

UČNI NAČRT PREDMETA/COURSE SYLLABUS

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| Predmet: | Petrogeneza magmatskih in metamorfnih kamnin |
| Course title: | Petrogenesis of Igneous and Metamorphic Rocks |

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

Univerzitetna koda predmeta/University course code:

| 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:

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

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

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.

Prerequisites:

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:

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 metamorfih kamninah, termodinamika mineralov in fazna ravnotežja v metamorfih kamninah, mineralna kemija metamorfih kamnin, metamorfni kristalizacijski mehanizmi,

Content (Syllabus outline):

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
METAMORPHIC ROCKS:
chemical reactions and chemical kinetics in metamorphic rocks, mineral thermodynamics and phase equilibrium in metamorphic rocks, mineral chemistry of metamorphic rocks, metamorphic crystallization mechanisms,

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| <p>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</p> <p>VAJE:</p> <p>makroskopsko in mikroskopsko prepoznavanje različnih vrst magmatskih in metamorfnih kamnin (tudi hidrotermalno spremenjenih) ter uporaba različnih diagramov in računalniških programov za njihovo klasifikacijo in za frakcionirano kristalizacijo</p> | <p>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</p> <p>TUTORIALS:</p> <p>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</p> |
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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:

CILJI: Študent se seznanja 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 metamorfnih kamnin. S študijem »pseudosekcij« in sodobnih geotermobarometričnih kalibracijskih modelov se usposobi za izračun in modeliranje metamorfnih pogojev, ki so jim bile kamnine izpostavljene. Zna interpretirati nastanek in izvor kamnin.

Objectives and competences:

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, thermometry 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 metamorphic 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:

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

Intended learning outcomes:

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

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| 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. | 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. |
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| 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: |
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| ocena vaj ter seminarja | 50,00 % | exercises and seminar |
| ocena teoretičnega dela - pisni izpit | 50,00 % | theoretical part - written 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, 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.