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Българската геология и българските геолози в чужбина

Резюмета на статии в чуждестранни издания, излезли през 2015–2017 г.

2015

Andreeva, P. 2015. Middle Devonian (Givetian) supratidal sabkha anhydrites form the Moesian Platform (Northeastern Bulgaria). – *Carbonates and Evaporites*, *30*, 439–44.

The Middle Devonian (Givetian) anhydrites from deep wells in the Moesian Platform (Northeastern Bulgaria) are commonly distinguished into nodular and contorted structures. The latter includes a great variety of non-bedded (nodular, nodular-mosaic, mosaic and mosaic to massive), bedded (bedded nodular, bedded nodular-mosaic and bedded mosaic to massive) and distorted (distorted nodular-mosaic, distorted mosaic, distorted bedded mosaic, and "ropy bedded") types. Microscopically, the anhydrite types are characterized by felted, subfelted and microcrystalline (aphanitic) microfabrics. The associated carbonate lithofacies and the synsedimentary/early diagenetic anhydrite features suggest that these sediments were formed in an arid peritidal setting with well distinguished subtidal (ostracod mudstones and wackestones, paleosiphonoclad wackestones and packstones and ostracod-peloidal packstones and grainstones), intertidal (microbial mats) and supratidal (sabkha anhydrites) zones. The described nodular and contorted anhydrites are interpreted as originated by similar mechanisms as those operating in recent sabkha settings in the Arabian Gulf. Most probably, they are the result of replacement/displacement intrasediment sulphate growth within the vadose and upper phreatic zones of the supratidal sabkha. The various nodular and contorted types are regarded as formed from incipient nodular structure and represent different stages of anhydrite nodule enlargement and growth deformation due to additional sulphate accumulation in the supratidal zone.

Benderev, A., R. Atanassova, A. Andreev, V. Hristov, K. Bojadgieva, S. Kolev. 2015. Hydrochemical characteristics of Erma Reka geothermal reservoir (S. Bulgaria). – *Proceedings World Geothermal Congress 2015*. Melbourne, Australia, 1–9.

Erma Reka geothermal reservoir is located in the southern part of the Rhodopes massif (South Bulgaria), close to Greek border, and is a unique combination with a polymetallic Pb-Zn mineralization. The deposit was discovered in 1955 and the exploitation of polymetallic ore continues until now. The water temperature is within the range of 30 to 90 °C. The thermal water is accumulated in karst and cavernous marble body, located at a depth of 450 m below the surface and embedded in a gneiss complex. It is pumped to the surface and discharges in a small river, without using its thermal energy. Cavities and caverns, some of which are huge in size (from 400–1300 m) have been crossed during the drilling in the marble body. Thermal water from Erma Reka reservoir discharges through several springs located in the region of Thermes (N. Greece). The obtained TDS values of the water samples vary between 0.6 to 1.3 g/l depending on the depth and special deposition of the reservoir. The TDS is correlating with the ratio change of concentrations of the main species HCO_3^-/SO_4^{2-}, Ca^{2+}/Na^+, and with the H_2SiO_3 content, which reaches up to 250 mg/l at highest mineralization. Contents of other elements are analyzed in thermal water. Varied in composition and texture mineral depositions occur in wellhead where a significant temperature decrease is observed. The values of saturation index of various compounds regarding mineral phases have been determined. It has been established that various carbonate, phosphate and silicate mineral phases could be deposited in the cooling down process. Knowing the process of thermal water scaling is essential for the future use for a space heating in the town of Zlatograd, located at about 12 km to the southeast of Erma Reka geothermal reservoir.

2016

Chatalov, A. 2016. Global, regional and local controls on the development of a Triassic carbonate ramp system, Western Balkanides, Bulgaria. **–** *Geological Magazine*; DOI: 10.1017/S0016756816000923.

The Early to Late Triassic development of a carbonate ramp system in the subtropical belt of the NW Tethys was controlled by the interplay of several global and regional factors: geotectonic setting (slow continuous subsidence on a passive continental margin), antecedent topography (low-gradient relief inherited from preceding depositional regime), climate and oceanography (warm and dry climatic conditions, storm influence), relative sea-level changes (Olenekian to Anisian eustatic rise, middle Anisian to early Carnian sea-level fall), lack of frame-builders (favouring the maintenance of ramp morphology), and carbonate production (abundant formation of lime mud, non-skeletal grains and marine cements, development of diverse biota controlled by biological evolution and environmental conditions). Elevated palaeorelief affected the ramp initialization on a local scale, while autogenic processes largely controlled the formation of peritidal cyclicity during the early stage of ramp retrogradation. Probably fault-driven differential subsidence caused a local distal steepening of the ramp profile in middle–late Anisian time. The generally favourable conditions promoted long-term maintenance of homoclinal ramp morphology and accumulation of carbonate sediments having great maximum thickness (~500 m). Shutdown of the carbonate factory and demise of the ramp system in the early Carnian resulted from relative sea-level fall and subsequent emergence. After a period of subaerial exposure with minor karstification, the deposition of continental quartz arenites suggests the possible effect of the Carnian Pluvial Episode.

Pavlishina, P. 2016. Palynostratigraphy and palaeoenvironments around the Albian–Cenomanian boundary interval (OAE1d), North Bulgaria. – *Science China Earth Science*; DOI:10.1007/s11430-016-0067-2.

The palynological assemblages from two Albian–Cenomanian boundary sections in North Bulgaria are described. The samples analyzed yielded a diverse palynological content including dinoflagellate cysts and miospores. Based on dinocyst nutrient and productivity indices a phase of enhanced nutrient availability and high primary productivity is inferred for the latest Albian interval. The pronounced predominance of peridinioid dinocysts in this interval, namely *O. verrucosum, O. scabrosum* and especially *P. infusorioides* is considered to reflect eutrophic conditions. It coincides with the increased phosphorus mass accumulation occurring at the top part of the Upper Albian Dekov Formation. OAE 1d is indicated in the Tolovitsa karst spring section, based on palynofacies dominated by high amounts of granular amorphous organic matter (AOM) related to anoxic environmental conditions. These sections serve as evidence suggesting a relationship between Cretaceous peridinioid cysts (including *Palaeohystichphora infusorioides, Ovoidinium verrucosum, O. scabrosum*) and anoxic/suboxic conditions and/or high primary productivity. The pollen spectrum inferred relatively stable vegetation patterns of surrounding continental areas during and after the Albian/Cenomanian boundary interval and the times of OAE 1d formation. The hinterland vegetation integrated mainly pteridophyte spores and gymnosperms. The area was part of the Southern Laurasian floral province which was characterized by warm temperate to subtropical humid climate. Angiosperms were still minor part of this vegetation.

Tchoumatchenco, P. 2016. Bulgaria. – In: *INHIGEO Annual Record No 48 (Covering Activity Generally in 2015).* Online publication, 90–91.

This paper gave bibliographic information about the activity of Dr. P. Tchoumatchenco in the area of the History of the geology – four short articles and a presentation of paper on the 90th anniversary of the Bulgarian Geological Society.

Tchoumatchenco, P. 2016. Bulgaria. – In: Gerali, F. (Ed.) *INHIGEO Virtual Library*. Online publication, 24 p.

In this paper is given the bibliography of more than 450 papers from the area of the history of the Bulgarian geology – obituaries, memorials or information about new books, since the beginning of the Bulgarian geology up to the present days.

2017

Aysal, N., M. Keskin, I. Peytcheva, O. Duru. 2017. Geochronology, geochemistry and isotope systematics of a mafic–intermediate dyke complex in the Istanbul Zone. New constraints on the evolution of the Black Sea in NW Turkey. – In: Simmons, M. D., G. C. Tari, A. I. Okay (Eds.) *Petroleum Geology of the Black Sea.* Geological Society London, Special Publications, 464, https://doi.org/10.1144/SP464.4.

We report new U–Pb zircon ages, major and trace element data, mineral chemistry, and Sr-Nd isotopic analyses of the mafic–intermediate dykes and intrusions in the Istanbul Zone. Mafic dykes are represented by calc-alkaline to alkaline lamprophyre and diabase. Intermediate dykes and subvolcanics are andesitic to dacitic in composition and calc-alkaline in character, while intrusive rocks (stocks and small plutons) are granodioritic and dioritic in composition. New zircon U–Pb laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) dating yielded ages from 72.49±0.79 (Upper Cretaceous – Campanian) to 65.44±0.93 Ma (Lower Paleocene – Danian) for the intermediate dykes, and 58.9 ± 1.8 Ma (Upper Paleocene – Thanetian) for a small granodiorite stock. $^{87}Sr/^{86}Sr_{(i)}$ values of the mafic and intermediate dykes and small stocks span a range from 0.703508 to 0.706311, while their $^{143}Nd/^{144}Nd_{(i)}$ values vary from 0.512614 to 0.512812 and $eNd_{(i)}$ values from 5.09 to 1.24. NdTDM model ages range between 0.46 and 0.77 Ga. Dykes are enriched in LILEs and LREEs relative to HFSEs. Normal-type MORB normalized multi-element spidergrams of the majority of the mafic and intermediate dykes display a clear subduction signature, except a subset, which cut the Palaeozoic of Istanbul and the upper part of the Upper Cretaceous volcanics in the north of Istanbul (i.e. feeder dykes of the Kısırkaya Formation) and show a clear OIB signature indicating that the melts feeding the dyke system during the Late Cretaceous–Paleocene period were derived from two contrasting mantle sources: (1) initially a lithospheric mantle modified by subducted slab-derived melts which sourced the magmas with a clear subduction signature; and (2) followed by an asthenospheric mantle from which basic magmas with OIB signature. Petrological models indicate the interaction of these two discrete magma series via magma-mixing processes. Geothermometric calculations based on the composition of amphiboles are in the range of 769–953 and 938–994 °C. Geobarometric calculations indicate crystallization depths ranging over an interval between 3.0 and 20.2 km, implying polybaric crystallization. The oxygen fugacity ($\lg f_{O_2}$) values vary between –10.10 and –13.07 bar in the dykes cutting the Upper Cretaceous volcanics, and from –8.71 to –10.33 bar in intermediate dykes cutting the Istanbul Palaeozoic unit. H_2O_{melt} contents change between 4.91–6.89 and 4.82–7.51%, respectively implying that the dykes were emplaced at mid to shallow crustal levels. Dyke complexes of the Istanbul zone are interpreted to have been emplaced in a rifted volcanic arc margin related to the opening of the Black Sea during the Late Cretaceous–Paleocene period.

Chatalov, A. 2017. Anachronistic and unusual carbonate facies in uppermost Lower Triassic rocks of the western Balkanides, Bulgaria. – *Facies, 63*(4); DOI10.1007/s10347-017-0505-0

Anachronistic and unusual carbonate facies (AUCFs) are identified in four localities with exposed Spathian strata in the western Balkanides. These include thin-bedded micritic limestone, flat-pebble breccia/conglomerate, mud-chip conglomerate, limestone-marl ribbon rock, vermicular limestone, and microbial oolite. Their depositional and/or early diagenetic origin is interpreted on the basis of petrographic characteristics, results from previous studies and comparison with analogues from the geological record. Various controlling factors are distinguished in the context of their relative influence on global, regional, or local scale, i.e., environmental conditions (high degree of $CaCO_3$ supersaturation, fluctuations in oxygen levels and salinity), biological controls (bioturbation, microbial blooms, scarcity or abundance of metazoans), and uniformitarian sedimentary processes (wave agitation, storm action, terrigenous input, seismic shocks). Most of the AUCFs are assigned to features associated with enhanced $CaCO_3$ precipitation, while the vermicular limestones belong to fabrics that formed due to limited biologic activity. The thin-bedded micritic limestones, flat-pebble breccias/conglomerates and limestone-marl ribbon rocks represent anachronistic facies, while the remaining AUCFs are regarded as unusual sedimentary features and fabrics. This study reports a new occurrence of diverse Spathian

AUCFs formed in subtidal settings besides those described from the southwestern USA and south China. The results show that anomalous paleoceanographic conditions for carbonate sedimentation persisted locally in the shallow Western Tethys until late Early Triassic time.

Chatalov, A. 2017. Sedimentology of Hirnantian glaciomarine deposits in the Balkan Terrane, western Bulgaria: Fixing a piece of the north peri-Gondwana jigsaw puzzle. – *Sedimentary Geology*, *350*, 1–22; DOI: 10.1016/j.sedgeo.2017.01.004.

Glaciomarine deposits of late Hirnantian age in the western part of the Palaeozoic Balkan Terrane have persistent thickness (~7 m) and lateral uniformity in rock colour, bedding pattern, lithology, and sedimentary structures. Four lithofacies are distinguished from base to top: lonestone-bearing diamictites, interbedded structureless mudstones, crudely laminated diamictites, and finely laminated mudstones. The diamictites are clast-poor to clast-rich comprising muddy to sandy varieties. Their compositional maturity is evidenced by the very high amount of detrital quartz compared to the paucity of feldspar and unstable lithic grains. Other textural components include extraclasts derived from the local Ordovician basement, mudstone intraclasts, and sediment aggregates. Turbate structures, grain lineations, and soft sediment deformation of the matrix below larger grains are locally observed. Sedimentological analysis reveals that deposition occurred in an ice-intermediate to ice-distal, poorly agitated shelf environment by material supplied from meltwater buoyant plumes and rain-out from ice-rafted debris. Remobilization by mass-flow processes (cohesive debris flows and slumps) was an important mechanism particularly for the formation of massive diamictites. The glaciomarine deposits represent a typical deglaciation sequence reflecting retreat of the ice front (grounded or floating ice sheet), relative sea-level rise and gradually reduced sedimentation rate with increasing contribution from suspension fallout. This sequence was deposited on the non-glaciated shelf of the intracratonic North Gondwana platform along the southern margin of the Rheic Ocean. The Hirnantian strata of the Balkan Terrane can be correlated with similar glaciomarine deposits known from peri-Gondwana terranes elsewhere in Europe showing clear 'Armorican affinity'. Several lines of evidence suggest that the provenance of siliciclastic material was associated mainly with sedimentary recycling of mature sands which had been deposited across North Gondwana in Cambrian and pre-glacial Ordovician times.

Dekov, V., P. Rochette, J. Gattacceca. 2017. Meteorite falls in Bulgaria: Reappraisal of mineralogy, chemistry, and classification. – *Meteoritics and Planetary Sci*., *52*, 1649–1659; DOI: 10.1111/maps.12879.

We present a summary of the mineralogy, mineral chemistry, and magnetic characteristics of all the five Bulgarian meteorite falls. We report the first mineralogical descriptions, chemical analyses, and magnetic measurements of the Konevo (1931) and Silistra (1917) meteorites. We classify Konevo as LL5, and Silistra as an ungrouped achondrite with HED affinities. Pavel (1966; previously classified as an H5) is reclassified as H3-anomalous. We also provide precise mineralogy and mineral chemistry of the Virba meteorite (1873, L6), and more details on the mineral chemistry of Gumoschnik (1904, H5).

Dyulgerov, M., M. Ovtcharova-Schaltegger, A. Ulianov, U. Schaltegger. 2017. Timing of K-alkaline magmatism in the Balkan segment of southeast European Variscan edifice: ID-TIMS and LA-ICP-MS study. – *Intern. J. Earth Sci*., 1–18; DOI: org/10.1007/s00531-017-1527-0.

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 are impeded by the scarcity of Variscan domains with preserved magmatic, metamorphic, sedimentological and structural characteristics. 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-Visean (~330 Ma). 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.

Gautier, P., V. Bosse, Z. Cherneva, A. Didier, I. Gerdjikov, M. Tiepolo. 2017. Polycyclic alpine orogeny in the Rhodope metamorphic complex: the record in migmatites from the Nestos shear zone (N. Greece). – *Bull. Soc. géol. Fr., BSGF – Earth Sciences Bulletin*, *7*, 188.

The Rhodope Metamorphic Complex (RMC) is a high-grade crystalline massif located at the northern margin of the Aegean region. Numerous scenarios have been proposed for the evolution of the RMC during Alpine times. A debated issue is whether there has been a single protracted orogenic cycle since around the mid-Mesozoic or whether Alpine orogeny involved distinct episodes of subduction and crustal accretion. We describe a key outcrop located on the Nestos Shear Zone (NSZ), a major NNE-dipping top-to-SW shear zone characterized by an inverted metamorphic sequence. Structural and petrological data document the existence of two anatectic events. The first event, best preserved in decametric structural lenses, is pre-kinematic with respect to top-to-SW shearing and involved high-temperature "dry" melting.

Zircon and monazite LA-ICPMS U-Th-Pb data indicate that this event occurred at ~140 Ma. The second event is syn-kinematic with respect to top-to-SW shearing and involved lower-temperature water-assisted melting. Zircon and rutile LA-ICPMS U-Pb data indicate that this second event occurred at ~40 Ma. During ongoing top-to-SW shearing and as late as ~36 Ma, the rocks from the outcrop were at higher temperatures

than the peak temperatures experienced by lower levels of the NSZ. This confirms the existence of the inverted metamorphic sequence and demonstrates that the NSZ was a major thrust at 36–40 Ma. The ~100 Myr time laps between the two anatectic events encompasses the period from ~115 to ~70 Ma characterized by a gap in the geochronological record on the scale of the RMC (the Eastern Rhodope excluded). This ~45 Myr gap likely reflects a period of tectonic quiescence between the mid-Mesozoic orogen and the Cenozoic one, attesting for polycyclic Alpine orogeny in the RMC. Unlike assumed in several geodynamic scenarios, the Alpine evolution of the RMC did not consist of a single orogenic cycle of Mesozoic age followed by Cenozoic crustal-scale extension triggered by mantle delamination. Polycyclic orogeny has resulted in a two-loop P-T-t path for the hangingwall unit of the NSZ. The Cenozoic P-T paths of this unit and the footwall unit merged while both units were being exhumed, a feature attributed to synthrusting extensional spreading of the main mass of the hangingwall unit above the NSZ.

Kounov, A., I. Gerdjikov, D. A. Vangelov, E. Balkanska, A. Lazarova, S. Georgiev, E. Blunt, D. Stockl. 2017. First thermochronological constraints on the Cenozoic extension along the Balkan fold-thrust belt (Central Stara Planina Mountains, Bulgaria). – *Intern. J. Earth Sci*.; DOI: 10.1007/s00531-017-1555-9.

The Balkan fold-thrust belt, exposed in Bulgaria and north-east Serbia, is part of the north-east vergent segment of the bivergent Eastern Mediterranean Alpine orogen. It was formed during two distinct compressional stages; the first one lasted from the Middle Jurassic to the Early Cretaceous and the second from Late Cretaceous to the Paleogene. Although the compressional tectonic evolution of the Balkan fold-thrust belt since the Middle Jurassic and during most of the Mesozoic is relatively well studied, the final exhumation of the rocks of the belt during the Cenozoic has remained poorly understood. Here, we present the first thermochronological constraints, based on fission-track and [U-Th-(Sm)]/He analysis, showing that along the central part of the belt syn- to post-orogenic extension could have started as early as the middle Eocene. Low-temperature thermochronological analysis of samples collected from three areas reveals at least two phases of increased cooling and exhumation during the Cenozoic. The first exhumation phase took place between ~44 and 30 Ma and appears to be related to the syn- to post-orogenic collapse coeval with the earliest Cenozoic extensional stage observed across the southern Balkan Peninsula. A period of relative quiescence (between ~30 and ~25 Ma) is followed by the next cooling stage, between 25 and 20 Ma, which appears to be related to late Oligocene to early Miocene crustal extension across the Balkan Peninsula. Extension accommodated by the late Miocene to Recent age Sub-Balkan Graben System does not appear to have produced exhumation of rocks from beneath 2–4 km depth, as it was not detected by the low-temperature thermochronological methods applied in this study.

Marchev, P., Sh. Arai, O. Vaselli, F. Costa, A. Zanetti, H. Downes. 2017. Metasomatic reaction phenomena from entrainment to surface cooling: evidence from mantle peridotite xenoliths from Bulgaria. – *J. Petrol*., *58* (3), 599–640.

We present a detailed study of the mineralogical and chemical modifications of peridotite xenoliths during magma transport and cooling at the Earth's surface. The xenoliths are entrained in 3 small-volume (<1 km^3), monogenetic, Miocene–Oligocene, basanite domes in the Moesian Platform, N. Bulgaria, arranged along a NNE-directed right-lateral strike-slip fault. The domes show symmetrically decreasing volumes of erupted magma correlated with the size and quantity of the entrained xenoliths, according to their position along the fault. The xenoliths exhibit different degrees of mineralogical and chemical interaction with their host rocks, with the extent of interaction strongly depending on their position in the dome. Xenoliths from the fine-grained brecciated carapaces of the domes show very thin, fine-grained, reaction rims around orthopyroxene and spinel, and thin diffusion zones around olivine, limited mostly to the rims of the xenoliths. Clinopyroxene shows almost no visible reaction and is always strongly depleted in light rare earth elements (LREE) and Sr. Melt pockets in the xenoliths are small, composed mostly of fine-grained olivine and clinopyroxene. Modelling of Fe–Mg zoning in olivine suggests a very short residence time of a few days in the magma during transport and fast cooling at the Earth's surface. In contrast, xenoliths from the interior of the domes, hosted in holocrystalline groundmass, are much more strongly affected by the host basanite magma. Their constituent minerals have wider reaction rims around orthopyroxene, sometimes leading to its entire consumption, and show transformation of spinel into chromite. Fe–Mg diffusion profiles in olivine are up to 400 lm wide and calculations indicate diffusion times up to 200 days, recording protracted cooling in the inner part of the dome. Melt pockets are much larger and coarser-grained, composed of minerals identical to the host groundmass. With few exceptions, clinopyroxene is sieve-textured and shows variable enrichment in LREE and Sr, ranging from several times higher than in the depleted xenoliths to complete equilibration with the host basanite. Strongly veined xenoliths show stronger chemical modifications, facilitated by infiltrated melt, which also progressively increase depending on the position of the xenoliths in the dome. The most enriched xenoliths from the core of the dome exhibit large inter- and intra-grain variations in Sr and LREE. Our study demonstrates that chemical and mineral modifications, although starting at the time of entrainment of the xenoliths at mantle depths, were completed mostly during their residence in the magma at the surface. The reaction phenomena are the result of post-entrainment partial melting, and reactions between xenolith minerals and infiltrated fluids and melts from the host basalts. The large inter- and intra-crystal chemical variations in a single xenolith suggest that reactions strongly depend on the access of fluids and melts (permeability) in different parts of the xenoliths. The results of this study allow us to introduce the term 'host basalt metasomatism' for those mantle xenoliths that have undergone chemical alteration at or near the surface during cooling of the host magma. Comparison with xenoliths stored in large scale magmatic systems under La Palma (Canary Islands) shows that, although the products of interaction between xenoliths and host rocks are similar, there are considerable differences in the mechanism of entrainment, depth and longevity of the reactions between small-volume and large-scale magmatic systems.

Markova, K., A. Zdravkov, A. Bechtel, M. Stefanova. 2017. Organic geochemical characteristics of Bulgarian jet. – *Intern. J. Coal Geol.*, *181*, 1–10.

The paper presents the results of the organic geochemical studies of Bulgarian jet samples of early Jurassic and early Cretaceous age from 2 deposits located within the Moesian platform and the Balkan tectonic zone. Total organic carbon contents (71 and 78% daf) indicate sub-bituminous coalification rank. Moderately high to high sulfur contents (0.8–1.7% daf) support activity of sulfate reducing bacteria. High amounts of volatile matter (53–59% daf) and slightly enhanced HI values

(185–249 mg HC/g TOC) argue for organic matter bituminization. The latter is also confirmed by the very low T_{max} values (~400 °C), which are interpreted as a result of the release of bituminous substances during the early stages of pyrolysis.

Extractable organic matter is consistent with the low maturity and is characterized by high portions of NSO compounds and asphaltenes (>80%). Hydrocarbons constitute about 10% and are characterized by the predominance of the saturated over the aromatics. The strongly short-chain homologs dominated n-alkanes distributions, with expressed maxima at n-$C_{17}$and n-C_{18}, and CPI in the range 1–2, is consistent with the woody origin of the jet. In addition, the low C_{29}/C_{27} (~ 1) sterane ratios denote possible impregnation of the drift woods with phytoplankton-derived lipids from the host rocks. Low Pr/Ph (0.42–0.65) and Pr/n-C_{17} (0.28–0.43) ratios, as well as high Ph/n-C_{18} (0.4–0.78) ratio outline anoxic conditions of jet formation. Furthermore, the absence of chromans in the jet extracts from the Moesian platform suggests depositional environment with reduced salinity, whereas low di-MTTC/tri-MTTS (0.32) in the sample from the Balkan tectonic zone points to normal marine conditions.

The occurrence of pimaranes and α-phyllocladane in the extracts from Nikolaevo jet points to Taxodiaceae or Araucariaceae conifers as possible precursors, whereas the presence of α-cedrane and cuparene in the sample from Lesidren deposit argues for Cupressaceae origin. In addition, triterpenoid biomarkers with lupane and ursane skeletal structures in the Lesidren jet is tentatively interpreted as an impregnation of the conifer drift wood with lipids from pre-angiosperm plants.

Results from the bulk and molecular analyses revealed that Bulgarian jet originates from conifer drift wood, deposited under anoxic environmental settings, and subsequently subjected to hydrogenation and biodegradation.

Sabeva, R. N., V. Mladenova, A. Mogessi. 2017. Ore petrology, hydrothermal alteration, fluid inclusions, and sulfur stable isotopes of the Milin Kamak intermediate sulfidation epithermal Au-Ag deposit in Western Srednogorie, Bulgaria. – *Ore Geology Reviews*; DOI: 10.1016/j.oregeorev.2017.05.013 (in press).

The Milin Kamak gold-silver deposit is located in western Srednogorie 50 km west of Sofia, Bulgaria. This zone belongs to the Upper Cretaceous Apuseni-Banat-Timok-Srednogorie magmatic and metallogenic belt. The deposit is hosted by altered trachybasalt to andesitic trachybasalt volcanic and volcanoclastic rocks with Late Cretaceous age, which are considered to be products of the Breznik paleovolcano. Milin Kamak is the first Au-Ag intermediate sulfidation type epithermal deposit recognized in Srednogorie zone in Bulgaria. It consists of eight ore zones with lengths ranging from 400 to 1000 m, widths from several cm to 3–4 m, rarely to 10–15 m, an average of 80–90 m depth (a maximum of 200 m) and dip steeply to the south. The average content of Au is 5.04 g/t and Ag 13.01 g/t. The styles of alteration are propylitic, sericite, argillic, and advanced argillic. Ore mineralization consists of three stages. Quartz-pyrite stage I is dominated by quartz, euhedral to subhedral pyrite, trace pyrrhotite and hematite in the upper levels of the deposit. Quartz-polymetallic stage II is represented by major anhedral pyrite, galena, Fe-poor sphalerite; minor chalcopyrite, tennantite, bournonite, tellurides and electrum; and trace pyrrhotite, arsenopyrite, marcasite. Gangue minerals are quartz and carbonates. The carbonate-gold stage III is defined by deposition of carbonate minerals and barite with native gold and stibnite.

Tchoumatchenco, P., T. Nikolov. 2017. *Three Stars of Russian Origin in Bulgarian Geology: Andrei Janichevsky, Rostislav Beregov, Svetlana Černjavska: Life and Scientific Creativity.* Lambert Academic Publishing, 103 p.

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Videnov, M. 2017. Review of the biography of an eminent Bulgarian geologist – Todor Nikolov, professor, PhD, DSc. – *INHIGEO Annual Record*, 49/for 2016, 68–70.

Prof. T. Nikolov is the best connoisseur of the stratigraphy and the ammonite paleontology and paleogeography of Lower Cretaceous in Bulgaria and the Balkan Peninsula. He works successfully in the theory of stratigraphy, paleogeography and paleoclimatology, the global changes of the climates in the Earth's history, on theory of evolution, and the field petroleum geology. He has authored more than 270 scientific articles, including more than 25 papers in the area of the history of the geology – obituaries, memorials, compendium of the Bulgarian paleontologists, etc., and numerous monographic books.