Резюмета на научните трудове

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обявен в бр. 94 на „Държавен вестник” от 30.10.2012 г.

1. Научни публикациите за участие в конкурса (1996-2012)

Lakova, I. 1996. Basic principles of acritarch grouping at suprageneric level. *Acta Universitatis Carolinae sectio Geologica* 40 (1997), 477-480.

The purpose of this study is to specify the hierarchy of acritarch morphological features and to elabotare a combined polytomic-dichotomic key for determination and arrangement of the acritarch genera. The following subordination of four acritarch taxonomical features is proposed (in descending order): symmetry; vesicle shape; presence or absence of processes and complexity of processes; presence or absence of membrane. Using this key, all known acritarch genera could be englobed into five informal first-order symmetry units (sphaerical, polyhedral, polygonal, rotational homopolar and rotational heteropolar) further subdivided into second-order shape subunits, third-order processes subunits and fourth-order membrane subunits.

This preliminary model of key for determination and informal suprageneric arrangement of the fossil acritarch and prasinophytic genera is based on four subordinated morphological features which in descending order are the symmetry, vesicle shape, processes and membrane. According to the proposed subordination of morphological criteria in acritarchs, all genera could be arranged and grouped into five informal first-order categories called “symmetry units”. They are further subdivided into second-order “shape subunits”, third-order “processes subunits” and fourth-order “membrane subunits”.

Lakova, I. 1996. *Derventia* gen. nov. – enigmatic microfosslis from the Silurian of Strandzides, SE Bulgaria. *Acta Universitatis Carolinae sectio Geologica* 40 (1997), 481-495.

A low-grade metamorphic formation of black shales, slates and quartzites of the Dervent Heights, SE Bulgaria, recently dated as Silurian on acritarchs has also yielded cylindro-conical, conical and ellipsoidal transparent smooth possibly organic-walled microfossils of unknown affinities. They are 22-90 μm long and 8-24 μm wide, one end is tapering or bluntly oval, the other end is oval or broken. All specimens have a dark-brown central channel or central body. A generic name *Derventia* is being proposed for eight unnamed species differing in their general form, the outline of their ends and the proportion of central channel width to the total width.

An assemblage of numerous dispersed transparent organic-walled microfossils is recorded from a low-grade metamorphic formation of the Dervent Heights, SE Bulgaria. These microfossils are conical, cylindro-conical, cylindrical or ellipsoidal and have an axial central channel or central body of dark-brown colour. They are associated with acritarchs of Llandovery/Wenlock age as recently reported by Lakova *et al.* (1993). A generic name *Derventia* gen. nov. is proposed for these enigmatic microfossils. Based on some morphological features, such as general outline, shape of the ends, position and relative width of the central channel/central body, the genus *Derventia* is subdivided into eight species, still unnamed. *Derventia* differs morphologically from all known Early Paleozoic organic-walled microfossils (acritarchs, chitinozoans, scolecodonts, cryptospores, trilete miospores, tubular and filamentous plant macerals) and its systematic position and biological affinities remain uncertain.

Лакова, И., Стоянова, Д. 1997. Калпионелидно зониране на титон-валанжински карбонатни сукцисии в Западния Предбалкан (регион Монтата). ***Сборник доклади от конференции „50 години специалност Геология, СУ „Св. Климент Охридски", София,*** **7-10.**

Цел на изследването е получаване на нови данни за вертикалното разпространение на калпионелидните видове и установяване на детайлна зонална и подзонална подялба на титон-валанжински карбонатни формации в Западния Предбалкан, както и уточняване на критериите за поставяне на етажните граници титон-бериас и бериас-валанжин в светлината на съвременните зонални схеми.

Изследвани са най-горната част на Гинската свита, пълният обем на Гложенската свита и основата на Салашката свита (Пъстринишки член) в северното бедро на Михайловградската антиклинала. Опробвани са разрезите при с. Николово и с. Горно Белотинци в района на Монтана и при гара Орешец в района на Белоградчик. Установена е непрекъсната калпионелидна сукцесия и всички зони и подзони от *Chitinoidella* (среден титон) до *Calpionellites* (долен валанжин). Границата титон-бериас се прокарва в основата на зоната *Calpionella*, а границата бериас-валанжин — в основата на подзона *Praecalpionellites murgeanui* на зона *Calpionellopsis*.

Lakova, I., Stoykova, K., Ivanova, D. 1997. Tithonian to Valanginian bioevents and integrated zonations on calpionellids, calcareous nannofossils and calcareous dinocysts from the Western Balkanides, Bulgaria. ***Mineralia Slovaca,*** **29, 4-5, 301-303.**

The results of a joint biostratigraphic investigation on three planktonic microfossil groups (calpionellids, calcareous nannofossils and calcareous dinocysts) from continuous successions of pelagic carbonates in the Western Balkanides have enabled a fine zonal and subzonal subdivision of the Tithonian, Berriasian and Valanginian Stages. Three formations have been studied: Gintsi Formation (pink and gray nodular limestones), Glozhene Formation (gray micritic limestones) and Salash Formation (micritic limestones, clayey limestones and marls).

The purposes of this study are: to obtain authentic, detailed and integrated data on the vertical distribution of calpionellid, nannofossil and calcareous dinocyst species by co-sampling of same levels at same sections; to select characteristic bioevents, mainly first occurrence data, within the parallel successions of the three microfossil groups; to evaluate the biostratigraphic potential of the selected bioevents for refining and enhancing the resolution of Tithonian to Valanginian zonal schemes.

A total of 117 microfossil species are identified (40 calpionellids, 48 calcareous nannofossils and 29 calcareous dinocysts) in the Tithonian, Berriasian and Valanginian successions. Range-chart of selected species from Barlya section is shown in Fig. 1. Starting from the Middle Tithonian, the sections are divided into 7 calpionellid zones and 12 subzones on the basis of 15 successive bioevents widely recognized in the Tethyan Realm. Three additional calpionellid events are potential candidates for lower boundaries of subzones. The evolution of the calcareous nannoplankton during the Late Kimmeridgian to Valanginian shows 22 successive events which are not uniformly distributed across the sections but form 5 groups of bioevents. The nannofossil zonation consists of 5 Tethyan and regional zones. As for the calcareous dinocysts, 14 events are selected thus enabling a subdivision into 9 total-range and interval zones. Among them, 2 zones in the Valanginian are introduced here as regional zones for the first time in the Tethyan Lower Cretaceous. The microfossil zonations of the Tithonian, Berriasian and Valanginian in the Western Balkanides are comparable to earlier zonal schemes proposed by Pop (1994), Bralower et al.(1989) and Rehanek (1992).

As a rule, the bioevents recorded in the evolution of the calpionellids, calcareous nannofossils and calcareous dinocysts do not coincide. The accumulated number of successive, non-coinciding bioevents in the three groups is 42 which enhances the potential for a high-resolution microbiostratigraphy of the Tithonian, Berriasian and Valanginian. The common study of the three microfossil groups ensures also a shared control between the registered events by direct calibrations. In cases of coincidence of bioevents in two or in all the three groups, it further increases the argumentation of the zonal subdivisions. Calpionellid, nannofossil and calcareous dinocyst events across the Tithonian/Berriasian and Berriasian/Valanginian boundary intervals are of special interest.

Lakova, I. 1997. Additional palynological data on the age of the Rashcha Formation, Osogovo Mts, West Bulgaria. *Geologica Balcanica*, 27, 1-2, c. 20.

The age of the low-grade metamorphic rocks of the Rashcha Formation (various types of schists and quartzites) has been questionable for long time. Primarily it was supposed to be Precambrian based on scarce acritarch findings on the territory of the Republic Macedonia. The palynological assemblage reported by Lakova et al. (1995) from the sample 242 at the locality Rasovo, Gueshevo area, West Bulgaria, determined the age of the Rashcha Formation within the time interval from Wenlockian to Early Devonian. The age determination was proposed mainly on the occurrence of relatively longer-ranging acritarch species.

A recently undertaken study on the trilete miospores from the same assemblage of sample 242 has enabled a further age specification. The palynological preparations contain the species *Emphanisporites zavallatus* Richardson, Streel, Hassan & Stteemans, 1982, a coarsely sculptured *Emphanisporites*, which is a very characteristic biostratigraphic marker. The time span of this miospore species is restricted at the end of Lochkovian. It is an index-species of the latest Lochkovian *Breconisporites breconensis – Emphanisporites zavallatus* Assemblage Miospore Zone introduced by Richardson & McGregor (1986) and recognized in Belgium, south Wales, Poland (Turnau, Jakubowska, 1989) and the subsurface of the Moesian Platform in Romania. Undeterminable zonate miospores are also present. It is to be mentioned that in the sporomorph evolution the incoming of zona (prominent equatorial cingulum) occurred not earlier than the beginning of Lochkovian (Richardson, 1996).

Along with the acritarchs and trilete miospores, single specimens of tubular structures of *Porcatitubulus annulatus* Burges & Edwards, 1991 occur, its stratigraphic range being from Wenlock to Middle Devonian. These are organic-walled microfossils (tubular structures with annular internal thickenings) which are most probably related to the early stages of land plant evolution during the Silurian and Early Devonian. Rich associations of tubular structures, inlcuding *P. annulatus*, were documented so far in the Anglo-Welsh Basin (Burgess, Edwards, 1991), Scotland (Wellman, 1995), Pennsylvania, USA (Strother, Traverse, 1979), Virginia, USA (Pratt et al., 1978), as well as in a number of boreholes from the subsurface of the southern part of Moesian Platform, Bulgaria (unpublished data by the author).

This occurrence of the miospore species *E. zavallatus* indicates that the age of the Rashcha Formation in the locality Rasovo is Late Lochkovian. The presence of representatives of the open sea microplankton (acritarchs) in the palynological preparations of sample 242, although co-occurring with miospores and tubular stuctures, shows that the Rashcha Formation was deposited in marine environment with some supply of terrestrial plant debris from the neighbouring land.

Lakova, I., Stoykova, K., Ivanova, D. 1999. Calpionellid, nannofossil and calcareous dinocyst bioevents and integrated biochronology of the Tithonian to Valanginian in the Western Balkanides, Bulgaria. *Geologica Carpathica*, 50, 2, 151-168.

The chronostratigraphic assignment of the calpionellid zones from *Chitinoidella* to *Tintinnopsella* (Middle Tithonian – Hauterivian) is given according to Pop (1994) and the bioevents and zonations on nannofossils and calcareous dinocysts are correlated to those on calpionellids. The Kimmeridgian-Tithonian boundary is fixed on the basis of diagnostic FO of nannofossil and calcareous dinocyst species. The FOs of *Faviconus multicolumnatus* and *Conusphaera mexicana mexicana* (the lower boundary of *C. mexicana* nannofossil Zone) and the simultaneous FO of *Committosphaera pulla* in the middle portion of *Carpistomiosphaera tithonica* dinocyst Zone mark the Kimmeridgian-Tithonian boundary.

At the Lower/Middle Tithonian boundary, the almost coeval first occurrences of the calpionellid *Chitinoidella dobeni* and dinocyst *Colomisphaera tenuis* are documented, thus determining the bases of *Ch. dobeni* Subzone and *C. tenuis* Zone, respectively. Later in the Tithonian, the FO of *Pr. andrusovi* (i.e. the base of *Praetintinnopsella* Zone) coincides with the FO of the nannofossil *Umbria granulosa granulosa* close to the Middle/Upper Tithonian boundary. Within the Upper Tithonian Substage (*Crassicollaria* Zone) there is a clearly documented simultaneous FOs of representatives of calpionellides, nannofossils and dinocysts: *Calpionella grandalpina, Microstaurus chiastius, Nannoconus* sp. n., *Stomiosphaerina proxima*. This gives ground to define the coinciding lower boundaries of three biostratigraphic units: *Cr. massutiniana* calpionellid Subzone, *M. chiastius* nannofossil Zone and *Stomiosphaerina proxima* dinocyst Zone.

The Tithonian/Berriasian boundary is easily determinated in terms of calpionellids at the base of *Calpionella* Zone on the explosion of *C. alpina* and the LO of *C. elliptalpina*, events occurring together with the FOs of nannofossil species *Cruciellipsis cuvillieri* and *Nannoconus compressus*. Another coinciding microfossil events to be mentioned are the FOs of *Calpionellopsis simplex* (base of *Calpionellopsis* Zone) and *Nannoconus steinmanni minor* and *N. dolomiticus* (base of *N. steinmanni* nannofossil Zone). The base of *Calpionellopsis* Zone corresponds to the boundary between *T. occitanica* and *F. boissieri* ammonite Zones commonly regarded as Middle/Upper Berriasian boundary, even though there is no final agreement on the substage division of the Berriasian. Later on, *Calpionellopsis oblonga and Nannoconus steinmanni steinmanni* make their first co-occurrences (at the base of *Calpionellopsis oblonga* Subzone). In the upper portion of this subzone there is a coincidence of the FOs of *Remaniella filipescui* and *Stomiosphaera wanneri*, the latter event defining the base of *St. wanneri* dinocysts Zone. The Berriasian/Valanginian boundary remains hardly determinable in terms of microfossil bioevents and zonations because the only criterion to place this boundary is the FO of *Praecalpionellites murgeanui* (the lower boundary of *Pr. murgeanui* Subzone), a species which is very rare indeed. On the other hand, within the basal Valanginian it is much easier to recognize the lower boundary of *Calpionellites* Zone (FO of *Calpionellites darderi*), coinciding with the lower boundary of *Colomisphaera conferta* dinocyst Zone defined at the FO of C. *conferta*.

At the Lower/Upper Valanginian boundary or a little earlier, the FOs of two dinocyst species, *Carpistomiosphaera valanginiana* and *Colomisphaera vogleri*, are used to define the base of *C. valanginiana* Zone. The LO of representatives of the genus *Calpionellites* which approximates this event is much hardly recognizable because the extinction is rather gradual and slow. In the Late Valanginian (lower part of *Tintinnopsella* Zone) the first co-occurrence of the nannofossil species *Diadorhombus rectus* and the calcareous dinocyst *Stomiosphaera echinata* are recorded (the base of *St. echinata* Zone). A Late Valanginian – Early Hauterivian age is suggested to this zone on the basis of diagnostic ammonite finds.

Apart from the coinciding events in the evolution of calpionellids, nannofossils and calcareous dinocysts reviewed above, there is a number of non-coinciding events which can be helpful for finer and more precise subdivision and correlation of the Tithonian, Berriasian and Valanginian Stages. Moreover, this triple common study of stratigraphic ranges, bioevents and zonations may serve as a reference biochronology of the Tithonian to Valanginian Age and provides a background for further application of independent studies on nannofossils and/or dinocysts in different lithologies lacking calpionellids.

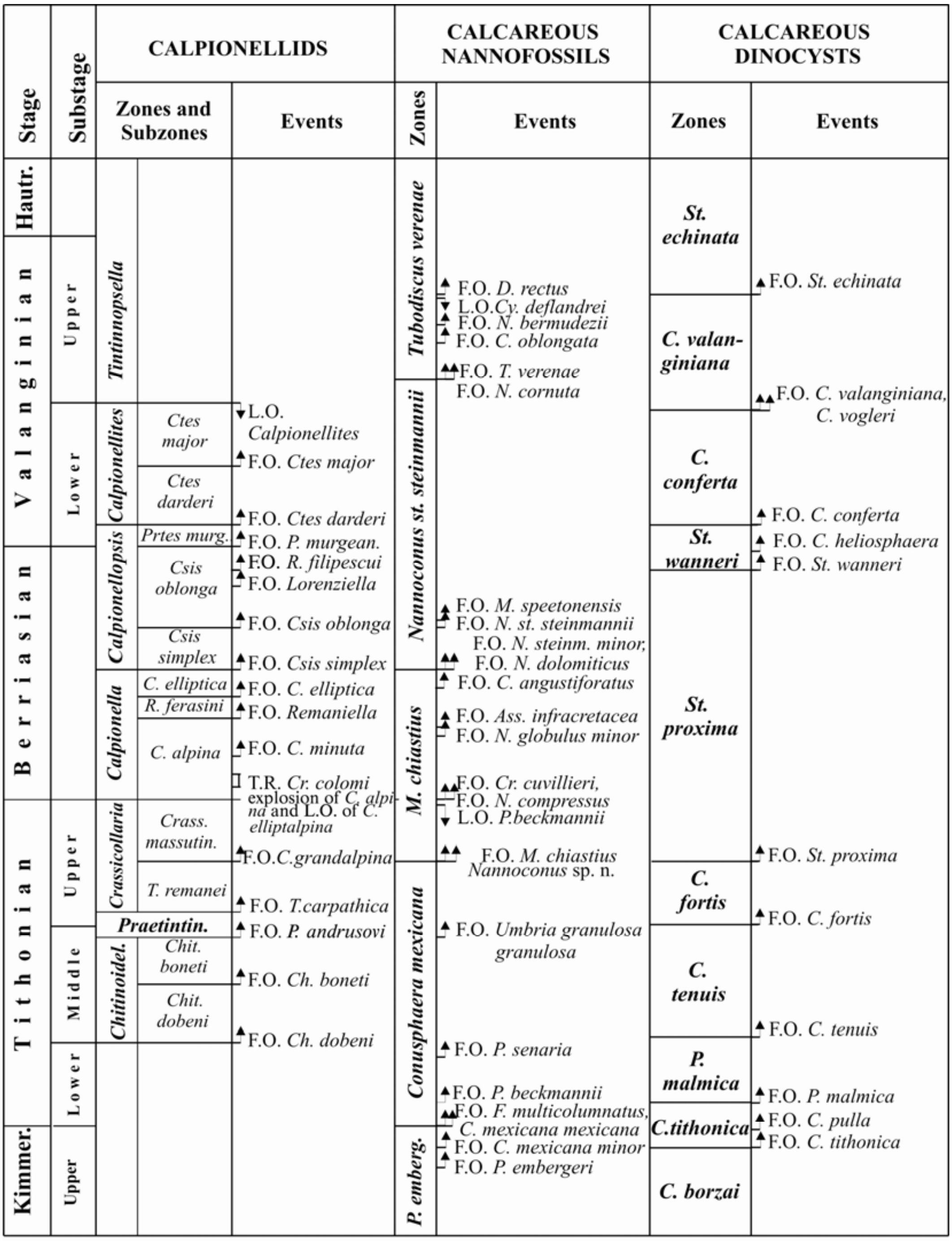

Fig. 9. Lakova, Stoykova & Ivanova

Paris, F., Grahn, Y., Nestor, V., Lakova, I. 1999. Revised classification of chitinozoan genera. *Journal of Paleontology*, 73, 4, 547-568.

The successful definition of chitinozoan genera depends primarily on the precision of the criteria used. A standardized morphological terminology based upon details from scanning electron microscope observations of the most representative taxa bearing these characters is therefore proposed. The 143 genera, or subgenera, described so far in the literature are reviewed in order to exclude invalid taxa and obvious junior synonyms. Particular attention is paid to preventing the overlap of generic definitions of the 56 genera ultimately retained. A brief account of the diagnostic features and stratigraphic range of selected genera is given, and basic information concerning the type material of these genera is listed. Finally, a suprageneric classification of the whole Chitinozoa group based on diagnostic features whose hierarchy is established on statistical and evolutionary grounds, is given. One new subfamily, Pogonochitininae, three new genera, Baltochitina, Hyalochitina, and Saharochitina, and a new species Baltochitina nolvaki, are defined. The subspecies Fungochitina fungiformis spinifera is elevated to a specific rank.

Lakova, I. 1999. Joint chitinozoan and acritarch biostratigraphy of the Pridoli and Lochkovian from the Moesian Platform, Bulgaria. *Geologica Carpathica*, 50, special issue, 48-49.

The marine argillaceous Silurian and Lower Devonian sedimentary rocks from the subsurface of the Moesian Platform consist of chiefly black shales and siltstones and minor sandstones and black clayey limestones. This succession is involved in the non-metamorphic pre-Variscan basement of the Moesian Platform. The backgrounds of the Silurian and Lower Devonian stratigraphy of the Moesian Platform in Bulgaria were made by Spasov & Janev (1966) and the age determinations were mainly based on single finds of graptolites, conodonts, bivalves and tentaculites in the core intervals.

This study of co-occurring chitinozoans and acritarchs across the Silurian/Devonian boundary in the Moesian Platform confirmes the high biostratigraphical value of the chitinozoans and the much lower potential of the acritarchs (despite their great diversity) for fine subdivision. Six chitinozoan zones are here recognised, two for the Pridoli, and four for the Lochkovian. Most of these zones are of global application and allow wide and precise correlatons. Only the topmost Lochkovian *U. simplex – C. plusquelleci* Zone is still of regional value. The vertical ranges of many acritarch species, specified in this study, allow to place just tentatively the Silurian/Devonian boundary at the last occurrence of an assemblage of species. The previous palynostratigraphic practice to define combined palynozones based on chitinozoan, acritarch and spore asemblages for the Silurian and Devonian in North Africa and the Moesian Platform (Jardine et al., 1974; Beju, 1972) did not provide exact and fine resolution. In terms of palynostratigraphy, the mid-Paleozoic marine black shale successions could be best divided using a complex procedure of four steps involving: 1/ chitinozoan record and zonation; 2/ direct correlation of the co-occurring acritarch and spore record with the chitinozoan zonation; 3/ separate definition of acritarch and spore zones; 4/ calibration of the zonations based on chitinozoans, acritarchs and spores. Only the first two steps are here executed due to the nature of the acritarch record in the Pridoli and Lochkovian of the Moesian Platform in Bulgaria.

Ivanova, D., Stoykova, Lakova, I. 2000. New microfossil data on the age relationship between Slivnitsa and Salash Formation in Dragoman Region, Western Bulgaria. *C. R. Acad. bulg. Sci.*, 53, 4, 77-81.

The purpose of this study is to obtain new micropalaeontological data on the age of the top of Slivnitsa Formation and the base of Salash Formation at the area of Dragoman (western Bulgaria) and to specify the relationships in space and time between these two formations deposited during the early Early Cretaceous on the Dragoman positive block.

The present report provides detailed biostratigraphic evidence on the age of the sedimentary rocks just below and over the contact between the Slivnitsa and Salash Formations. Three sections, situated north-west of Sofia, have been sampled and studied. These are the sections at Chavchi Kamak (Tri Ushi Hill), Dragoman and Kalotina. New biostratigraphic data are herein presented on four planktonic mirofossil groups: benthic foraminifers, calcareous dinocysts, calcareous nannofossils and calpionellids. The age determinations are consisstent with the zonations on calpionellids, calcareous nannoplankton, benthic foraminifers and with the recently proposed Berriasian to Valangian calcareous dinocyst zonal sheme by one of the authors (Ivanova in Lakova et al. 1999).

The present report confirms the concept of westward youngering of the lithological contact between the Slivnitsa and Salash formations. Also, the age of this contact is constrained and specified - from a late Early Valanginian at Chavchi Kamak to latest Valanginian - early Hauterivian at Kalotina. Within the stduied area, there are no micropalaeontological data on a Tithonian age of the top of Slivnitsa Formation, neither on submarine wash-out or a considerable stratigraphic gap related to the lithological contant between the Slivnitsa and Salash Formations, as it had earlier been supposed.

Lakova, I. 2000. Dispersed tubular structures and filaments from Late Silurian to Middle Devonian marine deposits of North Bulgaria and Macedonia. *Geologica Balcanica*, 30, 1-2, 29-42.

Fourteen species of tubular structures and filaments were reported from Europe, North America and North Africa. In addition, two new species are erected in this study, *Porcatitubulus reticulatus* sp. nov. from the subsurface of the Moesian Platform, and *Ornatifilum macedonensis* sp. nov. from the easternmost part of the Republic of Macedonia.

The Silurian and Lower Devonian of the Anglo-Welsh Basin (Burgess and Edwards 1991) and of Scotland (Wellman 1995) yielded the most diversed associations of tubular structures and filaments. The greatest part of the localities of dispersed tubes and filaments occur within the Old Red Sandstone Continent or Laurussia (British Islands, Norway, Poland, U.S.A. and Canada) .The only record of *Laevitubulus tenuis* of the North Gondwanan Realm derives from Libya (Al-Ameri 1983).

The assemblages of tubular structures and filaments of the Pridolian and Lochkovian from the southern part of Moesian Platform, North Bulgaria, exhibit similarities to those previously described from coeval sedimentary successions and confirm Wellman's (1995) conclusion that these microphytofossils are geographically widespread.

As for the paleogeographical position of the recent southern part of the Moesian Platform and other Lower Paleozoic terrans in Western and Southeastern Bulgaria within the Baltoscandia - North Gondwana interface during Silurian and early Devonian times, some recently obtained paleobiogeographical results on chitinozoans from the Moesian Platform suggest a close relation to contemporanous North Gondwanan faunas (Lakova 1995b). Similarly, Le Herisse and Gourvennec (1995) established the presence of a *Deunffia-Domasia* acritarch association on the North Gondwanan margin which was situated between 45 and 70'S during the Llandovery and Wenlock. These associations are known from North Africa, Saudi Arabia, Carnic Alps in Austria, Bohemia, as well as from the Dervent Heights of Southeastern Bulgaria (Lakova et al. 1992). Consequently, even the tubular structures and filaments from the southern part of Moesian Platform seem cosmopolitan themselves, the paleobiogeographical affinities of the Silurian and Lower Devonian chitinozoans and acritarchs documentad from the area suggest that the Lower Paleozoic basement of the Moesian Platform is most probably of North Gondwanan origin.

Lakova, I. 2001. Biostratigraphy and provincialism of late Silurian - early Devonian acritarchs and prasinophytes from North Bulgaria. *15th International Senckenberg Conference – Joint Meeting IGCP 421/SDS, May 2001, Frankfurt am Main*, 58-59.

The Pridoli and Lochkovian acritarch assemblages of 88 species from the Moesian Platform in Bulgaria have been compared with coeval microfloras from North Gondwana, Avalonia-Baltica and Laurentia. There is a remarkable similarity (number of common species) in acritarchs between Bulgaria and North Gondwana - Brittany (France), Spain, North Africa, Argentina and Florida. In contrast, the resemblance in acritarchs between the Moesian Platform and Podolia in Ukraine (Baltica) is very insignificant. Divided into four biogeographic categories, the acritarchs of Bulgaria are 48% cosmopolitan, 24 % endemic, 20 % of North-Gondwanan affinities and 8% of Baltica affinities. This biogeographic results on acritarchs contribute to the hypothesis that the Moesian microplate represented a terran of peri-Gondwanan origin during the mid-Paleozoic.

Nikolov, T., Peybernes, B., Lakova, I., Ciszak, R., Durand-Delga, M., Ivanov, M. 2001. Sur l'age Tithonien-Berriasien du lithostratotype de la Formation Magura (anticlinal de Belogradchik, Prebalkan Occidental): implications paleogeographiques. *Geologica Balcanica*, 31, 3-4, 37-47.

Типовият разрез на Магурската свита в Западния предбалкан се намира на Рабишката могила. В този разрез бяха намерени микрофосили: калпионелиди, бентосни фораминифери и варовити алги, които определят къснотитонска и ранноберияска възраст на варовиците на Магурската свита и по този начин се отхвърля възгледа за „ургонска" (барем-аптска) възраст. Магурската свита се характеризира с рифови фосили в долната си част. Тя се разглежда като лагерален клин (апофиза) на Макрешката свита, която е дписана в сондаж Р-1 Макреш на север ф пределите на Мизийската платформа. От друга страна, новите данни показват, че Магурската свита е с много по-стара възраст от масивните варовици от „ургонски" тип с баремска възраст, които се разкриват в юго-изток в района на Орешец-Ружинци. По-рано тези варовици са били отнасяни към Магурската свита, но те се корелират много по-добре със Симеоновската свита, която е разпросранена на север в Мизийската платформа.

В сондаж Р-1 Макреш бе установена калпионелидна асоциация на дълбочина 1491 m. Скалите се отнасят към долния валанжински подетаж, подзона Calpionellites major на зоната Calpionellites. По-долу в сондажния разрез, на дълбочина 1797 m, е установена сравнително богата калпионелидна асоциация характерна за най-горната част на бериаския етаж, подзона Calpionellopsis simplex на зоната Calpionellopsis.

Ivanova, D., Lakova, I., Polishina, P., Koleva-Rekalova, E. 2002. Joint biostratigraphy and lithofacies of Berriasian and Valanginian limestones from subsurface sections in NE Bulgaria. *Geologica Balcanica*, 32, 2-4, 63-67.

The subject of this joint microbiostratigraphical and lithological study are mainly the limestones of Ticha Formation penetretated by four well in Provadiya area in the period 1985-1986. The Ticha Formation was introduded by Sapunov (1976) and the type section was later described in the Ticha River gorge by Николов, Сапунов (1977). The age of the formation was determinated as Late Callovian to Late Valanginian.

The succession of the Ticha Formation was interpreted as a sub-flysch deposition (Начев, 1976; Николов и др., 1991; etc.). It is characterized by an irregular alteration of micrite and clayey limestones and marls. At the base of the formation interbeds of intraclastic limestones occur (Николов и др., 1991). The Ticha Formation is chiefly composed of micrite limestones with calpionellids, sponge spicules and fine bioclasts in the deep boreholes of the Yunak and Bliznak areas while the presence of the micrite limestones (in some places dolomitized) increases to the north, for example in the boreholes of the Sultantsi and Padina areas (Николов и др., 1991). The Upper Jurassic (Kimmeridgian-Tithonian) coarse-clastic limestone sediments – conglomerate-breccia, breccia-conglomerates and rare conglomerates with micrite matrix were petrographic investigated in the boreholes P-1 and P-3 (Yunak area) and P-7 (Sultanci area) (Николова, 1983).

81 thin-sections and palynological samples have been studied from four subsurface sections: R-10 Padina, R-6, R-7 and R-8 Sultantsi. Since successive productive thin-sections with calppionellids and calcareous dinocysts, as well as palynological samples are not frequent, the considered below zones are only proved in the mentioned intervals without determination of their boundaries.

In addition to combined calpionellid and calcareous dinocyst zonation, a direct correlation with organic-walled dinocyst successions and zones is being made. This study was an opprtunity to test the bathymetrical range of application of the joint Tithonian to Valangian calpionellid and calcareous dinocyst zonation (Lakova et al., 1999) elaborated for pelagical sfelf limestones, in this case - in a more distal depositional environment where sub-flysch succession were accumulated.

Гутиерес-Марко, Х.К., Янев, С.Н., Сачански, В., Рабано, И., Лакова, И. 2003. Нови находки на трилобити и граптолити в ордовика на България. *Списание на БГД*, 63, 1-3.

Abstract. Darriwilian trilobites and graptolites from the Grohoten Formation (Svoge anticliorium, Sofia Stara Planina Mountain) are reviewed in the light of the new records and by direct examination of the original material reported by previous authors between 1934 and 1958 years. Middle Ordovician fossils are distributed in three stratigraphically successive assemblages. The oldest one derives from Lower Oretanian shales with nodules and consists of pendent and extensiform didymograptids (*Didymograptus* cf. *artus*, *D.* cf. *spinulosus*, *D.* s.l. *ferrugineus*), some biserials (*Haddingograptus* ?), a single benthic atheloptic trilobite (*Placoparia balcanica* n. sp.), and probably also of rare pelagic form *Cyclopyge* cf. *kossleri*. The middle assemblage which is dominated by pelagic trilobites such as *Pricyclopyge binodosa binodosa*, *P. binodosa prisca* and *Microparia* sp., and sparse benthic elements (*Ectillaenus* sp.), is recorded from siltstones and silty shales that directly overlie a variously developed middle, quartzitic member. The presence both of the graptolite *Didymograptus murchisoni* and the rare biserial forms confirm an Upper Oretanian age for the association. Finally, the third and youngest Middle Ordovician palaeontological horizon is characterized by the occurence of the Dobrotivian cyclopygid trilobite *Pricyclopyge binodosa longicephala*, which derives from the settled shales and is located well below the latest assemblage of trilobites and brachiopods already of Berounian (Upper Ordovician) age. Closest comparisons of the Bulgarian trilobites are with the cyclopygid biofacies from the deep outer shelf settings of the peri-Gondwanan platform, shown by the record of some typical Bohemian taxa as *P. binodosa prisca* and *P. binodosa longicephala*.

Gutierrez-Marco, Yanev, S.N., Sachanski, V.V., Rabano, I., Lakova, I., San Jose Lancha, M.A., Diaz-Martinez, E., Boncheva, I., Sarmiento, G.N. 2003. New biostartigraphical data from the Ordovician of Bulgaria. In: Albanese, G.L., Baress, M.S., Peraeta, S.K. (eds), *Ordovician from the Andes. INSUGEO, serie Correlacion Geologica,* 17, 79-85.

Ordovician sedimentary rocks from Bulgaria are mainly integrated in the Balkan and Moesian terranes, wich are part of the complex tectonic collage of the pre-Alpine basement and Alpine terranes of the Balkan Peninsula.

Ordovician fossils were first identified in Bulgaria by Haberfelner and Bonchev (1934), who described a locality bearing some identifiable graptolites, as well as few trilobite fragments and nautiloids, considered to be of "upper Skiddaw" age. Zaharieva–Kovacheva (1957), Spasov (1958) and Belev (1963) added five other localities with Ordovician fossils, leading to the characterization of diverse "Llanvirn" to "Caradoc" graptolites (*Didymograptus perneri, D. murchisoni*, *Glyptograptus dentatus*), brachiopods (*Chonetoidea aquila*) andtrilobites (*Pricyclopyge prisca, P. prisca longicephala, Cyclopyge rediviva*, *Ectillaenus perovalis hughesi* and *Pseudobasilicus* sp.). These taxa, represented by less than fifty fossil samples (including only 11 trilobite specimens), were repeteadly listed in more than twenty papers on Bulgarian regional topics and geological syntheses, published between 1955 and 2000.

The first and oldest paleontological assemblage derives from lower Oretanian shales with nodules bearing pendent and extensiform didymograptids [*Didymograptus* cf. *artus* Elles and Wood, *D*. cf. *spinulosus* (Perner), *Didymograptus* s.l. cf. *ferrugineus* (Suess)], some biserials (?*Haddingograptus* sp.), a single benthic atheloptic trilobite (*Placoparia balcanica* n.n.) and probably also a rare pelagic form [*Cyclopyge* cf. *kossleri* (Kloucek)].

The second and middle paleontological assemblage is dominated by pelagic trilobites such as *Pricyclopyge binodosa binodosa* (Salter), *P. binodosa prisca* (Barrande) and *Microparia* sp., with some sparse benthic elements (*Ectillaenus* sp). Its concurrence with the graptolite *Didymograptus murchisoni* (Beck) and a rare indeterminable biserial form, characterize an upper Oretanian age for the assemblage. A single specimen of the trace fossil *Cruziana,* so far unknown in the Bulgarian Ordovician, was also recorded in the middle quartzite of the Zerie Mountain fossil site.

The third and youngest Middle Ordovician paleontological horizon is characterized by the occurrence of the cyclopygid trilobite *Pricyclopyge binodosa longicephala* (Kloucek), indicative of a lower Dobrotivian age. To an unknown stratigraphical horizon within the Grohoten Formation, we could also add the benthic dendroid graptolites described as two new species (*Callograptus belmustakovi* and *C. boncevi*) by Spasov and Nikolov (1959), at that time alleged to be of early Carboniferous age. However, the absence of marine Carboniferous rocks in the locality (6 in Figure 1) and the fact that the fossils were recovered from a block of shale in the river, suggest that it could come from the nearby outcrops of the Grohoten Formation, lying on the left margin of the same valley.

Upper Ordovician fossils have only been recovered from a single locality in the upper part of the Grohoten Formation. Paleontological data from the better known locality includes trilobites like *Dalmanitina* sp. and *Cyclopyge (C.)* cf. *rediviva* (Barrande), as well as the brachiopod *Aegiromena aquila* (Barrande). This assemblage most probably corresponds to a middle or late Berounian age.

Younger Ordovician rocks of the Cerecel Formation have been correlated with the Kosovian glaciomarine diamictite facies highly characteristic of northern Gondwana. The sedimentation of such deposits occurred after a period of eustatic emersion caused by the latest Ordovician glaciation, almost in every case associated to short erosive periods of variable intensity. For that reason, we consider that most probably such regional stratigraphic gaps could also be present in the basal and topmost contact of the Cerecel Formation. This unit bears poorly diversified ichnofossils (Yanev, 1992; Aceñolaza and Yanev, 2001), none of which displaying biostratigraphical significance.

The youngest Bulgarian Ordovician fossils were identified by Sachanski (1993) in the basal part of the Saltar Formation, where *Normalograptus persculptus* (Salter) has been recorded just below the oldest Silurian graptolites.

Goncuoglu, M.C., Lakova, I., Kozlu, H., Sachanski, V. 2003. The Silurian of the Istanbul unit in the Camdag area, NW Turkey. In: Ortega, G., Ascenolaza, G.F. (eds.), ***Proceedings 7th IGC – FNSSS, San Juan, Argentina, August 2003. INSUGEO, Serie Correlacion Geologica*****, 18, 131-133.**

The Paleozoic succession of the Camdag area is located between the Paleozoic of the Istanbul and Zonguldak terranes in NW Turkey and has a key location for the paleogeographic position of these terranes. The Silurian deposits (Findikli Formation) in this area includes from bottom to top: the Black Shale Member (gray to greenish gray, well cleaved shales with minor black siltstone and limy shale interlayers), the Shale-Siltstone Member (alternation of black shales, light gray quartz-rich siltstones with few limestone lenses), and the Shale-Limestone Member (black shales with limestone and dolomitic limestone interlayers), that is concordantly followed by Lower Devonian deposits. In this study, new graptolite, polynomorph and conodont findings from the Silurian Findikli Formation in NW Anatolia will be reported.

In contrast to the suggestions in the previous studies (e.g. Derman and Tuna, 2000) an almost complete succession of Silurian rocks has been encountered in the Camdag area in NW Anatolia. The studied Silurian and the conformably overlying Devonian successions are very similar to those in the Istanbul terrane. The Fındıklı Formation in the Zonguldak terrane (NW of Kastamonu town includes in its lower part (Dean *et al*. 1997) black siliceous shales with graptolites and acritarchs of middle Llandovery (Aeronian stage). Following a gap in exposure of about 80 m, gray schistose mudstones monograptid graptolite-bearing shales with *Monograptus flemingii* (Salter) and *Pristiograptus* cf. *parvus* (Ulst) are reported. This part of the succession has not yielded acritarchs but the graptolites are indicative for the upper part of the Wenlock series. The black shales are unconformably overlain by Lower Devonian conglomerates and carbonates, so that the upper part of the Silurian succession must have been not deposited or eroded due to a “Caledonian event”, which is completely missing in the Istanbul Terrane. By this the Paleozoic of the Camdag should be considered as the eastern continuation of the Istanbul Terrane.

Yanev, S., Göncüoglu, M.C., Boncheva, I., Gedik, I., Lakova, I., Maliakov, Y., Özgül, N., Sachanski, V., Saglam, G., Timur, E. 2004. Correlation of the Paleozoic Terranes in Bulgaria and NW Turkey: preliminary results. ***5th ISEGM, Thessaloniki, Greece*****, April 2004, Extended Abstracts, 215-218.**

The Trans-European Suture Zone (TESZ) is characterized by a mosaic of terranes of either Gondwanan-Perigondwanan or southern Laurussian origin, which were accreted during the Variscan orogenic event. The western and central compartments of the suture belt had been the subject of detailed international studies (for a review see Pharaoh 1999). The eastern continuation of the TESZ, on the other hand, is relatively less-known to the international community. Moreover, regional interpretations regarding the affiliation of smaller terranes in the Balkan and NW Anatolian regions are not based on detailed local studies and highly speculative. To overcome this problem, a joint-project with Bulgarian and Turkish earth-scientists had been initiated to correlate the stratigraphy, magmatism and succession of Paleozoic events in the Bulgarian and Turkish terranes. The present paper includes the preliminary results of this joint-project on the Paleozoic Meosian, Thracian and Balkan terranes (Haydoutov &Yanev 1997, Yanev 1993, 2000) in Bulgaria and the Istanbul and Zonguldak terranes (Göncüoglu et al. 1997; Göncüoglu & Kozur 1998) in NW Turkey.

In the Eastern Balkan realm, in Bulgaria, the Palaeozoic rocks outcrop in two different areas that belong to the Balkan and the Moesian Terranes. The generalized stratigraphic columnar sections are given in Figure 1.

In these units, the terrigenous-argillacous and carbonate Silurian and Devonian marine sedimentary successions with rich and diverse benthic and pelagic faunas are involved in the pre-Variscan cover of the Moesian Platform and the Balkan Mt (Stara Planina, Kraishte, etc.). Based on graptolite zonation (Sachanski 1998), the Silurian black shales, lydites and siltstones outcroping extensively in Western Stara Planina Mt. have been subdivided into formations. In the Moesian Platform, the chitinozoans have been used to prove the Wenlock to Emsian age of the black shale succession and to provide arguments on probable Peri-Gondwanan affinities (Lakova 1995). The subdivision of Devonian and Carboniferous sediments from the deep drillings in Moesian Platform are based on conodont zonation (Boncheva 1995; Yanev & Boncheva 1997), sedimentological and lithostratigraphical studies (Yanev 1972). In the Kraishte area of West Bulgaria, there are zonations of the shallow marine Lower Devonian deposits on conodonts (Boncheva 1991) and tentaculites (Sachanski 1996). Based on compilation of sedimentological, paleontological, paleoclimatical and paleomagnetical data on the Silurian and Devonian, it is proposed that these terranes originated from different parts of Gondwana and Perigondwana, migrated towards N and docked to Laurussia (e.g. Yanev 1993, 2000).

In the NW Turkey, recent studies (Göncüoglu, 1997; Göncüoglu & Kozur, 1998; 1999 and Kozur and Göncüoglu, 2000) have shown that the Palaeozoic successions of the former Istanbul Unit of Şengör et al. (1984) differ in the West (Istanbul-Gebze area) and in the East (Zonguldak-Safranbolu area). The differences include: a- the post Silurian-pre-Emsian regional unconformity accompanied with a Late Silurian thermal event in the Zonguldak Terrane contrasting with the continuous deposition in the İstanbul Terrane within the same time-span; b- the deposition of shallow-water carbonates and clastics during the Tournaisian–lower Namurian in the Zonguldak Terrane contrasting with the deposition of radiolarian cherts and flysch-type sediments during the Tournaisian and early Visйen in the İstanbul Terrane. Based on these differences these authors suggested the presence of two different terranes: Istanbul Terrane in the west and Zonguldak Terrane in the East. The generalized columnar sections of the Istanbul and Zonguldak terranes is given in Figure 2.

Steemans, P., Lakova, I. 2004. The Moesian Terrane during the Lochkovian – new palaeogeographic and phytogeographic hypotheses based on miospore assemblages. *Palaeogeogr., Palaeoclimatol., Palaeoecol.*, 208, 3-4, 225-233.

The relative position of terranes during the Palaeozoic can be indicated by a combination of palaeomagnetic and floral/ faunal evaluation. Palaeomagnetic data are absent from the Moesian Terrane, South-Eastern Europe, and its position is here estimated thanks to palaeophytogeographic considerations based on miospore assemblages. Miospore assemblages have been studied in two boreholes from northern Bulgaria. Preliminary analyses of chitinozoans, acritarchs and phytodebris have already been published. The oldest samples were considered to be of Pridoli age based on chitinozoan data, but here we provide new miospore evidence suggesting a Lochkovian age. This age determination is in accordance with the new interpretations based on previously published acritarch data. It is likely that the previous Pridoli age determination was influenced by Pridoli chitinozoans being reworked into the Lochkovian. The miospores are typical of assemblages only present in a small area of Avalonia and the western part of the Baltica Plate, and belong to the sinuosus–zavallatus (S–Z) Phytogeographic Province, defined here. On the contrary to the miospores, marine palynomorphs have affinity with Gondwanan assemblages. The different palaeogeographic affinities of the different palynomorph groups are not necessarily in contradiction, as it has recently been suggested that the Rheic Ocean did not act, around the Silurian–Devonian boundary, as a hermetic barrier for transoceanic chitinozoan and acritarch exchange. Therefore, the results are tentatively interpreted as indicating that the Moesian Terrane, belonging to the S–Z Province, was close to southern Laurussia during the Lower Devonian. This northern position of the Moesian Terrane during the Lower Devonian conflicts with most current palaeogeographic reconstructions, but partially supports the hypothesis of a migration of this terrane from Gondwana to Laurussia during the Palaeozoic. The possible presence of reworked palynomorphs in the Lochkovian may reflect early tectonic events associated with the close proximity of the Moesian Terrane and the Dobrudgea periphery of Palaeo-Europe.

Lakova, I., Sachanski, V. 2004. Cryptospores and trilete spores in oceanic graptolite-bearing sediments across the Ordovician-Silurian boundary in the Svoge anticline, West Balkan Mts, Bulgaria. *Review of the Bulgarian Geological Society*, 65, 1-3, 151-156.

Целта на това изследване е уточняване на граптолитната биостратиграфия и търсене на палиноморфи във финотеригенни скали на горния ордовик и долния силур в Свогенската антиклинала, Западна Стара планина. Извършени бяха пилотни опробвания в Церецелската, Сирманската и Салтарската свита. Фосилоносната долна част на Салтарската свита е представена от лидити и силицитни аргилити с прослойки от граптолитни аргилити. По граптолити са установени зоните *persculptus* (хирнантски етаж на ашгилската серия), *acuminatus-ascensus*, *vesiculosus* и *cyphus* (рудански етаж на ландоверската серия). Пробите бяха подложени на стандартна палиноложка обработка, а от тях бяха изготвени и дюншлифи.

Продуктивни за палиноморфи са две нива в Салтарската свита. Долното ниво представлява лидити от основата на Салтарската свита, където бе установено струпване на хиляди екземпляри от криптоспори. Тази находка съответства на граптолитната зона *Normalograptus persculptus*, най-горна част на хирнантския етаж на ордовика. Феноменът на масово присъствие на криптоспори от сухоземни растения в дистални океански граптолитоносни скали може да бъде обяснен с ефекта от пост-глациалното хирнантско повишаване на нивото на световния океан. Вследствие на това, прибрежни райони на сушата са били наводнени и в океанския басейн чрез воден транспорт са постъпили криптоспори, заедно с финотеригенен материал.

В по-горно ниво в Салтарската свита, в силицитни аргилити бяха установени трилетни спори, условно отнесени към морфон *Ambitisporites avitus-dilutus* Steemans. Тази находка е от граптолитната зона *Cystograptus vesiculosus*, средна част на руданския етаж на ландоверсата серия. Първата поява на трилетни спори в находища от различни палеоконтиненти не е синхронна и варира от късния ашгил до ранния уенлок. Находката от Западния Балкан е много точно и директно датирана по граптолити, представлява една от ранните първи появи и е едновъзрастна с първите трилетни спори от северната окрайнина на Гондвана (Либия и Саудитска Арабия).

Lakova, I., Goncuoglu, M.C. 2005. Early Ludlovian (early Late Silurian) palynomorphs from the Palaeozoic of Camdag, NW Anatolia, Turkey. *Journal of the Earth Sciences Application and Research Centre of Hacettepe University*, 26, 1, 61-73.

In the Çamdag area in north-western Anatolia, newly discovered tectonic slices including the Shale-Siltstone Member of the Findikli formation yielded a diverse palynological association with determinable acanthomorphic acritarchs and prasinophyte algae and tabular structures. From these, the short-ranging species *Ammonidium ludlowense*, *Eisenackidium wenlockium, Gorgonisphaeridium listeri listeri* and *G. succinum* are of biostratigraphical interest as they are restricted to the early Ludlow. This is so far the first early Late Silurian palynological data from NW Turkey and suggests that the deposition in the Çamdag area was more proximal, compared with the correlative units in the Perigondwanan ‹stanbul and Balkan Terranes.

Tghe early Ludlovian microphytoplankton discovered in the middle part (Shale-Siltstone Member) of the Findkli Formation in Çamdag, NW Anatolia, contains some organic-walled microfossil groups: opaque trilete spores, single cryptospores - spore dyads and tetrads, chitinozoans, scolecodonts, ?mazuelloids, as well as determinable acanthomorphic acritarchs and prasinophyte algae (*Ammonidium ludloviense*, *Cymatiosphaera* sp. cf. *C. octoplana*, *Comasphaeridium brevispinosum, C. williereae, Eisenackidium wenlokense, Gorgonisphaeridium listeri listeri, Gorgonisphaeridium succinum, Lophosphaeridium* sp. indet., *Oppilatala ramusculosa, Verychachium trispinosum*) and tabular structures (*Constrictitubulus cristatus, Porcatitubulus annulatus*, *Porcatitubulus strupus* and *Ornatifilum granulatum*). This association contains some indicative species suggesting early Ludlovian age and is so far the first palynomorph data from NW Anatolia. The lithologies and the organic-walled microfossils of the Shale-Siltstone Member suggest that it was deposited in an anoxic shallow-marine environment with clastic sediment supply from a fluvial source, rich in white mica. The rockunits of the same age in Istanbul and Tauride basins are significantly different and suggest a relatively deeper depositional environment. Consequently the Çamdag area was probably located nearshore at this period. In the Zonguldak basin, there is a stratigraphic gap between the graptolite-bearing upper Wenlock series and the unconformably overlying Emsian shallow-marine carbonates, being the characteristic feature of the Zonguldak terrane. A far-distance correlation with the middle Silurian deposits in Bulgaria suggests that the studied succession in the Çamdag area is similar to the Balkan Terrane rather than the Moesian one.

Yanev, S., Lakova, I., Boncheva, I., Sachanski, V. 2005. The Moesian and Balkan Terranes in Bulgaria: Palaeozoic basin development, palaeogeography and tectonic evolution. *Geologica Belgica*, 8, 4, 185-192.

This paper is a review of recent stratigraphical, biogeographical, palaeoclimatical, palaeofacial and palaeomagnetical data and represents a basis for paleogeographical and geodynamical interpretations. The geological development and palaeogeography of the Moesian and Balkan Terranes are here regarded in the scope of the geodynamical evolution of Baltica-Gondwana interface from Ordovician to Carboniferous. It is concluded that the Balkan Terrane was a part of the Armorican Terrane Assemblage during its whole Palaeozoic evolution. The origin and palaeogeographical affinities of the Moesian Terrane during the Early Palaeozoic remain unclearly determined. It is probable that during the Early Devonian the Moesian Terrane was at closer position to Armorica and Avalonia and moved northward to reach and collide to Baltica at the end of Devonian. The accretion of the Balkan Terrane to Moesia-Baltica occurred during the Late Carboniferous and Permian. Since the late Carboniferous to the end of the Palaeozoic, both the Moesian and Balkan Terranes were situated within the equatorial zone and had the same depositional history in the Permian.

Sachanski, V., I. Boncheva, I. Lakova. 2005. A continuous section across the Silurian-Devonian boundary in the Kraishte region: graptolite and conodont biostratigraphy. *Proceedings Jubilee International Conference "80 years Bulgarian Geological Society"*, 18-20.

Разкритията на горния силур и долния девон в Краищидната зона са изолирани и тектонски нарушени. Обикновено са представени различни етажи и серии, но непрекъснати разрези на границата силур-девон почти не се срещат. Спасов (1963, 1964) съобщава за граптолити от лудлоуската, придолската серия и лохковския етаж в находището при с. Станьовци. Основата на Врабченската свита в типовия разрез при с. Горна Врабча е отнесена към горния лохков по конодонти (Spassov, 1971, Boncheva, 1991), но остава неизяснен литоложкия характер и точната възраст на директната подложка. Досега в Краището няма описан и документиран с фосилни находки непрекъснат разрез на горния силур и долния девон.

При теренни изследвания по проект НЗ-1404 на НСНИ бяха описани няколко непрекъснати разреза на границата силур-девон с висок потенциал за детайлна биостратиграфия. В тази работа се описва разрезът при с. Г. Врабча, който отдолу нагоре включва аргилитна задруга, аргилитно-варовикова задруга и Врабченска свита (s.s.) и представлява непосредствена подложка на типовия разрез на Врабченската свита, описан от Спасов (1973). По граптолити и конодонти се установяват горсткия и лудфордския етаж на уенлокската серия, придолската серия и най-долната част на лохковския етаж.

Врабченската свита в типовия разрез се състои от глинести варовици в алтернация с аргилити и пачка лидити. Известната досега възраст на свитата по конодонти бе късен лохков – ранен емс (Boncheva, 1991). При това изследване бе документирана основата на свитата, която се отнася към най-долния лохков, конодонтна зона *I. woschmidti woschmidti*. Отдолулежащата аргилитно-варовикова задруга се поделя на четири пачки в зависимост от преобладаването на варовици или аргилити. В пачка 4 е установена също зона *I. woschmidti woschmidti*. В пачка 3 граптолитите от зоната *P. parultimus* доказват придолската серия. В основата на задругата, в пачка 1 е доказана конодонтната зона *P. siluricus*, лудфордски етаж на лудлоуската серия. Най-отдолу в разреза се разполага аргилитната задруга, в която е намерена граптолитната зона *N. nilssoni*, горстки етаж на лудлоуската серия. Така границата силур-девон в този разрез се поставя в долната част на пачка 4 на аргилитно-варовиковата задруга.

Аргилитно-варовиковата задруга се отличава от Врабченската свита по наличието на обособени пачки аргилити, но двете литоложки тела прехождат плавно едно в друго. Има основание аргилитно-варовиковата задруга да бъде отделена по-скоро като член на Врабченската свита, отколкото като свита.

В Западните Балканиди едновъзрастен разрез по границата силур-девон е представен от ивичести и черни аргилити, в които е установена придол-лохковска сукцесия от граптолитните зони *P. parultimus*, *M. bouceki* и *M. uniformis* (Sachanski, 1998). Аргилитите и варовиците в Краището са отложени в рамките на отворен шелф, докато аргилитите в Балканидите са образувани в басейнова обстановка. И в двете области обаче е налице непрекъсната седиментация в края на силура и началото на девона, неповлияна от Каледонската орогенеза.

Yanev, S., Goncuoglu, M.C., Gedik, I., Lakova, I., Boncheva, I., Sachanski, V., Okuyucu, C., Ozgul, N., Timur, E., Malyakov, Y., Saydam, G. 2006. Stratigraphy, correlation and palaeogeography of Palaeozoic terranes in Bulgaria and NW Turkey: a review of recent data. *Geological Society London, Special Publication*, 260, 51-67.

Within the Alpine tectonic units SE of the European Variscan Orogenic Belt in Bulgaria and NW Turkey several crustal blocks are identified. Although their contact relations with surrounding units are obscured by Alpine events, the differences in the succession of events, stratigraphy, sedimentology and palaeobiogeographical distribution within them permits recognition of the Moesian, Balkan, Istanbul and Zonguldak Terranes. The Moesian terrane corresponds to the pre-Variscan Palaeozoic and Neoproterozoic rocks of the Moesian microplate in north Bulgaria and south Romania. The Balkan Terrane in Bulgaria incorporates Neoproterozoic and Palaeozoic sequences in the Western Balkanides (part of the Carpathian Balkan orogen) and another three allochthonous units (Kraishte, Central Balkanides and Strandzhides). In NW Anatolia in Turkey, the Caledonian basement and Ordovician to Carboniferous sedimentary succession are divided into the Istanbul Terrane and the Zonguldak Terrane. With the exception of the Moesian Terrane in the Bulgarian area, they all comprise a Cadomian basement with relicts of oceanic lithosphere, volcanic arc and a continental crust of unknown affinity. Based on characteristic features within their Palaeozoic successions, these terranes are correlated with the main terrane assemblages in Central and Eastern Europe. It is suggested that they all are of peri-Gondwanan origin but behaved independently while drifting towards Laurussia. During the Early Devonian the Zonguldak Terrane docked to Baltica, whereas the others were still at similar palaeolatitudes to the Central European terranes (e.g. Saxo-Thuringian). This was followed by the successive accretion of the Moesian Terrane to Laurussia along the Rhenohercynian suture at the end of Devonian–Early Carboniferous and of the Balkan and Istanbul Terranes between the Early and Late Carboniferous.

Ivanova, D., Koleva-Rekalova, E., Lakova, I., Metodiev, L. 2006. Callovian to Berriasian pelagic carbonates in the Western Fore-Balkan, Bulgaria: microfacies, ammonite and microfossil zonations. *Volumina Jurassica, 7th International Congress on the Jurassic System, September 6-18, 2006, Krakow, Poland, Session 4: Integrated stratigraphy*, 175-177.

The Callovian to Berriasian pelagic carbonates in the Western Fore-Balkan crop out as a part of the Middle Jurassic – Lower Cretaceous peri-platform marine sediments deposited on the northern Tethyan continental margin. This pelagic record consists of marl-limestone alternation (Bov Formation), grey micritic limestones with reddish nodular limestones (Javorets Formation), *Ammonitico Rosso* type red nodular limestones (Gintsi Formation) and *Biancone*-type grey micritic regularly bedded limestones (Glozhene Formation) (Sapunov 1976). The stratigraphic distribution and relative abundance of pelagic microplankton organisms (thin-shelled bivalves, planktonic foraminifers, radiolarians, calcareous dinocysts, pelagic echinoderms and calpionellids) have been used for biostratigraphy and/or recognition of microbiofacies. Within the Oxfordian-Berriasian interval the calcareous dinocyst zones: *C. fibrata*, *C. borzai*, *C. tithonica*, *P. malmica*, *C. tenuis*, *C. fortis*, *St. proxima* and *St. wanneri* are recorded. The Middle Tithonian to Berriasian interval is characterized by the successive calpionellid zones: *Chitinoidella*, *Praetintinnopsella*, *Crassicollaria*, *Calpionella* and *Calpionellopsis* (Lakova *et al*. 1999). Five microbiofacies within the pelagic carbonates are superposed: mudstone and wackestone with filaments of pelagic bivalves (Callovian), *Globuligerina* wackestone and radiolarian wackestone [Oxfordian-Kimmeridgian(?)], *Saccocoma* wackestones (Kimmeridgian – Lower Tithonian), *Globochaete* mudstone (Middle Tithonian) and calpionellid mudstone (Upper Tithonian and Berriasian).

Boncheva, I., Sachanski, V., Lakova, I. 2007. Devonian in the Balkan Terrane, Bulgaria: Stratigraphy, faunas and sedimentary environments. *Field meeting of the IGCP 499 (IUGS/UNESCO) “Devonian land-sea interaction: evolution of the ecosystems and climate (DEVEC)”* San Juan, Argentina, 14-22 May, 2007, 75-77.

The Balkan Terrane was defined by Haydutov & Yanev (1997) to include Palaeozoic magmatic, metamorphic and sedimentary rocks outcropping in two areas of west Bulgaria - West Balkan and Kraishte. The Devonian sediments deposited under different conditions within a same basin

– purely silicilastic sediments of distal environment in the west Balkan and NE Kraishte area and carbonate-siliciclastic rocks of more proximal environment in the SW Kraishte area, as well as in the Shipka and Strandzha Mountains.

In the west Balkan and NE Kraishte area during the Early Devonian to Eifelian uniform fine siliciclastic succession of dark and light siltstones and shales deposited in a deepwater basin. A transition to chert-clayey sediments occurred in the Givetian, followed by the formation of a flysch deposits during the Late Devonian. In the SW Kraishte area the Early Devonian is marked by carbonate-rich pelagic sedimentation with indications of shallower conditions (*Icriodus* facies, some corals). Later, during the early Middle Devonian it turned to cherty-silicite succession which is followed by flysch deposited from the Givetian to early Carboniferous.

Boncheva, I., Sachanski, V., Lakova, I., Yaneva, M. 2007. Facial transition and biostratigraphic correlation of the Upper Silurian and Lower Devonian in West Bulgaria. *Geological Quarterly*, 51, 4, 407-418.

Upper Silurian and Lower Devonian shelf deposits in West Bulgaria are exposed in three main Alpine tectonic units: the West Balkan Unit, the Lyubash Monocline and the Morava Unit. The West Balkan and Lyubash units consist of siliciclastic deposits: black graptolitic shales, banded pale shales and black siltstones. The Ludlow, Pridoli, Lochkovian, Pragian and Emsian were recognized on the basis of graptolite and tentaculite faunas. In the Morava Unit, the Ludlow black shales are progressively replaced by clayey limestones and nodular and micritic limestones in the Pridoli and Early Devonian. Newly obtained conodonts show the presence of the *siluricus, eosteinhornensis, woschmidti, postwoschmidti, delta-pesavis, sulcatus, dehiscens* and *gronbergi* zones. Petrographic study of the Morava Unit shows an increasing carbonate content and shallowing conditions upwards. The biostratigraphical correlation and facies interpretation reveal the coeval existence of two different depositional environments within the same shelf basin as well as agradual shift inproximal direction.

Lakova, I., Tchoumatchenco, P., Ivanova, D., Koleva-Rekalova, E. 2007. Callovian to Lower Cretaceous pelagic carbonates in the West Balkan Mountain (Komshtitsa and Barlya sections): integrated biostratigraphy and microfacies. *Geologica Balcanica*, 36, 3-4, 81-89.

The Jurassic System in the West Balkan Mountains attracted the attention of the first scholars of geology and stratigraphy in Bulgaria F. Toula and V. Zlatarski more than 100 years ago. The intense field, palaeontological and stratigraphical studies of the Upper Jurassic and Lower Cretaceous pelagic carbonates in the Izdremets Syncline led to the lithostratigraphic subdivision and establishment of all stages from the Callovian to the Hauterivian as a relust of publications of I. Sapunov, I. Nachev, T. Nikolon and G. Mandov in the 60s and 70s of the lastcentury. An integrated micropalaeontological zonation of the Tithonian, Berriasian and Valanginian was elaborated by I. Lakova, K. Stoykova and D. Ivanova. Recently, P. Tchoumatchenco divided the sections at Komshtitsa and Barlya into second- and third-order sequences.

The subject of this paper is a synthesis of the existing stratigraphic knowledge of the Callovian to Valanginian pelagic carbonate succession at the sections of Komshtitsa and Barlya in the West Balkan tectonic unit, as well as a correlation with new micropalaeontological and microfacial results. A zonation on calcareous dinocysts for the Upper Jurassic is here presented and correlated to the ammonite zones in the Yavorets, Gintsi and Glozhene Formations.

The correlation of the ammonite and microfossil (calpionellids, calcareous dinocysts and nannofossils) zonations in the Yavorets, Gintsi, Glozhene and Salash Formation in the sections of Komshtitsa and Barlya is a background of determination the lower stage boundaries of the Callovian to Valanginian according to the recent Geological Time Scale. Ammonite data are used to define the Bathonian-Callovian and Kimmeridgian-Tithonian boundary, and microfossil data – for all other stages. The lower stage boundaries are determinated as follows: Callovian – at the base *Herveyi* Zone, Oxfordian – close to the base of *C. fibrata* Zone, Kimmeridgian – within the *C. parvula* Zone, Tithonian – at the base of *Hybonotum* Zone, Berriasian – a t the base of *C. alpina* Subzone, and Valanginian – at the base of *Calpionellites* Zone. Six successive microfacies are characterized in the Callovian to Valanginian succession of micritic limestones, clayey limestiones, and limestone-marl alternation: filamentous, *Globuligerina* – radiolarian, *Saccocoma*, *Globochaete*, calpionellid and spicule.

Lakova, I., Koleva-Rekalova, E., Ivanova, D., Metodiev, L., Petrova, S. 2008. Transgressive-regressive cycles in the Tithonian and Berriasian pelagic limestones of the West Balkan Unit, Bulgaria. *Berichte der Geologischen Bundesanstalt*, 74, 47-48. First international Meeting on CCMM, Wien, 16-18 April 2008.

Two Tithonian and Berriasian sections of pelagic limestone-marl alternations have been studied for determination of transgressive-regressive cycles based on the bedding pattern and abundance curves of microfossils. The biostratigraphy was provided by calpionellids, calcareous nannofossils and calcareous dinoflagellates (Lakova et al., 1999). The studied interval comprises the Upper Tithonian and Berriasian (p.p.) as documented on the continuous succession of the calpionellid zones *Crassicollaria, Calpionella* and *Calpionellopsis* and their subzones. The time interval spans 5.4 Ma between the Lower-Upper Tithonian boundary (147.2 Ma) and *Csis simplex – Csis oblonga* subzones boundary (141.8 Ma)

Relatively monotonous medium- to thin-bedded micritic and intraclastic limestones with thinner marly interlayers crop out. They belong to the slope and basinal environments of the Late Jurassic and Early Cretaceous basin in the West Balkan tectonic unit. The measuring is bed by bed and thin-section samples have been taken at each 1 m.

The Upper Tithonian and Lower Berriasian (Glozhene Formation) represent mainly limestones, the bed thickness ranging from 10 to 30 cm, exceptionally 5 cm or up to 70 cm. Very thin marly interbeds of 1-3 cm occur randomly separating the limestone beds. A total of 147 beds are counted, deposited within a time interval of 5.0 Ma. The Upper Tithonian is 10 m thick and consists of 42 beds ("elementary cycles" in the sence of Pasquier, Srtasser, 1997), each formed at average time of 40 Ka. The Lower Berriasian is 20 m thick and consists of 105 limestone beds or limestone-marl alternations, each "elementary cycle" of 32 Ka duration.

The overlaying lower part part of the Salash Formation (Upper Berriasian, p. p., *Csis oblonga* Subzone) is an irregular alternation of micritic limestones, clayey limestones and marls representing a fast shift onto hemipelagical depositional environment. The bed thickness is normally 5-10 cm, exceptionally 20-30 cm. The thickness is 10 m and the time interval of deposition is 0.4 Ma. The number of limestone-marl alternations is 42. Each "elementary cycle" deposited during average time 10 Ka, and the rate of sedimentation dramatically increased to 25 mm/Ka compared to 6-7 mm/Ka for the Glozhene Formation.

The bedding pattern has been analysed in order to differentiate zones of maximum flooding, boundaries of T-R cycles and transgressive-regressive trends. These are directly correlated to the parallel abundance curves of calpionellids, calcareous dinoflagellates and nannofossils. The maxima of microfossil abundance approximately coincide with zones of thinner and more marly beds and are interpreted as maximal transgressions. The minima of the microfossils abundance correspond to thicker, pure limestone beds and are considered as regressive surfaces or sequence boundaries. The elementary cycles have been grouped into seven 3rd-order T-R cycles, covering a time interval of 5.4 Ma, and have been correlated to the sequences chart by Handerbol et al. (1998).

Boncheva, I., Leslie, S., Goncuoglu, M.C, Lakova, I., Sachanski, V., Konigshof, P. 2009. New conodnt and palynological data of the Palaeozoic in Northern Camdag, NW Anatolia, Turkey. *Acta Geologica Polonica*, 59, 2, 157–171.

Two main thrust slices in the Camdag area (NW Anatolia) were informally named the Southern and Northern Camdağ units. New micropaleontological and palynological data about the Ordovician, Silurian and Devonian in the Northern Camdag have allowed a better understanding of the early Palaeozoic evolution of this critical area between the Istanbul Terrane in the west and the Zonguldak Terrane in the east. The Middle Ordovician age obtained from the conodont-bearing limestone band within the Aydos Formation in this study is in agreement with the data from the Zonguldag Terrane. Acritarch evidence suggests a Late Ordovician age of the upper part of Aydos formation. This paper concerns the Northern Camdag Unit. Three members are distinguished in the Fındıklı Formation and dated biostratigraphically. The lower member (Black Shale Member) of the Findiklı Formation is absent from the Kabalak dere section, but was assigned elsewhere to the Llandovery on the basis of graptolites. The middle member (Shale-Siltstone Member) is dated as Wenlock and Ludlow on the basis of acritarchs. The upper member (Shale-Limestones Member) spans a continuous upper Silurian – Lower Devonian succession. The overlaying Ferizli Formation is assigned to the Middle Devonian on the basis of conodonts. The new stratigraphic data indicate that the Southern Camdag Unit corresponds to the Istanbul Terrane and the Northern Camdag Unit to the Zonguldak Terrane. The tectonic contact between the Northern and the Southern units is a steep south-verging thrust-fault.

Лакова, И. 2009. Акритархни доказателства за силурска възраст на ниско-метаморфния палеозой в Краището. *Списание на БГД,* 70, 1-3, 23-30.

Седиментните палеозойски формации в Моравската единица в Краището са в голямата си част с изяснена възраст и суперпозиция. Нискометаморфните палеозойски свити обаче са в усложнени отношения помежду си и съдържат оскъдни или никакви фосили. Известните свити от нискометаморфни палеозойски скали в Моравската единица в района на гр. Земен и с. Трекляно, Кюстендилска област, са Чешлянска, Бъзовишка и Косовска. Бъзовишката и Косовската свита, заедно с неметаморфозираните палеозойски скали, се отнасят към Пенкьовския навлак, а Чешлянската свита – към Милевския навлак. В статията са представени нови данни за силурска възраст на Косовската и Чешлянската свита по акритархи и други палиноморфи. В Бъзовишката свита в България не бяха намерени микрофосили, но е направена корелация с аналогични датирани силурски и девонски метаседименти от Източна Сърбия. Не се потвърдиха предишни предположения за ордовишка възраст на която и да е от изследваните свити. Доказаната тук силурска възраст на Чешлянската и Косовската свита подкрепя концепцията, че те са латерални времеви аналози една на друга, както и на аргилитната и аргилитно-карбонатната задруга от Пенкьовския навлак.

Lakova, I., Petrova, S. 2009. Calpionellid zonation of the Tithonian, Berriasian and Valanginian around the village of Gintsi, West Balkan Mountains. *Proceedings National Conference Geosciences 2009, Sofia, 3-4 December*, 51-52.

46 calpionellid species belonging to 16 genera have been identified. The family Chitinoidellidae is represented by 13 species and 8 genera and the family Calpionellidae – by 33 species of 8

genera. The application of updated taxonomy of Chitinoidellidae proposed by Rehakova (2002) resulted in the recognition of the Tithonian genera *Longicollaria*, *Borziella*, *Dobeniella*, *Daciella*, *Carpathella*, *Almajella* for the first time in Bulgaria. The genera of the family Calpionellidae recorded are *Crassicollaria, Tintinnopsella, Calpionella, Remaniella, Calpionellopsis, Lorenziella, Praecalpionellites* and *Calpionellites*. Six calpionellid zones and eleven subzones are documented within the Middle–Upper Tithonian to the Lower Valanginian. In the two studied sections, a stratigraphic gap between the Glozhene and Salash Formations has been established corresponding to Calpionellopsis simplex Subzone in the Upper Berriasian.

Ivanova, D., Lakova, I. 2010. Bulgarian contributions to IGCP projects in the 21-st century (2005-2009). In: Lamolda, M.A. et al. (eds), *Geoevents, Geological Heritage, and the role of IGCP, Caravaca de la Cruz, 15th-18th September 2010, Abstract Book,* 95-97.

Bulgarian contributions to the IGCP activities in the period 2005–2009 were mainly in Palaeontology, Stratigraphy and Sedimentology (nine projects), and Mineralogy (one project). Bulgaria hosted three international IGCP Meetings: IGCP 469 Meeting in Sofia (2004) – papers published in the journal *Geologica Balcanica*; IGCP 486 Meeting in Kiten (2005) – the reports published in the periodical *Geochemistry, Mineralogy and Petrology;* Fourth Plenary Meeting of Projects IGCP 521 and INQUA 0501 in Bucharest, Romania and Varna, Bulgaria. The Bulgarian Working Groups published a total of 94 articles and abstracts. Members of the Bulgarian IGCP Committee were involved in the various research and outreach during the International Year of Planet Earth – IYPE (2007–2009) activities.

Иванова, Д., Колева-Рекалова, Е., Лакова, И., Стойкова, К., Иванов, М., Методиев, Л., Петрова, С., Чумаченко, П., Рабренович, Д., Радулович, В., Малешевич, Н. 2010. Итегрирана стратиграфия и корелация на платформените и басейновите горноюрски-долнокредни карбонатни седименти около българо-сръбската граница. *Сборник разширени резюмета Национална конференция „Геонауки 2010”, София, 9-10 декември,* 74-75.

Карбонатната седиментация започва с формирането на хомоклинална рампа през Каловския век и преминава в платформа с окрайнина през Ранния Кимериджки подвек. В еволюцията на платформата се очертават ясно три основни етапа – постъпателна проградация, аградация и ретроградация. Развитието на тези етапи започва през Късния Кимериджки подвек и завършва през Валанжинския век. Разрушаването и потъването на карбонатната платформа стартира в дисталните части на платформата и се документира от ерозионни повърхнини, хиатуси и кондензирани нива, на места с глауконит. Потъването на платформата се е осъществявало постепенно от Ранния до Късния Валанжински подвек. През Късноюрската епоха в басейна са съществували стабилни условия за седиментация, докато през Късния Бериаски подвек се очертава ясна батиметрична тенденция в пелагичните карбонати в посока от запад към изток, която се изразява в преминаването от склон на платформата, към басейн и периферия на флишки трог.

Петрова, С., Лакова, И., Иванова, Д. 2010. Салашката свита в Западното Средногорие: литология, възраст и граници. *Сборник разширени резюмета Национална конференция „Геонауки 2010”, София, 9-10 декември,* 93-94.

Салашката свита в Западносредногорската единица се разкрива в най-западната част в разрезите при Три уши, Драгоман, Летница, Прекръсте и Калотина. Подложката навсякъде е представена от варовиците на Сливнишката свита, а покривката – от карбонатно-глинесто-теригенните скали на Камчийската свита.

При това изследване бяха получени нови микропалеонтоложки данни за най-горните 5 m от Сливнишката свита и най-долните 20 m от Салашката свита по рида Чавчи камък. Границата Бериас–Валанжин попада в най-горните нива на Сливнишката свита. На 0,40 m под върха на Сливнишката свита е намерен калпионелидният вид *Calpionellites darderi* (Colom). По-долу в свитата е установен *Calpionellopsis oblonga* (Cadisch) от Горния Бериас. Зоната Calpionellites (Долен Валанжин) обхваща най-горните нива на Сливнишката свита и част от Салашката свита и е с дебелина около 11 m.

В разреза при Драгоман в основата на Салашката свита, непосредствено над контакта със Сливнишката свита, във варовит брекчо-конгломерат е намерен амонит, характерен за най-горната зона Furcillata на Горния Валанжин. Амонитната зона Radiatus (Долен Хотривски подетаж) обхваща около 26,75 m от Салашката свита се характеризира със сравнително богата амонитна асоциация (пачки 5–8). Амонитната зона Loryi (Долен Хотривски подетаж) е с дебелина над 20 m (пачки 9–10). Границата между Валанжинския и Хотривския етаж, т.е. между амонитните зони Furcillata и Radiatus, е поставена в основата на пачка 5 (на 8,65 m от основата на Салашката свита). Границата Салашка–Камчийска свита представлява постепенен преход.

В разреза при Калотина на 12 m от основата на Салашката свита бе установена най-горната амонитна зона на Горния Валанжин (Furcillata). В долната част на Салашката свита се срещат *Tintinnopsella carpathica* (Murgeanu & Filipescu), *Stomiosphaera echinata* Nowak, *Colomisphaera heliosphaera* (Vogler), *Cadosinopsis nowaki* Borza, което подкрепя късновалланжинската възраст. Границата между Сливнишката и Салашката свита е в Горния Валанжин. Прекъсването на седиментацията е било краткотрайно.

Салашката свита в разрезите при Драгоман и Калотина се отнася към Горния Валанжин и Хотрива. На височината Три уши (Чавчи камък) Салашката свита е доста нетипична и принадлежи към Валанжинския етаж.

Boncheva, I., Lakova, I., Sachanski, V., Koenigshof, P. 2010. Devonian stratigraphy, correlations and basin development in the Balkan Terrane, western Bulgaria. *Gondwana Research*, 17, 2-3, 573-582.

Devonian sediments in western Bulgaria occur in three specific Alpine tectonic units: the Svoge, Lyubash-Golo Bardo and Morava units. In the Svoge and Lyubash-Golo Bardo units, purely siliciclastic Lower and Middle Devonian rocks occur, whereas in the Morava Unit the Lower and Middle Devonian are represented by clayey limestones, shales and lydites. Stratigraphically important Lower Devonian fossils in the Svoge and Lyubash-Golo Bardo units include graptolites and tentaculitids, whereas in the Morava Unit, they include conodonts, graptolites, tentaculitids and plant macrofossils. The Lower Devonian in the Svoge and Lyubash-Golo Bardo units was deposited in a basinal facies setting, whereas the Lower Devonian in the Morava Unit represents an open shelf environment. From the Givetian until the end of the Devonian, a uniform deep basin developed throughout the Balkan Terrane, in which thick turbiditic succession was deposited. The Devonian sediments of the Balkan Terrane represent a continuation of marine development on the passive margin of peri-Gondwana and record the final pre-Variscan stage of basin evolution related to the closure of the Rheic Ocean. During the Early Carboniferous, the Lower Palaeozoic sediments of the Balkan Terrane were affected by the Variscan orogeny and covered by Upper Carboniferous and Permian continental molasse sediments.

The Rheic Ocean in Europe opened in the Early Ordovician and its closure is related to the Variscan orogeny, which occurred in the Late Carboniferous (Nance et al., 2010). The southeastern continuation of the Rheic suture is difficult to trace due to complex post-Variscan tectonics (Kalvoda and Babek, 2010), however, various Palaeozoic terranes, including the Balkan Terrane, Saxo-Thuringia, Armorica, and the Carnic Alps, bordered the Rheic suture in southeastern Europe and Turkey (Keppie et al., 2010; Zeh and Gerdes, 2010).

The continuous Ordovician to Early Carboniferous section in the Balkan Terrane shows that the Devonian basin was inherited from an Ordovician shelf margin basin. The Devonian sedimentary rocks of the Balkan Terrane in Bulgaria do not themselves provide univocal palaeoclimatical, palaeobiogeographical or palaeomagnetical data on the exact position of the sedimentary basin within the Rheic Ocean. There are, however, such data for the Middle and Upper Ordovician, which underlie the continuous Silurian and Devonian sedimentary succession. Using the proven Gondwanan affinity of the Ordovician fauna from the Balkan Terrane and the presence of Hirnantian sediments of glaciomarine origin in the area (with a palaeolatitudinal position of 40°S) (Yanev, 1997b; Gutierrez-Marco et al., 2003), as well as the inheritance of the Ordovician basin in the Silurian, Devonian and Early Carboniferous, we support the proposal of earlier workers (e.g. Yanev, 1993, 1997b) that the Balkan Terrane represents the deep-water outer shelf margin of the peri-Gondwana platform. According to palaeomagnetic data from the Serbian part of the Balkan Terrane, Yanev (2000) suggested a palaeolatitude for the Balkan Terrane of about 38°S–39°S in theOrdovician, and about 10–15°S during the Middle Devonian. The final stage of Devonian flysch sedimentation in the Balkan Terrane clarifies the time of closure of the Rheic Ocean and the beginning of the Variscan collision between the Moesian Terrane and the Balkan Terrane. Yanev (1997b) assumed that the accretion of the Moesian Terrane to the Dobrogea periphery of the Eastern European Platform began in the Early and Middle Devonian and continued into the Carboniferous with the Balkan Terrane. Recent U–Pb zircon dating of Variscan magmatic rocks from the Balkan Terrane indicates Early Carboniferous (332 Ma) and Late Carboniferous ages (302–307 Ma) (Peytcheva et al., 2006) and formation in a post-collisional regime. This supports the collision between the Balkan Terrane and the Moesian Terrane during the Early Carboniferous as part of the Variscan orogeny (Yanev, 2000).

Petrova, S., Lakova, I., Ivanova, D. 2011. Berriasian–Valanginian boundary in Bulgaria. *Review of the Bulgarian Geological Society*, 72, 1-3.

Дефиницията на границата Бериаски–Валанжински етаж в България е претърпяла значителни промени през последните 40 години. Тази статия разглежда еволюцията на възгледите за границата Бериас–Валанжин, основани на разпространението и събитията на първа поява на калпионелидите и амонитите. Разгледани са нови данни по амонити, корелирани с по-рано установени микрофосилни зони по калпионелиди и варовити диноцисти в разреза Бърля (Западна Стара планина), както и нови данни по три микрофосилни групи (калпионелиди, варовити диноцисти и фораминифери) в разреза Чавчи камък (Западно Средногорие). Новите резултати позволиха да се уточни позицията на границата Бериаски–Валанжински етаж в тези разрези съгласно съвременните критерии – по първата поява на калпионелидния вид *Calpionellites darderi* и на амонитния вид *Thurmanniceras pertransiens*. Данни за паралелното ветрикално разпространение на различни варовити микрофосили показват още две събития на първа поява на тази граница – на варовития диноцист *Colomisphaera conferta* и на фораминиферния вид *Meandrospira favrei*, които могат да се използват като допълнителни критерии за определяне на основата на Валанжинския етаж в пелагични карбонати и в преходни фациеси към карбонатната платформа.

Bedi, Y., Vasilev, E., Dabovski, Ch., Ergen, A., Dogan, A., Ocuyucu, C., Boncheva, I., Sachanski, V., Ivanova, D., Lakova, I., Goncuoglu, M.C. 2011. The napped Structure of the Istranca crystaline complex in NW Turkey and SE Bulgaria. ***3rd International Symposium on the Geology of the Black Sea Region, Bucharest,*** **01-10.10.2011, Abstracts, 28-30.**

The Istranca Crystalline Complex is made of several nappes, collectively named as the "Istranca Nappes". They are classified according to differences in their basements, Triassic lithostratigraphy and metamorphism. From bottom to the top they are named as Sarpdere (with Subbalkanide-type Triassic), Mahyadag (with Istranca-type Triassic) and Doğanköy (with Sakar-type Triassic) nappes, which were thrust onto the Subbalkanide Autochthonous. The autochthonous occurs mainly in the Bulgarian area and comprises a basement of Precambrian? high grade metamorphic rocks, intruded by Late Paleozoic granitoids, and Paleozoic greenschist facies metasediments and felsic metavolcanics. The unconformably overlying succession includes Lower Triassic metaclastics, Middle Triassic carbonates and Middle to Upper Triassic olistostromes with olistoliths. The Upper Triassic comprises massive carbonates, overlain by an alternation of carbonates and fine-grained clastics. In the Turkish area, no pre-Triassic rocks were observed and the Subbalkanide type Triassic of Sarpdere Nappe is overthrust by Mahyadağ Nappe. The basement of the Mahyadağ Nappe comprises a low-grade metamorphic succession of Devonian siltstones and carbonates, an alternation of Devonian-Permian carbonates and quartzites and latest Permian- earliest Induan pelecypod-bearing carbonates. This basement is disconformably overlain by conglomerates, quartzites and siltstones, that grade into Lower-Middle Triassic carbonates. The Middle Triassic is characterized by limestones and dolomites. The upper part of the Mahyadağ Nappe consists of ammonite and crinoid-rich Middle-Upper Triassic carbonates with clayey and sandy interlayers. The Doğanköy Nappe, representing originally the uppermost Cimmerian nappe, comprises a crystalline basement complex of Precambrian-Early Paleozoic metasedimentary rocks and orthoamphibolites, intruded by pre-Carboniferous felsic and mafic intrusions. Variably deformed and metamorphosed Variscan granitoids (Kırklareli Group) and post-Variscan biotitehornblende granitoids (Sakar Pluton) have subsequently intruded this basement. The crystalline basement complex is disconformably overlain by Early-Middle Triassic metaconglomerates, followed by psammo-pelitic gneisses with crinoidal limestone interlayers. This unit is cut by Triassic? Quartzporphyries and conformably overlain by a thick succession of Middle Triassic crinoidal carbonates.

Sachanski, V., Göncüoğlu M.C., Lakova I., Boncheva, I., Saydam-Demiray, G. 2012. Silurian Graptolite, Conodont and Cryptospore Biostratigraphy of the Gülüç Section in Ereğli, Zonguldak Terrane, NW Anatolia, Turkey. ***Turkish Journal of Earth Sciences,*** **21, 6, 867-903.**

The studied Guluc section of the Silurian Fındıklı Formation is situated on the western bank of Guluc Creek in Ereğli, NW Anatolia, Turkey, in the eastern part of the Zonguldak Terrane. The Guluc section consists of 3 sedimentary packages: greenish grey limy siltstones, 5–7 m thick (1), overlain by an irregular alternation of black shales and clayey limestones, about 15 m thick (2), and a 6–7 m thick succession of mainly siltstones and sandy limestones (3). A combined biostratigraphy based upon graptolites, cryptospores and conodonts indicates that Package 1 is of Llandovery (Rhuddanian, Aeronian and/or early Telychian) age, Package 2 and Package 3 are of late Wenlock–early Ludlow (Homerian and Ludfordian) age. Graptolites in packages 2 and 3 indicate the presence of the *Cyrtograptus lundgreni, Neodiversograptus nilssoni* and

Lobograptus scanicus graptolite biozones. The *Ozarkodina crassa* Biozone occurs in the lower Gorstian (Ludlow). The specific features of the Guluc section (lithological changes, condensation, stratigraphic gap, change in graptolite diversity) are related to the global model of Silurian T–R cycles. The Silurian Fındıklı Formation in the Guluc section, about 20 m thick, represents a condensed lithological succession which differs significantly from the coeval thick, stratigraphically widespread black shales and siltstones of the same formation in the Zonguldak and İstanbul terranes. Sixteen cryptospore species are described and their stratigraphic and geographic dispersal is shown.

Lakova, I., Petrova, S. 2012. Towards a standard calpionellid zonation of the Mediterranean Realm (Tithonian to Valanginian). ***Proceedings National conference "Geosciences 2012", Sofia, December 13-14*****, 89-90.**

Calpionellid zonation is crucial in detailed subdivision of the early Lower Cretaceous pelagic and hemipelagic carbonate sequences. This report aims at synthesizing the achievements in calpionellid zonation in the Mediterranean during the last 25 years and proposing a zonal standard valid from Mexico to Iran. The summary of calpionellid zonations of the publications referred is confirmed and refined by the present authors with results from Bulgaria and Eastern Serbia.

The modern detailed calpionellid zonal and subzonal scheme which was first eatablished in the Western and Southern Carpathians in Romania and Slovakia, respectively, (Pop, 1997; Reháková, Michalik, 1997) and confirmed in Sicily (Italy) is being applied in the Balkan Mts of the west Bulgaria and east Serbia (Lakova et al., 1999 and this study). It works also in the Tithonian to Valanginian pelagic carbonates in Cuba, Spain, Poland, Hungary, Austria, Iran, etc. On the other hand, the fairly different zonation by Grün and Blau (1997) from northern Italy is only partly applied in its Tithonian part in North Africa. Thus, the "Carpathian" calpionellid zonation needs just insignificant refinement and precision towards its formal approval as standard for the Mediterranean Realm.

Lakova, I., Petrova, S. 2013 Towards a standard Mediterranean calpionellid zonation from the Tithonian to Valanginian. ***Acta Geologica Polonica*** **(in press).**

Based on the vertical ranges of 53 chitinoidellid and calpionellid species in the Tithonian to Valanginian time interval, a zonation of the pelagic carbonates from the Western Balkanides is proposed. It consists of the widely accepted calpionellid zones in the Medeterranean Realm, such as Chitinoidella, Praetintinnopsella, Crassicollaria, Calpionella, Calpionellopsis, Calpionellites and Tintinnopsella. Subzonal divisions are comparable to those in the Carpathians in Slovakia, Poland and Romania. Direct correlations between ammonites and calpionellids suggest that the base of the Upper Tithonian is to be traced at the FO of *Chitinoidella boneti*, that of the Upper Berriasian – at the onset of the genus *Calpionellopsis*, and the base and top of Lower Valanginian – at the FO and LO of the genus *Calpionellites*, respectively. The bloom of modern detailed calpionellid zonations in 21st century covering a vast territory of the Mediterranean Realm from Cuba to Iran suggests that a standard calpionellid zonation is to appear. Calpionellid zonal schemes represent a background for calibrations with ammonites, calcareous nannofossils and magnetic polarity chrons.

The apllication of updated taxonomy of Chitinoidellidae proposed by Pop (1997a, 1998a) and Reháková (2002) resulted in the recognition of the Tithonian genera *Longicollaria*, *Borziella*, *Dobeniella*, *Daciella*, *Carpathella*, for the first time in Bulgaria.

The lower boundaries of the 6 zones and the 11 subzones (from Tithonian to Lower Valanginian) are defined on the basis of 11 events of the FO and 1event of the LO.

2. Резюмета от научни конференции за участие в конкурса (2000 – 2012)

Lakova, I. 2000. Biostratigraphy, correlation and paleobiogeography of Upper Silurian - Lower Devonian chitinozoans of Northern Gondwana. ***I Congresso Iberico de Paleontologia / VIII International Meeting of IGCP 421, Livro de Resumos*****, p. 251.**

The black shale Pridoli to Emsian succession, more than 2000 m thick, of the pre-Variscan basement of the Moesian Terran in north Bulgaria yielded diverse chitinozoans, acritarchs, spores and tubular structures. Among them, 62 chitinozoan species and 15 species of tubular strucrures (Anteturma Trichomiformis, Burgess & Edwards) have been identified from R-1 Dalgodeltsi, R-119 Kardam, OP-2 Mihalich and R-2 Vetrino sections. A chitinozoan biozonation of ten biozones is proposed surving as a chronostratigraphic framework and correlation tool.

The chitinozoan biozones defined are: Calpichitina acollaris (Wenlock), *Fungochitina kosovensis* and *Margachitina elegans* (Pridoli), *Eisenackitina bohemica, Fungochitina lata, Urochitina simplex, Cingulochitina plusquelleci* (Lochkovian), *Bursachitina elliptica, Bulbochitina bulbosa* and *Bursachitina bursa* (Pragian – Emsian). Most of these biozones correspond to the global Silurian and Devonian standards on chitinozoa. *Calpichitina acollaris*, *Cingulochitina plusquelleci* and *Bursachitina elliptica* Biozones are of local occurrence.

The first record of diverse tubular structure and filament associations within the probable peri-Gondwanan Moesian terran and the direct correlation of their stratigraphical ranges to the chitinozoan biozonation has shown the occurrence of these terrestrial microfossils up to Emsian.

C.I.M.P. Chitinozoan Subcommission and Verniers, J., Paris, F., Asselin, E., van Grootel, G., Achab, A. in collaboration with Nestor, V., Lakova , I., , Nolvak, J., Grahn, Y, Sutherland, S, Winchester-Seeto, J., Vandenbroucke, T. 2002. CHITIREF: a database with all published chitinozoan references (1930-2001) and a list of all chitinozoan species. ***International Meeting and workshop of CIMP - 2002, Villeneuve d'Ascq, September 2002*****, Abstracts, p. 14.**

Under the auspices of the CIMP subcommission Chitinozoa a database was constructed with all references on chitinozoans. It replaces the 1967 CIMP database of all references known by that time. Chitiref includes the authors, title, title of the journal, book etc. of more than 1100 publications. They are separated into four categories: A. publications in journals, books, containing information on Chitinozoa useful for the study of the group, as taxonomy and descriptions with or without illustrations, presence, ranges, biostratigraphy, palaeogeography, abundance, diversity, etc.; B: abstracts with Chitinozoa mentioned; C: unpublished works, according to bibliographical standards, as unpublished M.Sc. or Ph.D theses, reports; D: publications, books, textbooks, manuals, dictionaries or encyclopaedias mentioning the word Chitinozoa/chitinozoans or general information about them, not of use to the Chitinozoa study. The latter category is not complete in the database but cab . The latter category can amount to the same number as categories A, B and C together. Special care was put into the right spelling and uniform transcription of non-Latin alphabets. The database that will be demonstrated is constructed in a Procite program contains the four categories. Category A can also be delivered as a document file.

Finally a complete list of all published species will be added, calssified by generic and by species order. The list is also to be consulted on the website.

Yanev, S., Lakova, I. 2004. The Moesian and Balkan Terranes in the light of evolution of the adjacent terranes. – Avalonia-Moesia. *Symposium and workshop on the Early Palaeozoic orogens of the Trans-European Suture Zone, 9-11 October 2004, Ghent/Ronse, Belgium*, Abstractbook, p. 48.

The position of the Moesian and Balkan terranes during Neoproterozoic and Paleozoic times is being discussed in the light of the evolution of a major terrane boundary - the Rheic Suture, separating Avalonia-Baltica from the terrans of the Variscan intertids, accreted in late Paleozoic time. Recently published and new data on the paleogeographical position of the Moesian and Balkan terranes in Bulgaria are reviewed.

In the Moesian terrane a 500 m thick Ordovician siliciclastic rock succession, unconformably overlain by 2000 m thick Silurian and Lower Devonian mainly black shale deposits developped. The Lochkovian chitinozoans indicate rather high paleolatitude untypical for Avalonia-Baltica, the acritarchs are similar to Gondwana, Armorica and Avalonia, whereas the coeval and co-occurring miospores showed clear Avalonian provenance. The Middle-Upper Devonian and Lower Carboniferous carbonate platform sequence of limestones and dolomites is 2400 m thick and reveales a northward migration of depositional environment from the south temperate humid through the south arid climatic zone. Following a sedimentation break, pelitic-siliciclastic Upper Visean rocks up to 2800 m thick were deposited. Paleomagnetic data suggest that Permian continental rocks accumulated in the northern arid zone 8-14^{o} from the paleoequator.

In the Balkan terrane, an island-arc association of cumulates, dikes and pillow lavas metamorphosed to green-shist facies outcrops in the Western Balkan Mts. Recent zircon dating of intrusive rocks indicated about 493 Ma, confirming Cambrian-early Ordovician age of the island-arc. These ages are similar of Pan-African ages and provide further evidence of Gondwanan origin of the Balkan terrane. The island-arc complex is transgressively and unconformably overlain by an Arenigian olistostome sequence. Unmetamorfosed Middle and Upper Ordovician shales and sandstones, 2000 m thick, with brachipods and trilobites cover the olistostrome sequence. Middle Ordovician benthic faunas of the Balkan terran in west Bulgaria and east Serbia are of Bohemian and North African affinities. Paleomagnetical data from the Middle Ordovician of Kucaj Unit in eastern Serbia indicated a paleolatitude of 30^{o}-40^{o} to the south of the paleoequator. The Silurian of the Balkan terrane representes a pelagic pelitic succession of 300 m lydites, black graptolitic shales and laminated shales-siltstones dated on graptolites. The Devonian represents a 1500 m continuous seccession of shales and siltstones without macrofauna (Lower and Middle Devonian), silicicalstic pre-flysh alternation of shales and lydites (Middle Devonian) followed by a thick flysh deposits with macroflora of the Upper Devonian to Visean. Continental cover consists of Upper Carboniferous coal-bearing and Permian siliciclastics.

The stratigraphical sedimentological, paleoclimatical and paleobiogeographical data support Yanev's hypothesis of peri-Gondwanan origin of the Moesian terrane, its northward migration from Ordovician to Devonian, the lack of Acadian unconformity, drifting to the sub-equatorial arid zone in the Late Devonian-Early Carboniferous time and accretion to Baltica in the Carboniferous. The Balkan terrane is very similar to the Saxo-Thuriangian Zone and belongs to the late Paleozoic accreted terranes south of the Rheic Suture. The accretion of the Balkan terrane to Moesia-Baltica postdated the Early Carboniferous and continued during the Late Carboniferous and Permian. Since the Late Carboniferous both Moesian and Balkan terranes were situated within the equatorial zone and shared the same depositional history and macrofloras in the Permian.

Lakova I. 2006. Biodiversity, stratigraphic and geographic distribution of Pridoli and Lochkovian acritarchs and prasinophyte algae from the Moesian Terrane, North Bulgaria. ***CIMP Meeting, Praha 2006, Prague, September*****, 32-33.**

The Upper Silurian and Lower Devonian subsurface succession of mainly dark shales and siltstones in the Moesian Platform in Bulgaria and Romania is a part of the pre-Variscan sedimentary cover of the Moesian Terrane. Two borehole sections, R-1 Dalgodeltsi in NW Bulgaria and R-119 Kardam in NE Bulgaria, yielded diverse chitinozoans, acritarchs, spores and tubular structures. A chitinozoan zonation adapted to the global Silurian and Devonian standards was proposed and tubular structures were described (Lakova, 2001) and joint chitinozoan and miospores zonations were directly calibrated (Steemans, Lakova, 2004). A chitinozoan zonation established consisting of the successive M. elegans, E. bohemica, F. lata, U. simplex and U. simplex – C. plusquelleci Zones suggests Pridoli and Lochkovian ages. The miospore zonation representing the *micrornatus-newportensis* Zone divided into its MN (siα), MN (siβ) and MN (G) subzones revealed some age discrepancies with the chitinozoan zonation regarding the Pridoli.

Co-occurring with the chitinozoans and miospores, 90 species of acritarchs and prasinophyte algae are identified within the Pridoli–Lochkovian section. The Pridoli assemblages are very diverse and dominated by species of *Cymatiosphaera, Gorgonisphaeridium, Micrhystridium* and *Visbysphaera*. The Lochkovian is much poorer in acritarhs. The only criterion for recognition of the Pridoli from Lochkovian is the coeval last occurrence of *Duvernaysphaera aranaides, Quadraditum fantasticum* and *Onondagella deunffii*. Throughout the North and West Gondwana (Libya, Tunisia, Spain, France, Argentina, Florida), these species occur within the Pridoli and persist only in the earliest Lochkovian. In the Moesian Terrane these LOs coincide with the lower part of *E. bohemica* chitinozoan zone. Other biostratigraphic criteria for the base of Lochkovian, the FOs of *Elektoriskos intonsus* and *Riculasphaera fissa* as proposed by Molyneux et al. (1996) are not applicable in Bulgaria as these taxa co-occur with Pridoli chitinozoans such as *Fungochitina kosovensis* and *Kalochitina lorensis*.

Even the biostratigraphic potential of the Pridoli and Lochkovian acritarchs from the Moesian Terrane is fairly low these diverse assemblages are very useful for palaeobiogeographic reconstructions. Thus, the geographic distribution analysis reveales a remarkable affinities between the latest Silurian and early Devonian acritarchs in Bulgaria and those from Brittany in France and Spain (Ibero-Armorica), Algeria, Tunisia and Libya (North Gondwana) and much less similarities with Gotland in Sweden, North America, Carnic Alps in Austria, Bolivia and Podolia in Ukraine. These essentially peri-Gondwanan affinities of the Pridoli and Lochkovian acritarchs from the Moesian Terrane correspond to the affinities of the co-occurring chitinozoans (Lakova, 1995).

Lakova, I., Goncuoglu, M. C., Sachanski, V., Boncheva, I. 2006. Silurian graptolite, conodont, and cryptospore biostratigraphy at Guluc section, Zonguldak Terrane, NW Anatolia. ***CIMP Meeting, Praha 2006, Prague, September*****, 33-34.**

The studied section of the Silurian Findikli Formation is situated near Gülüc village at the western (left) bank of Gülüc Creek in Eregli area, NW Anatolia, Turkey. In terms of tectonostratigraphy it occupies the eastern part of the Zonguldak Terrane. The Gülüc section consists of 3 packets: 5-7 m thick greenish gray limy siltstones (1), followed by an irregular alternation of black shales and clayey limestones, about 15 m thick (2) and a 6-7 m thick packet at the top of the siltstones and sandy limestones with single sandstone and limestone beds (3).

The section has been measured and sampled for conodonts and palynomorphs. Graptolites have been collected from selected levels. As a result, a joint biostratigraphy on graptolites, conodonts and cryptospores has allowed proving the Llandovery, Wenlock and Ludlow for the first time in the area and in the Zonguldak Terrane.

At the base of the section, within the greenish grey siltstones, acritarchs and cryptospores occur, the former being badly preserved. The cryptospore assemblage consists of 17 species of naked and enveloped monads, dyads and tetrads of the genera *Laevolancis, Dyadospora, Tetrahedraletes, Abditusdyadus, Segestrespora, Velatitetras*, and *Imperfectotriletes*. The co-occurrence of enveloped cryptospores and *Laevolancis divellomedia* suggests a Llandovery (Aeronian-Telychian) age (Steemans and Pereira, 2002).

Upwards, within the shale-limestone alternation packet, the black shales are predominant and yielded fairly diverse graptolites. The lowermost 3 m belong to *Cyrtograptus lundgreni* Zone (Homerian, Wenlock). The following 6 m are also assigned to the Homerian based on conodonts. The graptolites at 9 m above the packet base prove *Neodiversograptus nilssoni* Zone (lower Gorstian, Ludlow). The second productive limestone bed is about 10.5 m above the base and yielded the conodonts *Ozarkodina saggita, Oz. inclinata* and *Oz. crassa* (lower Gorstian). The uppermost 4 m of the packet 2 correspond to *Lobograptus scanicus* Zone (Gorstian). In the packet 3, within the limy sandsones graptolite finds indicate *Saetograptus leintwardinensis* Zone (Ludfordian, Ludlow).

The Findikli Formation at Gülüc section (less than 30 m thick) represents a specific relatively condensed and diverse lithological succession and differs from the thick uniform black shales of the same formation to the east, in the Camdag area (Sachanski and Goncuoglu, 2003), and to the west, at Karadere section in the Zonguldak Terrane (Dean et al., 2000).

Lakova, I., Sachanski, V., Goncuoglu, M. C. 2006. Tremadoc graptolites, acritarchs and cryptospores from Karadere section, Zonguldak Terrane, NW Turkey. *CIMP Meeting, Praha 2006, Prague, September*, 34-35.

Karadere section in Safranbolu area, NW Anatolia, Turkey, reveals the oldest Lower Palaeozoic sedimentary rocks directly overlaying the Cadomian basement in the Zonguldak Terrane. These sediments of the Bakacak formation represent 4 m sandstones with gabbro and granite pebbles; 1.5 m grey shales with small inarticulate brachiopods; 10 m black shales with graptolites and 300 m thick succession of grey-green shales and sandstones.

During a joint Turkish-Bulgarian project in 2003 and 2004, graptolites and palynological samples have been collected from the basal 15 m of the Bakacak formation. *Rhabdinopora flabelliformis* ssp. occurs within the 1.5 m thick packet of grey shales with brachiopods and numerous finds of *Paradelograptus antiquus* are recorded from the overlaying packet of 10 m black shales. *R. flabelliformis* ssp. is characteristic for the Early and early Late Tremadoc and *P. antiquus* first occurs in the early Late Tremadoc (Cooper, 1999). Thus, the base of Bakacak formation is first assigned to lower part of the Upper Tremadoc based on graptolites.

Palynological samples have been collected from the shaly packets at the base of Bakacak formation. The sample Kar 4 at about 10 m above the unconformity contains poorly preserved acritarchs, leiospheres and cryptospores. The acritarch assemblage consisting of *Acanthodiacrodium formosum* Gorka, *Acanthodiacrodium spinum* Rasul, *Stelliferidium* sp., *Vulcanisphaera* cf. *britannica* Rasul and diverse diacrodians is characteristic of the mid-Tremadoc. Dean et al. (2000) reported Tremadoc acritarchs from essentially the same level.
Single naked cryptospore tetrads, dyads and monads also occur which could be referred to the genera *Tetrahedraletes, Dyadospora,* and *Laevolancis.* Numerous leiospheres and less common 'charophyte algae' are also components of the palynological assemblage.

Whereas the Caradoc to Llandovery cryptospores are of wide geographical distribution and diversity (Steemans, 2000), the pre-Caradoc cryptospore record is very scarse. The previous oldest documented sporomorphs of land plants were from the Llanvirnian in Saudi Arabia (Strother et al., 1996) and represent most of the cryptospore morphologies known from younger sediments.

This Tremadoc cryptospore assemblage is fairly badly preserved and of low diversity but represents the oldest cryptospore record independently dated on graptolites and acritarchs.

Lakova, I., Steemans, P. 2008. Contradictory palaeogeographic results on microplankton and miospores from the Moesian Terrane during the late Silurian and Early Devonian. ***Final Meeting IGCP 497 and IGCP 499, Frankfurt am Main, September 30–October 3, 2008, Abstracts and Programme*****, 73-75.**

The palaeogeographic position of the Moesian Terrane during the Palaeozoic is a matter of discussion in the last decades. The palaeogeographic reconstructions concerning the Moesian Terrane are summarized by Yanev et al. (2005). They vary from the classical concept regarding Moesia as a southern margin of Baltica, through correlations with Avalonia to relations with the Armorican Terrane Assebmblages of north Gondwanan origin. The palaeogeographic affinities of Pridoli and Lochkovian chitinozoan from the Bulgarian part of Moesia are clearly North Gondwanan, comparable to localities in Armorica, Iberia, Libya and Algeria (Lakova, 1995). These chitinozoan assemblages consist of more than 50% N Gondwana species, such as, *Ancyrochitina lybiensis, A. floris, A. regularis, A.brevis, Margachitina corta, M. saretensis* (in the Pridoli) and *Angochitina chlupaci, A. geradis, Cingulochitina plusquelleci, Fungochitina lata, Eisenackitina taugourdeaui, Urochitina verrucosa* (in the Lochkovian). Vaida, Verniers (2005) demonstrated the occurrence of characteristic North Gondwanan chitinozoans in the Romanian part of the Moesian Terrane, e.g. *Cingulochitina plusquelleci ,C. ervensis, Fungochitina lata* and *Margachitina catenaria*. Marine microphytoplankton (acritarchs and prasinophyte algae) from the Lochkovian in the Moesian Terrane in Bulgaria also indicated position close to the northern margin of North Gondwana (Lakova, 2001).

On opposite, palaeophytogeographical analysis on Lochkovian miospore assemblages from the Moesian Terrane in Bulgaria indicated a presence of specific palaeophytogeographic *sinouosus-zavallatus* (S-Z) miospore province, restricted to Avalonia and west Baltica in the earliest Devonian (Steemans, Lakova, 2004). This province was defined on the basis of a phylogenetic lineages in the miospore genus *Emphanisporites* and is characterized by the morphological transition from *E. micrornatus to E. zavalltus* (Breuer et al., 2005) which orrucced only in Belgium, England, Germany, Poland, Bulgaria and Romania. Thus, the palaeogeographic implications based on Lochkovian microplankton and co-occuring miospores from north Bulgaria are apparently controversial – North Gondwanan affinities of the chitinozoans and acritarchs and Avalonia-Baltica affinities of the miospores. This lead Steemans, Lakova (2004) to propose that in the early Devonian the Moesian Terrane was at close proximity to Baltica. Such results do not confirm the palaeogeographic reconstruction which situated the Moesian Terrane closer to North Africa according to the palaeomaps by Scotese, but rather suggest the narrowing of the Rheic Ocean and a proximity to Baltica as plotted in the palaeocontinental reconstructions by Cocks, Torsvick (2002).

The palaeobiogeographic data on diffirent fossil groups are also controversial for the Carmbrian to Devonian in Romania. Seghedi et al. (2005) summarised the Lower Palaeozoic facies and faunas (trilobites, acritarchs, chitinozoans) and suggested that East and West Moesia, separated by the Intra-Moesian Fault, might represented distinct terranes, the West Moesia being a Baltica-derived piece, and the East Moesia sharing Avalonian affinities and history from the Cambrian to the Early/Late Ludlow.

Actually, N Gondwanan affinities of acritarchs, chitinozoans, as well as shelly faunas were suggested for the Romanian part of Moesia since 70th of the last century. However, Cambrian trilobites of unclear Bohemian or Baltican affinities also occur. The Moesian Terrane was defined by Yanev (1993) as a Gondwana-derived terrane which migrated northward to dock Baltica in the Devonian-Carboniferous time. Later, Seghedi et al., 2004 discussed the models proposing different scenarios of the origin, developmet and palaeocontinental affinities and concluded that that the problem of the timing of docking of Moesian to Baltica is far from final solution.

It is interesting no note about a recent palaeomagnetic study of the Bohemian Massif (Patocka et al., 2003) which suggested that the Tepla-Barrandian Unit drifted from cold temperate latitude in the Middle Cambrian to sub-equatorial-tropical zone in the Middle Cambrian. There are no palaeomagnetic data on the Lower and mid-Palaeozoic in the Moesian Terrane which makes it difficult to reconstruct the Palaeozoic paleogeographic affinities. Different organic-walled microfossils, on the other hand, provide controversial results. Nevertheless, the palaeogeographic reconstruction accepting fast narrowing of the Rheic Ocean and fast northward migration of the peri-Gondwana Moesian Terrane to the southern margin of Baltica are not in conflict with the data on Early Devonian microplankton and miospores from Bulgaria. The Siluro-Devonian sedimentary basin of the Moesian Terrane was close enough to Avalonia and southern Baltica, on one hand, and to Ibero-Armorica and north Africa, on the other hand, to allow the distribution of miospores of S-Z province and transoceanic exchange of microplankton (chitinozoan and acritarchs) from North Gondwana through the narrow Rheic Ocean.

Boncheva, I., Lakova, I., Sachanski, V. 2008. Devonian flysch deposits in western Bulgaria – age extent and implication to the basinal evolution. ***Final Meeting IGCP 497 and IGCP 499, Frankfurt am Main, September 30–October 3, 2008, Abstracts and Programme*****, 160-161.**

The Devonian turbiditic sedimentation in western Bulgaria proceeded from Middle Devonian to Lower Carboniferous. If the age problem concerning the flysch is considered in general terms, the lower boundary of the turbiditic complex (including the pre-flysch) could be regarded as starting from Emsian-Eifelian. In this study, conodont evidence in three sections from the Lyubash and Morava Units has indicated that conodont-bearing olistoliths of Emsian - Eifelian, Givetian, Frasnian, Famennian and Tournaisian age consist of facies associating with the flysch sedimentation. The Devonian flysch sedimentation was deposited with carbonate lenses as normal members of the sequence and the conodont-bearing layers have provided evidence on the age extent. The Devonian flysch sediments are transgressively overlain by Upper Carboniferous and Permian molasses.

In the Lyubash Monocline, the turbiditic deposits lay with tectonic contact over the Lower Devonian graptolitic black shales. The flysch was divided into three formations: Parcharska Fm. (a flyschoid suite bearing a small amount of limestones), Tumbeshka Fm. (lydite suite) and Propalnishka Fm. (a flysch suite with fluxoturbidites). The Parcharska Fm. is assigned to the Emsian-Eifelian to Frasnian. Conodonts of the *varcus* Zone proved the Middle Givetian at the base of the formation, as well as the *hassi* Zone in the Frasnian (Spassov, 1973). The conodont fauna here established from the limestones interbeds belongs to: Emsian *serotinus* and *patulus* Zones, Eifelian *costatus* Zone, Early Givetian *ensensis* Zone, Middle Givetian *varcus* Zone, Late Frasnian *linguiformis* Zone and Early Famennian *triangularis* Zone. The age of Tumbeshka Fm. is not determinated with fossils, but on its stratigraphic position it is assigned to Famennian. The overlaying thick flysch of Propalnishka Fm. is represented by about

500 m thick rhythmic alternation of sandstones and shales with rare limestone layers. Macrofloristic data (Spassov, Yanev, 1985) suggest a Late Famennian to Early Tournaisian age.

In the Morava Unit (Kraishte region), the Lower Devonian is a non-rhythmic succession of limestones and shales. The Lochkovian, Pragian and Emsian were established on conodonts and tentaculites (Boncheva, 1991, Sachanski & Boncheva, 1994). Upwards, siliciclastic series of black shales with lydites and shales were deposited. The age is assigned to Eifelian on the stratigraphic position. The flysch deposits are represented by Tranovdol Formation, about 1300 m thick. This is a turbiditic alternation of shales, sandstones and mosaic conglomerates, with lydite and carbonate interbeds without age data. Additionally, conodonts of Late Famennian *expansa* Zone, Latest Famennian *praesulcata* Zone and Early Tournaisian *sulcata* Zone have been documented from limestone olistolits within the Jurassic flysch.

In the West Balkan Unit, above the Middle Devonian conformably lay the flysch sediments of Katina Fm., up to 1000 m thick, consisting of sandstones, shales and limestone layers. There are conodont data about Late Devonian age of the flysch deposits (Boncheva &Yanev, 1993). It is questionable wheather the flysch sedimentation started after Middle Devonian and or it was simultaneous in the Western Balkan Mountains and Kraishte region.

A more complete idea about the spatial-time relationships of the processes and areas of the turbiditic sedimentation could be obtained after comparing the flysch deposits in western Bulgaria and Eastern Serbia – Suva Mountain and Kuchai Mountain. The paleontological data from Eastern Serbia (Krstich & Sudar, 1992) show that the Paleozoic turbiditic sedimentation in occurred from Emsian to early Visean.

The Devonian flysch accumulation in the western Bulgaria marked the final stage of the Paleozoic marine basin development related to compression and the Variscan orogeny.

Sachanski, V., Tetlie, O.E., Boncheva, I., Lakova, I. 2008. Early Lochkovian Eurypterids in the peri-Gondwana Europe and their palaeoenvironmental implications. *Final Meeting IGCP 497 and IGCP 499, Frankfurt am Main, September 30–October 3, 2008, Abstracts and Programme*, 226-227.

The Silurian/Devonian boundary interval in Bulgaria is represented by two facies – deep pelagic black graptolitic shales and limestone-marl alternation of the outer shelf. Recent biostratigraphic studies of the black shales at Stanyovtsi section confirmed the Lochkovian age on graptolites – *M. uniformis* and *M. hercynicus* Zone as defined by Spassov (1963).

Detailed sampling and measuring of the Lower Lochkovian at Stannyovtsi section led to the collection of new eurypterid finds in the *Monograptus uniformis* Zone. This is the first discovery of euripterids in Bulgaria and SE Europe. Previously, finds of these rare arthropods were reported from peri-Gondwanan localities in Germany (Jaeger, 1959), Czech Republic (Chlupac, 1994) and Spain (Chlupac et al., 1997).

The arthropoda Eurypterids are rare fossils of sea scorpions which have been found in marine brackish and freshwater conditions during the Ordovician through the Pennsylvanian (Tetlie, 2007). The only known pterygotid genera known to survive the end of the Silurian are *Pterygotus*, *Acutiramus* and *Jaekelopterus*, and all these three are likely candidates for these fragments, but without the chelicerae, it is impossible to make identification. Pterygotids show their maximum development in strata of Přídolian age and they tend to be concentrated in offshore dark platy limestone facies with anoxic bottom influences. They are constituents of marine faunas and exhibit the same environmental dependence as the coeval phyllocarid crustaceans. Thus, the Lockhovian age in Stanyovtsi section is not in conflict for pterygotids occurrence.

Compared to the other peri-Gondwana eurypterid-bearing localities in Europe, this in Bulgaria (graptolitic black shales) seems to be the most distal and deeper-water. In the Czech

Republic the eurypterids were found in a pelagic limestone-shale alternation, whereas in Spain and Germany they occur in shales which replaced the carbonate platform sedimentation across the Silurian – Devonian boundary. Even the most impressive eurypterids occur in fresh-water deposits of the Lower Palaezoic, fully marine environments such as deep anoxic basin could also provide habitat for some of these arthropods.

Lakova, I., Rabrenovic, D., Petrova. S. 2009. Calpionellid biostratigraphy across the Jurassic-Cretaceous boundary in the Western Balkan Mountains (Bulgaria and Serbia). ***The 8th symposium of IGCP 506 Marine and non-marine Jurassic: global correlation and major geological events, Bucharest, Romania, 28 August-3 September 2009, Abstracts and field guide*****, 18-19.**

According to the working status of IUGS (Gradstein *et al.*, 2004) the Jurassic/Cretaceous boundary is the base of Berriasian defined at the base of *Berriasella jacobi* ammonite zone. The absolute age is 145.5 Ma. Additional criterion is the base of *Calpionella* Zone (*C. alpina* Subzone). Almost coeval to this is the first occurrence of the nannofossil *Nannoconus steinmanni minor*. Alternative candidate for the base of Berriasian is the base of the magnetic chron M18r.

This study represents calpionelid biostaratigraphy across the Tithonian – Berriassian boundary in five sections of pelagic micritic limestones in the Western Balkan Mountain in the border area between Bulgaria and Serbia. These are: Gintsi 1, Gintsi 2, Komshtitsa and Barlya section in western Bulgaria and Rosomach section in eastern Serbia. Successive calpionellid bioevents (first and last occurrences, abundance dymanics) are documented within *Crassicolaria* Zone (Upper Tithonian) and *Calpionella* Zone (Lower Berriasian). In W Bulgaria the studied sections are assigned to the Glozhene Formation and in E Serbia – to the Rosomach Limestone Formation.

The base of *Calpionella* Zone is clearly defined by the explosion of the spherical form of *Calpionella alpina*. This bioevent coincides exactly with the rapid decline of *Calpionella grandalpina* and the last occurrences of *Crassicollaria massutiniana, Crassicollaria brevis* and *Calpionella elliptalpina*. This level is related to a significant decrease in the total abundance of calpionellids. The base of *Calpionella* zone is thus traced at the first sample in which *C. alpina* predominates over *C. grandalpina* and represents more than 50% of all specimens (Lakova, 1994). Higher in *Calpionella alpina* Subzone, the calpionellid association consists almost enterily of the index-species with some *Tintinnopsella carpathica* and *Crassicollaria parvula*. An acme of *Crassicollaria parvula* together with the restricted occurrence of *Crassicollaria colomi* is documented in the lower third of the subzone. *Calpionella minuta* first occurs in the upper third of the subzone. Calpionellid zonation of the Tithonian and Berriasian across the Bulgaria-Serbian border provide precise chrostratigraphic correlation.

The second level of interest, the base of *Ferasini* Subzones, is defined at the first occurrence of *Remaniella ferasini* or other *Remaniella* species. The subzonal association consists of *Calpionella alpina, Calpionella minuta, Calpionella sp., Tintinnopsella carpathica, Remaniella ferasini* and *Remaniella duranddelgai*. Below the base of *Ferasini* Subzone there is a significant decrease in the total calpionellid abundance.

Andreeva, P., Boncheva, I., Lakova, I., Yanev, S., Ivanova, D. 2010. Devonian stratigraphy and depositional environment of the Moesian Plarform, NE Bulgaria. ***Abstracts Volume XIX Congress CBGA, Thessaloniki, Greece, 23-26 September 2010*** **(Chatzipetros, G. et al., eds.)*****, Geologica Balcanica,*** **39, 1-2*****,*** **p. 26.**

The Devonian sequence of the Moesian Platform in Bulgaria and Romania represents a part of the pre-Variscan sedimentary cover which overlies the Proterozoic metamorphic basement. A total of sixteen boreholes have been run in different parts of the Devonian. The Lower Devonian, together with the Silurian, consists of dark shales, siltstones, and minor limestones and sandstones (calcareous-terrigenous-clayey formation). The age assignment of this formation is based on chitinozoans, acritarchs, miospores, graptolites, and conodonts.

Predominantly carbonate rocks (limestones and dolostones) and rare evaporites (anhydrites) build the Middle and Upper Devonian successions. They were subdivided into the following formations from bottom to top: carbonate-sulphate formation, dolomite formation, formation of banded limestones, formation of intraclastic and peloidal limestones, and formation of organogenic limestones. The lower clayey-carbonate package of the carbonate-sulphate formation consists of clayey limestones and shales of Eifelian age and the upper parts of this unit consist of Givetian dolostones, limestones, anhydrites, and scarce shales. The dolomite formation includes mainly dolostones and limestones, also of Givetian age. The formation of banded limestones consists of banded micritic limestones related to Upper Givetian and Lower Frasnian. The uppermost part of the Devonian is represented by the formation of intraclastic peloidal limestones (Frasnian-Famennian) and the formation of organogenic limestones (Famennian). The Middle and Late Devonian ages of these formations were mostly proved by conodont faunas and less commonly by brachiopods and foraminifers. Sedimentary features and conodont evidence indicate the presence of numerous erosional surfaces and stratigraphic hiatuses within the Middle and Upper Devonian carbonate sequence.

The silicicalstic sediments of Silurian and Early Devonian age (calcareous-terrigenousclayey formation) are regarded as formed in deep-water open-marine to shallow shelf settings. Middle Devonian successions are interpreted as inner- and mid-ramp deposits developed in a shallowing-upward sequence.

Eifelian carbonate sedimentation (clayey-carbonate package of the carbonate-sulphate formation) occurred in an open-marine setting below normal wave base (mid-ramp zone) which is gradually replaced by a shallow open-marine environment above normal wave base (inner-ramp zone). The shallowing tendency continued during the Givetian when carbonate-evaporite sediments precipitated under arid climate conditions (carbonate and evaporite packages of the carbonate-sulphate formation). Deposition took place in a low-energy tidal-flat setting (back ramp) with restricted or semi-restricted water circulation and locally developed supratidal sabkha evaporites. Repeated alternation of subtidal, intertidal, and supratidal successions observed in the well sections suggests a cyclic character of the Givetian sedimentation. Tidal-flat deposition continued later during the Givetian and Frasnian (dolomite formation, formation of banded limestones and formation of intraclastic and peloidal limestones) but without distinct evaporite precipitation. However, carbonate pseudomorphs after gypsum crystals observed in some intertidal/supratidal sediments indicate that arid climate conditions still existed. Finally, the Famennian carbonate deposition (part of the formation of intraclastic and peloidal limestones and the formation of organogenic limestones) reflects a gradual transition to open-marine shallow and deeperwater settings.

With the final of the carbonate sedimentation in the Early Carboniferous, the wholeDevonian underwent intense folding, vertical and horizontal displacement as a result of the Variscan orogenic events.

Ivanova, D., Koleva-Rekalova, E., Lakova, I., Stoykova, K., Ivanov, M., Metodiev, L., Petrova, S., Tchoumatchenco, P., Rabrenović, D., Radulović, V., Malešević, N. 2010. Upper Jurassic-Lower Cretaceous platform-to-basin integrated stratigraphy across the Bulgarian-Serbian border. ***Abstracts Volume XIX Congress CBGA,***

***Thessaloniki, Greece, 23-26 September 2010* (Chatzipetros G. et al. eds.)*, Geologica Balcanica,* 39, 1-2*,* 168-169.**

This report presents the results of integrated microfossil biostratigraphy, facies and microfacies analyses with the purpose of age determination, correlation and tracing out of the carbonate platform-to-basin transition in the Callovian to Valanginian carbonate sequences across the Bulgarian – Serbian border. The Upper Jurassic and Lower Cretaceous are of wide occurrence in the western Bulgaria and eastern Serbia. The sediments deposited in a bathymetrically differentiated basin, associated with the gradual emergence of the southern landmass and the formation of the Central Moesian Basin. The shallow-water sections are located in the southwestern prolongation of the Western Moesian Carbonate Platform and belong to the West Srednogorie Unit (Bulgaria) and Vidlić/Tepoš Zone (Serbia). The main part of the carbonate platform is represented by the limestones of the Slivnitsa Formation (Bulgaria) and the Crni Vrh Limestones (Serbia). Both formations are built up by thick-bedded to massive light grey to whitish organogenic and less common micritic limestones containing a large number of benthic foraminifers and algae, colonial corals, rudists, brachiopods, crinoids, gastropods and other benthic forms. The age interval is Callovian to Valanginian based on foraminifera and calcareous dinocyst. Six successive foraminiferal zones are recorded. Seven facies (facial zones) with specific microfacies types are superposed within the platform carbonates: homoclinal ramp (peloidal); reef and perireef (bioclastic); subtidal lagoon (nonfossiliferous and oncoidal), intertidal flat (fenestral and foraminiferal); subtidal lagoon (foraminiferal); reef (*Bacinella* and *Lithocodium*) and slope (bioclastic). The carbonate platform deposits are covered by the clayey limestones and marls of the Salash Formation of Valanginian to Early Hauterivian age.

The Callovian to Valanginian peri-platform pelagic carbonates were deposited on the northern Tethyan continental margin. In the Western Balkan Unit (Bulgaria) the pelagic record consists of the sediments of the Yavorets, Gintsi and Glozhene formations. Their correlatives in the Stara Planina-Poreć Zone (Serbia) are Kamenica, Pokrovenik an Rosomać formations. These are micritic and clayey nodular pelagic limestones formed in relatively deep basin conditions under quite low rates of sedimentations. Starting from the Late Berriasian, the basinal carbonate accumulation was quickly replaced by hemipelagic alternation of clayey limestones and marls which continued up to the Hauterivian (Salash Formation in western Bulgaria and Ržana Formation in eastern Serbia). Diverse ammonites and planktonic microfossils such as calcareous dinocysts, calcareous nannofossils and calpionellids were applied for detail zonations, stage and substage subdivisions. For the Oxfordian–Valanginian interval twelve calcareous dinocyst zones, five calcareous nannofossil zones and seven calpionellid zones are recorded. In the basin facies six microfacies within the pelagic carbonates are superposed: filamentous, *Globuligerina*-Radiolarian, *Saccocoma*, *Globochaete* and calpionellid and spicule microfacies. Stable sedimentary environment persisted during the whole Late Jurassic. Since the Late Berriasian a clear bathymetrical tendency occurred in the pelagic carbonates from west to east – platform slope, basin and a periphery of flysch trough.

The carbonate platform sedimentation started with the formation of a homoclinal ramp in the Callovian and passed through a rim platform during the early Kimmeridgian. The platform evolution includes three main stages – stepwise progradation, aggradation and retrogradation during the late Kimmeridgian to Valanginian. The phase of platform drowning started in distal portions of the platform. The drowning phases are documented by erosional surfaces, hiatuses and condensed glauconitic beds. The drowning of the platform shows westward youngering from the earliest to Late Valanginian.