water Resources, United States Department of Agriculture, Forest Service, Minerals and Geology Management, Watershed, Fish, Wildlife, Air, and Rare Plants Engineering, FS-881, 281 p.
LÜKENGA, W., 2015, Water Resource management, bookboon.com, 282 p.
European Commission, 2007, Common implementation strategy for the Water framework directive (2000/60/EC), Guidance on Groundwater in Drinking Water Protected Areas, Guidance Document No. 16, Office for Official Publications of the European Communities, 34 p.
European Commission, 2010, Common implementation strategy for the Water framework directive (2000/60/EC Guidance on risk assessment and the use of conceptual models for groundwater, Guidance document No. 26, Office for Official Publications of the European Communities, 67 p.
European Commission, 2008, Groundwater Protection in Europe, Office for Official Publications of the European Communities, 35 p.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Študenta seznaniti z konceptom zaščite podzemne vode in vodnih virov pitne vode pred negativnimi vplivi povzročenimi s strani človekovih in drugih aktivnosti. KOMPETENCE: Študent bo sposoben samostojno načrtovati zaščitne ukrepe za preprečitev onesnaženja podzemne vode in virov pitne vode.	OBJECTIVES: Students acquainted with the concept of groundwater and drinking water sources protection from the negative effects caused by human and other activity. COMPETENCES: Students will be able to independently design protection measures to prevent pollution of groundwater and drinking water sources.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Pridobljeno temeljito poznavanje zaščite in upravljanja s podzemno vodo in drugih virov pitne vode.	Acquired a thorough knowledge of the protection and management of groundwater and other sources of drinking water.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in seminar (30 in 15 ur) z uporabo prezentacij. Vaje potekajo kot vodene seminarske vaje (30 ur).	Lectures and seminar (30 and 15 hours) by using presentations. Rehearsals will take place as tutorials (30 hours).

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit: teoretična vprašanja	45,00 %	Written and/or oral exam: theoretical questions
Seminarske vaje: predstavitev (15%) + seminar (35%)	50,00 %	Tutorial: presentation (15%) + seminar (35%)
Prisotnost na predavanjih in vajah	5,00 %	The presence at lectures and tutorials
Pogoji za pristop k izpitu: vsaj 75% prisotnost na predavanjih in vajah in pozitivno opravljene seminarske vaje (predstavitev in seminar). Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		Conditions for the exam: at least 75% attendance at lectures and tutorials and successfully done tutorials (presentations and seminar). Grading scale: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) having regard to the Statute of UL and faculty rules.

Reference nosilca/Lecturer's references:

SOUVENT, Petra, VIŽINTIN, Goran, CELARC, Sašo, ČENČUR CURK, Barbara. Ekspertni sistem za podporo odločanju na aluvialnih telesih podzemnih voda Slovenije = An expert system as a support to the decision making process for groundwater management of alluvial groundwater bodies in Slovenia. Geologija, 2014, vol. 57/2, str. 245-250, doi: 10.5474/geologija.2014.021.
ČENČUR CURK, Barbara, BOGARDI, I. WP7 Final report: [Water supply managment measures]. V: STEVANOVIĆ, Zoran (ur.), RISTIĆ, Vesna (ur.), MILANOVIĆ, Saša (ur.). Klimatske promene i njihov uticaj na vodosnabdevanje = Climate Change and Impacts on Water Supply. Beograd: Rudarsko-geolološki fakultet, Departman za hidrogeologiju: = Faculty of Mining & Geology, Department of Hydrogeology, 2012, str. 417-467.

VIŽINTIN, Goran, SOUVENT, Petra, VESELIČ, Miran, ČENČUR CURK, Barbara. Determination of urban groundwater pollution in alluvial aquifer using linked process models considering urban water cycle. Journal of Hydrology, 2009, vol. 377, str. 261-273, doi: 10.1016/j.jhydrol.2009.08.025.

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Zgodovina življenja
Course title:	History of Life
Članica nosilka/UL Member:	UL NTF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri
Geologija, druga stopnja, magistrski	Regionalna geologija in paleontologija (modul)	1. letnik, 2. letnik	1. semester

Univerzitetna koda predmeta/University course code:	0562383
Koda učne enote na članici/UL Member course code:	755

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
45	30	0	0	0	75	5

Nosilec predmeta/Lecturer:	Luka Gale
Vrsta predmeta/Course type:	Izbirni/Elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Osnovno znanje geologije, paleotnologije in/ali biologije.	Basic knowledge in Geology, Paleontology and/or Biology.

Vsebina:	Content (Syllabus outline):
- Geološki vzroki evolucijksih dogodkov (tektonski, klimatski, okoljski, biogeokemični), - Življenje na spreminjajoči se Zemlji, tektonika plošč, klima in življenje, - Pojav in trajnost življenja, najstarejše celice, evolucija atmosfere, - Prvi metazoji, - Evolucija živali, - Spol/reprodukcija, - Prvi vretenčarji, - Prehod na kopno, - Vzporednost rastlinske in animalne evolucije, - Razvoj čeljusti, - Razvoj lokomocije, - Termoregulacija, - Dinozavri, - Ponovna vrnitev v morje, - Evolucija letenja, - Evolucija sesalcev, - Množična izumiranja	- Geological causes for evolutionary events (tectonic, climatic, environmental, biogeochemical), - Life on ever changing Earth, plate tectonics, climate and life, - Origin and durability of life, oldest cells, evolution of the atmosphere, - First metazoans, - Animal evolution, - Gender/reproduction, - First vertebrates, - Transition to land, - Parallels in plant and animal evolution, - Evolution of jaw, - Evolution of locomotion, - Termoregulation, - Dinosaurs, - Transition back to sea, - Evolution of flight, - Evolution of mammals, - Mass extinctions

Temeljna literatura in viri/Readings:

- COWEN, R., 1995, History of Life, Blackwell Science, 462 pp.
- COCKELL, C., 2008, An introduction to the Life-Earth system, Cambridge Uni. Press, 319 pp.

Cilji in kompetence:	**Objectives and competences:**
CILJI: Vsebina predmeta je povezana z razlagami kako in zakaj se je življenje kronološko razvijalo na Zemlji. Predmet bo obravnaval vse ključne evolucijske dogodke v Zemljini zgodovini, njihove kontraverznosti in vzroke zanje (tektonske, klimatološke, okoljske, biokemične) iz zgodovinske, t.j. paleontološke perspektive. KOMPETENCE: Slušatelj bo usposobljen razumevanja evolucijskih dogodkov v zgodovini življenja, paleoekoloških in okoljskih vzrokov zanje ter časovno kontrole evolucijskih sprememb.	OBJECTIVES: The objectives of the course are to show the how and why of the evolution on Earth through time. The course covers key evolutionary events, contraversions and causes for these events (tectonic, climate, environmental, biochemical) from historical, i.e. paleontological perspective. COMPETENCES: Students will be able to understand evolutionary events in the history of life, palaeoecological and evnironmental causes for them and timing og evolutionary changes.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Slušatelj bo spoznal ključne evolucijske dogodke iz fosilnega zapisa v Zemljini zgodovini, njihove kontraverznosti in vzroke (tektonske, klimatološke, okoljske, biokemične) zanje.	Students will get to know key evolutionary events from the fossil record, its contraversions and causes for these events (tectonic, climate, environmental, biochemical).

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja z uporabo prezentacij, vodena seminarska naloga iz izbrane literaturne tematike.	Lectures through the use of power-point presentations, supervised seminar work from selected topics.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni in/ali ustni izpit: teoretična vprašanja	100,00 %	Written and/or oral exam: theoretical questions
Za pozitivno oceno mora kandidat doseči ali preseči 50% vseh možnih točk. Ocenjevalna lestvica: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) ob upoštevanju Statuta UL in fakultetnih pravil.		For positive marks, student has to get at least 50% of possible points. Grades: 51-60% (6); 61-70% (7); 71-80% (8); 81-90% (9); 91-100% (10) taking into account UL statute and faculty rules.

Reference nosilca/Lecturer's references:

GALE, Luka, KELEMEN, Matej. Early Jurassic foraminiferal assemblages in platform carbonates of Mt. Krim, central Slovenia. Geologija, 2017, vol. 60, no. 1, str. 99-115, doi: 10.5474/geologija.2017.008.
GALE, Luka, NOVAK, Uroš, KOLAR-JURKOVŠEK, Tea, KRIŽNAR, Matija, STARE, France. Characterization of silicified fossil assemblage from upper Carnian Amphiclina beds at Crngrob (central Slovenia). Geologija, 2017, vol. 60, no. 1, str. 61-75, doi: 10.5474/geologija.2017.005.
GALE, Luka, SKABERNE, Dragomir, PEYBERNES, Camille, MARTINI, Rossana, ČAR, Jože, ROŽIČ, Boštjan. Carnian reefal blocks in the Slovenian Basin, eastern Southern Alps. Facies, 2016, vol. 62, no. 4, str. 1-15, doi: 10.1007/s10347-016-0474-8.