

РЕЗЮМЕТА НА ПУБЛИКАЦИИТЕ НА
Д-Р МОМЧИЛ МИЛЧЕВ ДЮЛГЕРОВ,
ПРЕДСТАВЕНИ В КОНКУРСА ЗА ЗАЕМАНЕ
ДЪЛЖНОСТ „ДОЦЕНТ” ПО ПРОФЕСИОНАЛНО НАПРАВЛЕНИЕ 4.4 НАУКИ ЗА
ЗЕМЯТА (МАГМЕНА ПЕТРОЛОГИЯ)

A. ПУБЛИКАЦИИ В НАУЧНИ СПИСАНИЯ

A1. Статии в чуждестранни списания с импакт фактор

1. **Dyulgerov, M., Platevoet, B.** 2013. In situ differentiation and evolution of potassic syenites from Svidnya, Bulgaria. *Mineralogy and Petrology*, 107, 6, 971-984.

Abstract. Potassic syenites from Svidnya, Bulgaria, crop out as small bodies, plugs and dykes. The primary for this intrusion liquid has basic to intermediate composition, as despite its small amount the magma underwent extreme differentiation. The evolution in a small closed magma chamber created plutonic rocks ranging from basic (melasyenite) to acid (granite) and from metaluminous to peralkaline. The most mafic varieties show cumulative textures typical for orthocumulates, as cumulus phases are clinopyroxene, biotite, apatite and potassium feldspar. In the middle stratigraphic level of biggest body observes modal igneous layering with development of dark (clinopyroxene + amphibole) and light (potassium feldspar) laminae. The shape and dimensions of magma chamber predetermined intensive convection in the early stages of evolution, which rather enhanced separation of residual liquid from the crystal pile. Gravitational settling of heavy phases is a viable process for separation of particles in the bottom parts of magma chamber and the creation of mafic cumulates. Oscillatory crystallization around eutectic point resulted in cyclic separation of mafic and felsic phases in repetitive layers. Fractionation of Ca and Al rich phases – clinopyroxene, biotite, and potassium feldspar created peralkaline residual liquid strongly enriched in HFS elements.

2. **Dyulgerov, M., Ovtcharova-Schaltegger, M., Ulianov, A., Schaltegger, U.** 2018. Timing of K-alkaline magmatism in the Balkan segment of southeast European Variscan edifice: ID-TIMS and LA-ICP-MS study. *International Journal of Earth Sciences*, 107, 1175-1192.

Abstract. The Variscan orogen in southeast Europe is exposed in isolated remnants, affected by a subsequent Alpine tectono-magmatic overprint. Unlike the central European Variscides, in SE Europe the juxtaposition and correlation of the events and products is impeded by the scarcity of Variscan domains with preserved magmatic, metamorphic, sedimentological and structural characteristics. In order to reveal the particular evolution of the Variscan orogen in Balkan Mts, we present the results of ID-TIMS and LA ICP-MS dating of three potassic-alkaline intrusions: Svidnya, Buhovo-Seslavtsi and Shipka. The age determinations from the plutons do not permit to establish their unequivocal ages, but they bracket the time interval of emplacements. Based on geochronological, tectonic and stratigraphic evidence the emplacement interval for plutons could be: 317 – 310 Ma for Svidnya, 330 – 310 Ma for Buhovo-Seslavtsi and 320 – 303 Ma for Shipka. These results show that the generation of potassic-alkaline magmas was post-Visean and is contemporaneous with the adjacent numerous calc-alkaline granitoid plutons. Thus, the Variscan orogen in the Balkan Mts is not characterized by a time-dependent geochemical evolution of magma generation. Hence, the

observed differences in the rocks' compositions can be interpreted solely by distinction between the magma sources. The available data for both potassic-alkaline and calc-alkaline rocks indicate that the major episodes of crustal stacking and shearing in the Balkan part of the Variscan edifice are pre-Viséan (~330Ma). The present study reveals that the potassic-alkaline rocks from the Balkan Mts are younger than the central European potassic granitoids (durbachites). It suggests that melting of enriched mantle source took place at different times throughout the Variscan orogen. In spite of the alkaline character of the magmas, the studied zircons show a complex nature, with inherited cores and magmatic overgrowths. The observed heterogeneities in the zircons imply the presence of much older materials in the petrogenesis of the rocks from the potassic-alkaline plutons.

3. Dyulgerov, M., Oberti, R., Platevoet, B., Kadiyski, M., Rusanov, V. 2018. Potassic-magnesio-arfvedsonite – $\text{KNa}_2(\text{MgFe}^{2+}\text{Fe}^{3+})_5\text{Si}_8\text{O}_{22}(\text{OH})_2$: mineral description and crystal chemistry. *Mineralogical Magazine*, 1-19, doi: 10.1180/mgm.2018.135.

Abstract. The complete mineral description of potassic-magnesio-arfvedsonite, a recently approved (IMA-CNMNC 2016-083) new species of the amphibole supergroup is provided using electron microprobe and LA-ICP-MS analysis, single-crystal structure refinement, Mössbauer and Raman spectroscopy as well as measurement of optical and physical properties. The holotype material was found in syenitic and granitic dyke rocks in association with quartz, potassium feldspar and aegirine-augite from the Buhovo-Seslavtsi pluton (Bulgaria). Potassic-magnesio-arfvedsonite is monoclinic $C2/m$, with unit-cell parameters: $a = 9.9804(11)$, $b = 18.0127(19)$, $c = 5.2971(6)$ Å, $\beta = 104.341(2)^\circ$, $V = 922.61$ Å³. In transmitted plane-polarized light ($\lambda = 590$ cm⁻¹), potassic-magnesio-arfvedsonite is pleochroic (X yellow pale-green, Y green, Z dark-violet brown). It is biaxial (-), $\alpha = 1.645(2)$, $\beta = 1.655(2)$, $\gamma = 1.660(2)$ and $2V$ (meas): 70° . The empirical unit formula obtained from EMP analysis and structure refinement is $^A(\text{K}_{0.86}\text{Na}_{0.08})_{0.94}$ $^B(\text{Na}_{1.74}\text{Ca}_{0.25}\text{Mn}^{2+}_{0.01})_{2.00}$ $^C(\text{Mg}_{2.67}\text{Fe}^{2+}_{1.42}\text{Fe}^{3+}_{0.76}\text{Ti}_{0.12}\text{Mn}^{2+}_{0.03})_{5.00}$ $^T\text{Si}_8\text{O}_{22}$ $^W(\text{OH}_{1.58}\text{F}_{0.22}\text{O}_{0.20})_{2.00}$. The $\text{Fe}^{3+}/\text{Fe}_{\text{tot}}$ ratio (0.35) is coherent with both the Mössbauer spectra and the single-crystal structure refinement. The 10 strongest X-ray powder reflections [d values (in Å), I , (hkl)] are: 8.519, 80.5, (110); 3.402, 67.3, (131); 3.295, 41.0, (240); 3.173, 65.0, (310); 2.752, 35.6, ($\bar{3}31$); 2.715, 100.0 (151); 2.591, 44.1, (061); 2.542, 73.2, ($\bar{2}02$); 2.348, 38.5, ($\bar{3}51$); 2.174, 42.0, (261). Potassic-magnesio-arfvedsonite is the product of strongly peralkaline and potassic (perpotassic) magma compositions. Trace-elements analysis shows that this amphibole did not exert significant control on trace elements distribution in the crystallizing peralkaline magma.

4. Ivanov, V., Dyulgerov, M., Oberti, R. 2018. Polarized Raman spectroscopy and lattice dynamics of potassic-magnesio-arfvedsonite. *Physics and Chemistry of Minerals*, doi.org/10.1007/s00269-018-0996-4.

Abstract. We report for the first time polarized Raman spectra from potassic-magnesio-arfvedsonite obtained in all informative scattering configurations from oriented crystals. On the basis of polarization selection rules the observed vibrational modes are unequivocally classified by symmetry as A_g or B_g . The experimental Raman spectra are compared with the results of theoretical calculations based on a shell-model force-field and a bond-polarizability model. The simulated partial Raman spectra allow to assign the low-frequency Raman bands to specific

metal-oxygen bonds as well as Si-O vibration modes. In particular, we established clear Raman signatures for the presence of Fe³⁺ at 467, 540 and 589 cm⁻¹, which could be observed also in other trivalent iron bearing amphiboles. The calculated OH stretching frequencies are in a much narrower interval (3682 – 3706 cm⁻¹) than the experimentally observed (3659 – 3709 cm⁻¹).

A2. Статии в български списания без импакт фактор

5. Dyulgerov, M., Platevoet, B., 2009. Comparative mineralogical study of mafic minerals from Variscan potassic-alkaline rocks in Stara Planina Mountains, Bulgaria. *Списание на БГД*, 70, 47-62.

Abstract. Three potassic-alkaline intermediate and oversaturated plutons are exposed in Stara planina Mountains, Bulgaria. They consist of monzonitic and syenitic varieties, which evolve toward peralkaline residue. In peralkaline rocks calcic amphiboles, calcic pyroxenes and biotite become instable, and are replaced by sodic-calcic and sodic pyroxenes and amphiboles. In the three complexes mafic silicates present different trends of evolution, reflecting the different fO₂ conditions and the different whole-rock chemistry. Oxidizing conditions (above NNO buffer) favour crystallization of pyroxenes with high X_{Mg} (Svidnya), whereas more reducing conditions in Shipka (between NNO and QFM buffers) result in crystallization of essentially Fe²⁺+Mn enriched pyroxenes. Under agpaitic conditions the pyroxenes contain significant amounts of Ti and Zr. No simple relations explain the repartition of Ti and Zr into pyroxene structure and complex substitutions could be deduced. Amphiboles from Svidnya and Buhovo-Seslavtsi cover the whole spectrum from calcic to sodic varieties and during the evolution they preserve their magnesium character. The whole rock chemistry controls the composition of crystallizing amphiboles, thus resulting complete [A]-site filling by K in Buhovo-Seslavtsi magnesio-arfvedsonite and increasing Na content in same in Svidnya sodic amphiboles.

6. Dyulgerov, M., I. Peytcheva, R. Nedyalkov, A. von Quadt. 2010. Characteristic of Variscan granitoid magmatism in Tran region, Bulgaria. *Списание на БГД*, 71, 52 – 69.

Abstract. Two Variscan granitoid plutons crop out in the Kraishite zone, Western Bulgaria: Lutskan and Ruy. Ruy is relatively homogenous two phase body and it is built up by monzogranite and aplitic leucogranite, with a strong metasomatic alteration overprinted on the leucogranite. Lutskan pluton is complex, with several facial varieties. Monzogranite is the most voluminous, granodiorite and leucocrate species have only local occurrences. The plutonic rocks in Lutskan are followed by the dyke activity with syenite and granite composition. Presence of mafic microgranular enclaves and mafic dykes that intrude the granitoids of Lutskan pluton attests for synchronous generation of more mafic magma. The granitoids from both plutons are I - type, have metaluminous character and linear tendency of evolution of major oxides. The dykes from Lutskan pluton have pronounced potassic character and some of them present peralkaline chemistry. The rocks from Lutskan and Ruy plutons show significant incompatible trace elements enrichment and notably Sr, Rb, Ba, Th and U. The rocks were generated from enriched source in postcollisional geodynamic setting.

7. **Dyulgerov, M.** 2011. Potassic syenite from Shipka, Central Balkan Mts, Bulgaria: characterization and insight into the source, *Geologica Balcanica*, 40, 3-12.

Abstract. Petrographic, mineralogical and whole-rock chemistry data for a new outcrop of peralkaline potassic syenite with presumed Variscan age near Shipka town are presented here. The syenites exhibit peralkaline chemistry and very potassic character which markedly differs from nearby situated potassic monzonites, known as Shipka pluton. In spite the close spatial association of these the two bodies, genetic link between them hardly can be supposed. The syenites are composed of K-feldspar, diopside, mica and late interstitial amphibole. Mineral composition reflects the agpaite conditions of crystallization with formation of sodic amphibole and K-feldspars with important Sr and Ba content. The rocks have peralkaline whole-rock chemistry, very high potassic content and extreme enrichment in LILE, LREE, Th and U. Their trace element signature and isotope characteristics are in favour of derivation from metasomatically enriched mantle source.

Б. СТАТИИ В ПОРЕДИЦА

8. Милованов, П., Йорданов, Б., Попов, А., Маринова, Р., Герджиков, Ял, **Дюлгеров, М.** 2011. Обяснителна записка към геоложката карта на Република България М 1 : 50 000, картен лист Перник. *Геоложка карта на Република България М 1:50 000*, редактори: Саров, С., М. Антонов.

Абстракт. Геоложката карта е съставена по Проект 425/20.07.2004 г. на Министерството на околната среда и водите за съставяне на държавна геоложка карта на Република България в М 1:50 000, като е част от задачата “*Геоложко прекартиране в М 1:50 000 на части от Западна Стара планина, Трънско Краище, Западно Средногорие и Софийската котловина*” с ръководител М. Антонов. Материалите от цялостното изпълнение на задачата са обобщени в геоложки доклад (Антонов и др., 2010ф), който се съхранява в Националния геофонд при Министерството на околната среда и водите. Полевите работи върху Витошкия и Плански плутони са проведени през втората половина на 2009 г. от М. Дюлгеров. Описанието на скалните разновидности и техните особености са извършени чрез теренни и микроскопски наблюдения. Обобщена е наличната литература относно химичните особености на двата плутона.

9. Антонов, М., Милованов, П., Попов, А., Бонев, К., **Дюлгеров, М.**, Маринова, Р., Саров, С. 2011. Обяснителна записка към геоложка карта на република България М 1:50 000, картен лист София-Юг. *Геоложка карта на Република България М 1:50 000*, редактори: Саров, С., М. Антонов.

Абстракт. Геоложката карта на картен лист София-Юг е изработена по Проект 425/20.07.2004 г. на Министерството на околната среда и водите за съставяне на държавна Геоложка карта на Република България в М 1:50 000, като част от задачата: „Геоложко прекартиране в М 1:50 000 на части от Западна Стара планина, Трънско Краище, Западно Средногорие и Софийска котловина”. Материалите от цялостното изпълнение на задачата са обобщени в геоложки доклад (Антонов и др., 2010ф), който се съхранява в Националния геофонд при Министерството на околната среда и водите. Полевите работи върху Витошкия и Плански плутони са проведени през втората половина на 2009 г. от М. Дюлгеров. Описанието на скалните разновидности и техните особености са извършени

чрез теренни и микроскопски наблюдения

В. РАЗШИРЕНИ РЕЗЮМЕТА

10. Dyulgerov, M., I. Peytcheva, A. v Quadt, R. Nedyalkov. 2006. Source and age heterogeneities between the rocks of Lutzkan pluton. *Геонауки 2006, София*.177-180,

Abstract. The diorites and granitoides of Lutzkan pluton reveal different ages and distinct geochemical features. The diorites are Cambrian in age (537 ± 1.7 Ma) and can be correlated with the rocks of Struma Diorite Formation/Struma Unit (Lilov, 1981; Graf et al., 1998; Quadt et al., 2000; Kunov, 2003), which are exposed wider south of the Trun region. The diorites show ϵ_{Hf} -zircon values between +8.9 and +12.4. They have flat HREE distribution, Nb-Ta and Ti negative anomalies, calc-alkaline affinity and slightly enrichment in LILE and LREE. All these features are consistent with a subduction-related geodynamic setting. Isotope and geochemical signature suggest a generation of magma in a subcontinental mantle lithosphere, which was enriched in LILE resulting from subduction related slab dehydration.

The granitoids are Variscan in age (334.1 ± 1.2) Ma and collision- or post-collision related. They present elevated LILE/HFSE ratios, a fractionated trend of REE, important content of Th, U, K, and isotropic fabrics. The ϵ_{Hf} -zircon isotope signature of granitoides indicates an important role of crustal material in the magma generation. Geochemical characteristics of the granitoids imply melting of crustal materials with mixed crust-mantle origin. Subordinate input of mantle components could explain the similarity in the distribution of some trace elements with the diorites, as well as the presence of MME and the chemical heterogeneity of the rocks

11. Peytcheva, I., A. von Quadt, M. Dyulgerov, R. Nedyalkov. 2011. Age and source constraints on granitoid magmatism hosting Au–Ag \pm W mineralisation at Lutzkan and Ruy plutons, Bulgaria. *Proceedings of the Eleventh Biennial SGA Meeting Antofagasta, Chile*, 121-123.

Abstract. The Lutzkan magmatic complex (Lutzkan and Ruy plutons) in W Bulgaria hosts Au–Ag \pm W mineralisation of economic interest. The granitoids are I-type, calc-alkaline, mainly metaluminous in composition, fairly enriched in K, Rb, Ba, Cs, Sr, U, Th and LREE. Estimation of intensive variables (T, P) yields <8 km level of magma emplacement. The granitoids are dated by ID-TIMS U-Pb method at 334.1 ± 1.2 Ma (titanites) and 332.57 ± 0.60 Ma (zircons), applying the “chemical abrasion” technique and the double spike solutions ET2535. \square_{Hf} zircon values of +3 and -10 define crustal-dominated source of the magma. The geochemical characteristics and zircon inheritance imply melting of lower-middle crustal materials with mixed crust-mantle origin, and the basement 588.3 ± 1.6 Ma old metagranitoids are a possible candidate (\square_{Hf} between +6 and +11 at time of formation and +0.5 to +5.5 at 330 Ma). The gabbro-diorites of the Lutzkan pluton belong to the basement units with their Cambrian age 537 ± 1.6 Ma and mantle-dominated island-arc geochemical characteristics. Two sampled vein rocks in the Ruy pluton show striking geochemical characteristics and Eocene age.

Г. КРАТКИ РЕЗЮМЕТА

12. **Dyulgerov, M.** 2003. Comparative mineralogical study on pyroxenes and amphiboles from Variscan potassic-alkaline magmatism in Stara Planina Mts., Bulgaria. *Геонауки 2003*, София, 27-29.

Abstract. The evolution of pyroxenes in Buhovo-Seslavytzi, Svidnya is very similar in the both complexes. The evolution ends with the separation of almost pure aegirine. Lack of significant hedenbergite enrichment coupled with the dominance of Mg-NAT over Fe-NAT component in pyroxenes from Buhovo-Seslavytzi and Svidnya is an evidence for crystallization at relatively oxidizing conditions. Amphiboles in Buhovo-Seslavytzi complex show broad diversity in their composition. Several groups of amphiboles are present: calcic, sodic-calcic and sodic amphiboles. Amphiboles from Svidnya complex present narrow compositional variation from richterites to magnesio-arfvedsonite, rarely eckermanite. During the evolution amphiboles preserve their high mg# and the amphibole trend resembles those established in some undersaturated alkaline complexes. Thus the magnesian character seems independent of silica saturation of the magma and it is mostly related to conditions of crystallizations—especially T and fO₂.

13. **Дюлгеров, М.** 2004. Шипченски плутон – минераложки и петрохимични особености. *Минерогенезис – 2004. Научна сесия в чест на 90-годишния юбилей на академик Иван Костов*, Софийски Университет „Св. Климент Охридски”, 34-35.

Abstract. Шипченският плутон е изграден от оливинови монцонити, клинопироксен – биотитови монцодиорити и монцонити, амфиболови монцосиенити, амфиболови кварцсиенити до левкварцсиенити. Плутонът е изключително хетерогенен с много рязка смяна на фащиалните разновидности. Много и различни типове дайки придружават внедряването на интрузивното тяло: лампрофири, сиенитпорфири, пералкални сиенитпорфири, албитофири. La_N/Lu_N за интрузивните скали е в рамките на 10–15 и е указание, че източника на този тип магматизъм по всяка вероятност е шпинел–сдържаща мантия, набогатена на L.I.L. елементи по време на (?)орогенни процеси.

14. **Dyulgerov, M., B. Platevoet, U. Schaltegger.** 2007. Variscan potassic-alkaline magmatism in Stara planina, Bulgaria – composition, source and geodynamic significance. *Conference Abstract Goldschmidt, Cologne*, 247.

Abstract. Preliminary isotopic results show that the rocks have isotopic signature plotting in the enriched quadrant of Sr-Nd systematic. ⁸⁷Sr/⁸⁶Sr and ¹⁴³Nd/¹⁴⁴Nd for Svidnya pluton are 0.709 – 0.712 and 0.51192 – 0.51194 respectively. For Buhovo-Seslavytzi ⁸⁷Sr/⁸⁶Sr is 0.709 and ¹⁴³Nd/¹⁴⁴Nd is 0.51191 – 0.51188, coupled with εHf from -3.8 to -5.2. Concordant with the moderate enrichment in incompatible elements Shipka pluton shows less enriched composition: ⁸⁷Sr/⁸⁶Sr is 0.705 and ¹⁴³Nd/¹⁴⁴Nd is between 0.51215 and 0.51217.

15. **Dyulgerov, M.** 2008. New manifestation of the intrusive K-alkaline Variscan magmatism from Shipka, Stara planina Mts., Bulgaria. *Proceedings of Geosciences 2008*, Sofia, 43-44.

Abstract. New manifestation of K-alkaline magmatism was discovered in quarry 3 km NW from the town of Shipkap near river Golyama Varovita. The rocks are syenite and composed of K-feldspar (65 %), mica (20 %), pyroxene (7 %) and sodic amphibole (6 %); apatite and zircon are abundant accessories. The rocks show extreme enrichment in LIL and HFS elements. Preliminary isotopic results (time-corrected: 320 Ma) show that syenites characterise with $^{87}\text{Sr}/^{86}\text{Sr}$ - 0.708 and $^{143}\text{Nd}/^{144}\text{Nd}$ - 0.51194 (ϵNd : -5.6) plotting the rocks in the enriched quadrant of the isotopic systematic.

16. Peytcheva, I., von Quadt, A., **Dyulgerov, M.**, R. Nedyalkov. 2009. Au-Ag±W mineralization related to the collisional granitoids of the composite Lutzkan magmatic complex, Bulgaria, *Goldschmidt Conference Abstracts*, Davos, 1023.

Abstract. The characteristics of the Au-Ag±W mineralization at Zlata deposit are evident for a link with the differentiated Carboniferous granitoids. The intrusion of basic magma (dykes of gabbroic to diorite composition) into the granitoids might lead to magmatic volatile saturation and potentially trigger the formation of the magmatic-hydrothermal ore.

17. **Dyulgerov, M.**, B. Platevoet. 2009. Textural and structural evidences for cumulative processes and layering in Svidnya pluton, Stara Planina Mountain, Bulgaria. *Proceedings of Geosciences 2009*, Sofia, 45-46.

Abstract. Structural and textural properties of the plutonic rocks evidence the processes of accumulation and crystal settling. In the most melanocratic varieties - clinopyroxene - biotite melasyenite (shonkinite) orientated structure is marked by the parallel disposition of tabular potassium feldspar. Several processes can explain formation of the observed cumulates and layering. Density driven sedimentation, based on the Stocks law, is possible for mafic minerals plus apatite. The calculations yield settling velocities of $2.29 \cdot 10^{-7}$ m/s for clinopyroxene and $7.03 \cdot 10^{-8}$ m/s for biotite; 7.2 m/year and 2.22 m/year respectively. These values allow formation of 700 – 900 m thick cumulative pile for a reasonable time span.

18. **Dyulgerov, M.**, M. Ovtcharova, U. Schaltegger. 2010. Unraveling the time of formation of potassic-alkaline rocks in the Variscan edifice in Stara planina, Bulgaria: ID – TIMS and LA – ICP-MS study. *Abstracts, XIX Congress of the Carpathian-Balkan Geological Association*, Thessaloniki, Greece, 106-107.

Abstract. ID – TIMS analyses for plutonic rocks (syenite) from Buhovo-Seslavitzi display clustering around 340 - 325 Ma, and no reliable isochrone can be defined. LA – ICP MS analyses yield similar results: 350 – 325 Ma. For the peralkaline dykes from Buhovo-Seslavitzi ID – TIMS age determinations cluster in two time intervals: 318 – 312 Ma and 460 – 435 Ma, with a substantial discordance. LA – ICP MS results for the dyke rocks are mainly in the interval 470 – 430 Ma, as one analysis gives 310 – 303 Ma. Intrusive rocks from Svidnya plot in two separate time intervals: 315 – 305 Ma and 455 – 440 Ma (ID – TMS). Surprisingly LA – ICP MS show considerable scattering, as the results cover very large time span: 840 – 388 Ma. Both ID – TIMS and LA – ICP MS for dyke rocks from Svidnya plot mainly in the interval 460 – 450 Ma. Perfectly concordant ID – TIMS ages for the intrusive

rocks from Shipka delineate two intervals: 555-506 Ma and 303 Ma. LA – ICP MS determinations are grouped in several narrow intervals: 345-335 Ma, 319-326 Ma and 309-307 Ma. At the same time LA – ICP MS data for dykes from the pluton show much older age: 462-454 Ma.

19. Дюлгеров, М., П. Стефанов. 2016. Кумулативни процеси в югозападната част на Планския плутон, Средногорска зона. *Геонауки 2016*, София, 53-54.

Абстракт. Проведените изследвания показват, че меланократни скали присъстват южно и ЮЗ от с. Белчин, в близост до контакта с високостепенните метаморфити (амфиболити) от Огражденската надгрупа. Скалата е изградена от клинопироксен (75 %), върху когото на места има нараснал зелен амфибол (14 %) и плагиоклаз (10 %). Химизмът на скалата е базичен, характеризира се с умерено високо съдържание на преходните метали, ниско съдържание на несъвместимите елементи и сума на алкалните оксиди. Теренните взаимоотношения и геохимичните особености на скалите указват за вероятен кумулативен произход на габропироксенитите. Те могат да се схващат като окраен фациес, образуван в периферията на магматичната камера на контакта с вместиращите скали. Главната кумулативна фаза е клинопироксенът, придружен от непрогледния минерал. Липсата на реакционни структури (указващи за реакция минерал–топилка), линейните трендове на разпределение на оксидите в харкеровите диаграми и сходният характер на разпределение в нормираните диаграми не допускат вероятността описаният габропироксенит да е резултат на контаминация на магмата от Планския плутон и вместиращите амфиболити.