Parasequences in the Kotroman Formation, western Serbia

NENAD BANJAC¹ & DIVNA JOVANOVIĆ²

Abstract. An attempt was made to describe two parasequences separated within the sediments of the Kotroman Formation at the Mokra Gora Village in western Serbia. The whole formation, of Albian–Cenomanian age, in some general characteristics corresponds to tidal flats, some of which were described in the literature (LARSONNEUR 1975), and the sediments were compared with ones from recent tidal flat environments. The heterogeneous composition of the Kotroman Formation influenced different authors to describe several non-synchronous and incomparable superpositioned packages. The parasequences were investigated in the attempt to correlate them with the stratigraphic age of the members. The parasequences were formed during the Albian transgression and represent a gradual deepening of the wider area. Well-developed flooding surfaces with significant deepening indicated retrogradational stacking of certain transgressive system tracts and reflect landward movement of the shoreline, indicating a gradual sea level rise.

Key words: Parasequences, Kotroman Formation, palaeontology, sedimentology, Albian–Cenomanian, Mokra Gora, western Serbia.

Introduction

After a period of no deposition during the Aptian and the Albian, with a new transgressive cycle, land masses of Jurassic ophiolites (nowadays in western Serbia) were flooded with a shallow to moderately shallow sea. Although extensively eroded since, Cretaceous deposits that were formed during this transgressive cycle could be found on numerous outcrops in western Serbia. The most extensive exposure among these outcrops is located in the vicinity of Mokra Gora and occupies the Beli Rzav and Kamešina Valleys with their tributaries. The lower portion of these deposits near Mokra Gora Village was previously studied and described as the Kotroman Formation (Banjac et al. 2008 and references therein).

Previous Studies

The general consensus among the stratigraphic community was that the Mokra Gora deposits are Upper Cretaceous in age. However, much debate was involved to the question of the age of specific strati-
graphic sections. The Mokra Gora deposits were first described by Žujović (1893), as carbonates of Senonian age. The author sporadically mentioned numerous hippuritids and abundant fossil gastropod associations. The following works (Živković 1905, 1907; Petković 1925; Ampferer 1928; Milovanović 1933) confirmed Mokra Gora deposits as Senonian in age, locating the whole sequence as analogues to the Gosau Beds in Austria. The determination was based on macrofossil fauna assemblages with: Pyrgulifera picchieri, P. accinosca, P. lyra, P. striata, Glauconia kefersteini, G. renauxi, G. coquandi, Natica buliformis, N. lyrata, Hippurites gosaviensis, Radiolites lusitanicus, etc. However, Loczy (1924) indicated that the sediments are Upper Cretaceous in age, more specifically Cenomanian, Turonian and Senonian, based on the macrofossil fauna: Acanthoceras mantelli, Puzosia aff. gaudama, Biradiolites affilaisensis, etc. Milovanović (1935) just mentioned deposits from the Upper Cenomanian to the Upper Campanian age. Mitrović (1966), Mitrović et al. (1989), confirmed this age based on abundant echinid assemblages with numerous representatives of the Epiaster and Hemiaster genera. Pejović & Radoiĉić (1971, 1973, 1974) and Radoiĉić (1984), placed the whole Mokra Gora series as the Cenomanian, Turonian and older Senonian. According to these authors, the sandy and marly carbonate portion of the local stratigraphic column, "tens of meters above the weathering crust" Radoiĉić (1984, p. 136.), is characterized by mid-Cenomanian microfauna: Aeolisacus inconstans, Ovalveolina maccagnae and Rhipidionina laurinensis. Therefore, the authors concluded that the lower-most, palaeontologically sterile basal section can be recognized as the Albian stage. The upper portion of the local stratigraphic column is represented by marly limestone with abundant ostreids, Gryphaeas and inoceramids, as well as pelagic microfossils of the Pithonella ovalis, Hedbergella-Ticinaella group, which indicate the lower Turonian stage. However, upper Cenomanian age was accepted after later revision of the beds with Cisalveolina fraasi, (Radoiĉić 1984, 1995).

The uppermost member of the stratigraphic column is represented with massive limestone bearing hippurites and gastropods of Turonian age.

The Alban–Cenomanian age of the Mokra Gora Series was confirmed in the works of Banjić (1994, 1994a, 2000). The author reported mollusc fauna of Alban–Cenomanian and Turonian age, although some of the specimens, e.g., Paraglauconia lujani, is known from Aptian deposits. Đulić (2003), described it as the Alban–Cenomanian polynomorph association from the Mokra Gora Series. The same age was confirmed by Jovanović et al. (2004) based on the microfauna assemblage, as well as Banjić et al. (2007) based on the gastropod assemblage. Radoiĉić & Schlagintweit (2007) at the Mokra Gora Series established a new species Neomeris mokragorensis of Albanian age. It must be noted that lower portion of the stratigraphic column is described as deposits of Barremian age (Nirta et al. 2008; Menia et al. 2008).

Lithostratigraphic members

Due to heterogeneous composition of the Mokra Gora Series, authors described several non synchronous and incomparable superpositioned packages. Loczy (1924) differentiated five packages. (1) The first one consists of conglomerates and sandy horizons with oolith iron nodules, (2) the second with marly to sandy limestone, (3) the third with shaly and sandy limestone. The fourth package (4) is represented by greyish to yellowish fragile marl with large molluscs and bivalve fossil specimens, whereas the fifth package (5) is represented by massive reef limestone. Milovanović (1933) also differentiated 5 packages: (1) basal, represented by conglomerate, reddish quartzite and iron rich bearing schist; (2) tabular marl and limestone, which gradually become sandy limestone and sandstone; (3) lower package of sandstone, sandy limestone and marls with abundant associations of gastropods and most commonly the genus Pyrgulifera and (4) upper package of sandy limestone and marl with associations of gastropods, bivalves and echinoids. The uppermost package (5) is represented with massive reef limestone with abundant rudist fauna. This subdivision was generally accepted in the works of Drakulić & Dedić (1963) and Fotic (1965).

Pejović & Radoiĉić (1971, 1973, 1974), Radoiĉić (1984) described the biostratigraphic characteristics of the Mokra Gora Series, with three main levels: (1) the basal clastites, (2) carbonates with marls and (3) shallow water reef limestone. The lowermost level (1), transgressively overlying serpentine or a weathering crust, is represented by conglomerate, conglomeratic sandstone and sandstone lacking any fauna. The overall height is around 50 m. The authors emphasized the extremely heterogeneous composition and thickness of this level. The following level (2) was named by the authors as Carbonaceous or Pelagic beds, and bears two members of lower rank, i.e., (2a) sandstone, marl and carbonaceous deposits (150–200 m thick) and (2b) marly-carbonaceous deposits (150–200 m thick). The uppermost level (3) consists of massive limestone with hippurits of Turonian age. A similar partition with three principal units was presented by Mošlović et al. (1978) and Olujić et al. (1986). Nirta et al. (2008) and Menia et al. (2008) explained the lithologic characteristics of the Mokra Gora Series, describing two units (named A and B), which reflect two main deepening-shallowing cycles. These units correspond to the levels 1 and 2, respectively, suggested by Pejović & Radoiĉić (1971, 1973, 1974) and Radoiĉić (1984). The authors also mentioned, but did not study, the third unit (named C), which corresponds
to level 3 of massive limestone with hippurites sug-
gested by Pejović & Radoičić (1971, 1973, 1974).

Within an analysis of the Cretaceous deposits of
western Serbia, Jovanović et al. (2004) separated
three levels.

The first is basal terrigenous sandy series with no-
dular biomicrite. The biocomponent is represented
with rare fragments of microflora and microfauna in
addition to mollusc detritus. The frequent charophyts
and ostracods of the same age indicate the presence of
an intermittent freshwater environment at the same
period. Rich fossil assemblages can be found in the
uppermost section of the Kotroman Formation.

The next level is the Pelagic Series, composed of
thin-bedded marly limestone. These are fine laminat-
ed biomicrite with an abundant alevritic fraction and
centimetre thick beds of bioclastic marl, bioclastic
packstone, sometimes with accumulations of thin
shell fragments. They are commonly alternating with
thin marly layers.

The third level, uppermost portion of the Mokra
Gora Series, consists of massive carbonates with hip-
purits and gastropods of Turonian age.

The first of the aforementioned, the so-called Basal
terrigenous sandy series, was described by Banjac et al.
(2008), and proposed as the Kotroman Formation. The
Formation consists of clastic deposits in the lower part
and limestone beds in the upper part of the stratigraph-
ic column. The lower limit is a sharp transgressive
boundary with serpentinite or a few meters thick weath-
ering crust, while the upper limit is a blunt transition to
the so-called Hemipelagic Series. Three separate mem-
ers were distinguished in the Kotroman Fm.: the
Kamišna Mb, the Uroševići Mb and the Jatare Mb.

Kamišna Member

At the investigated locality, the Kamišna Member
is not exposed at its whole thickness. In its lower seg-
ment, transgressive extra-formational oligomict con-
glomerate can be observed. Fragments of serpentinite
and chert are deposited within a sandy or silty matrix.

Iron-rich, dark green chamosite ooides and serpen-
tinite particles can be frequently found in the con-
glomerate fragments. The grains are cemented with
calcareous or clay-ironstone cement. The described
sediments correspond to the gravel initially deposited
below the low-water tide level (Larsonneur 1975).

In the upper parts of the stratigraphic column, these
sediments increasingly interchange with iron-rich sand-
stone characterized by well-rounded pyritised grains
and fragments of serpentine, without any fossils. The
deposits gradually transform to sandstone containing
more than 25 % fine-grained rock fragments, predomi-
nantly pyroxene and spinel clasts. This coarse- to fine-
grained loose dark grey sandstone is present in the main

Parasequences

An attempt was made to describe the two para-
sequences separated within the Uroševići Member of
the Kotroman Fm. Their base is the upper portion of
the Kamišna Mb. while they are overlain by the Jatare
Mb. The whole Kotroman Fm. in some general way
corresponds to a tidal flat, some of which were
described in literature (Larsonneur 1975), and the
sediments were compared with those from the envi-
ronment of recent tidal flats. It must be noted that the
low latitude (less than 30° N) position of the area dur-
ing the Upper Cretaceous influenced not only the
presence of siliciclasite, but also of carbonates with
characteristics of the carbonate shelf system of the
whole formation. The section with the described para-
sequences is shown in Fig. 1.

Fig. 1. Parasequences at the Kotroman locality. Legend: FS1 - Flooding surface 1, FS2 - Flooding surface 2.

Parasequences

An attempt was made to describe the two parase-
quences separated within the Uroševići Member of
the Kotroman Fm. Their base is the upper portion of
the Kamišna Mb. while they are overlain by the Jatare
portion of the Basal Member. Small cherty fragments
as well as sand particles of different sizes are bound by
clayey or limonitic red or brown cement.

The described sediments correspond to gravelly sand which was deposited on about the low-water tide
level (Larsonneur 1975).
The iron-rich sandstone dominates in the upper portion of the Kamišna Mb. However nodular clastic limestone interbedded with yellowish thin marl occurs in this portion. The nodular limestone is represented by biomicrite, floatstone and wackestone, enclosed in an intimate mixture of clay and carbonate. Clasts of serpentine, pyroxene and quartz mixed with scarce mollusc shell fragments are found in a fine grain microsparite and clayey matrix. Extremely small crystals of quartz, pyrite and hematite can frequently be found in these deposits.

The quantity of the bioclastic fragments increases in the upper horizons, and rock gradually changes to bioclastic wackestone, packestone and floatstone, with sometimes large clasts. The characteristics of the rock resemble storm beds. The bioclasts are represented with numerous fragments of gastropods, bivalves, and ostracods. Floral remnants, such as fine dispersed plant particles and fragments of branches and tree trunks, are common. In addition, bisect particles of conifers, dominated by Pinus and rarely Podocarpus and Cedrus can be found.

The iron-rich sandstone of the upper portion of the Kamišna Mb. represents shallow water facies. It corresponds to biogenic sand and biogenic fine sand which was deposited about the high-water tide level (LARSONNEUR 1975).

Uroševići Member – Parasequence 1

Within the Uroševići Mb., two parasequences have been described, with an attempt to correlate them with stratigraphic age of the member (BANJAC et al. 2008).

The lowermost sediment of the Uroševići Mb. (within Kotroman Fm.) is represented with an almost one meter thick bed of sandy reddish nodular limestone with bivalve and gastropod shell fragments. Its lower boundary represents the flooding surface (FS1) that marks the base of a parasequence with abrupt contact. Sandy reddish nodular limestone lying directly on top of relatively shallow iron-rich sandstone located below the surface. The frequent appearance of small-scale erosion can be observed at this surface (Fig. 2).

In the following portion of the stratigraphic column, nodular limestone is frequently interbedded with thin layers of marl and siltstone.

The thin section of the reddish nodular limestone indicated bioclastic wackestone with frequent fossil shell fragments. Samples from the upper portion of these deposits revealed packstone, floatstone, rudstone and rarely fine-grained sandstone. The fossil content is represented with mollusc fragments, in some places with abundant gastropod and bivalve accumulations found in the cm-scale lenses of calcirudite and calcarenite. The mollusc shells frequently contain geopetal fillings. These beds also contain rare ostracode remnants, as well as gyrogonysts and chaetognahyte remnants, which indicate intermittent fresh water influxes. In addition, the algae Radiocicelapses sp. and Hemicyclamina sigali MAYNC can be found.

The microfauna assemblage consists of codiacean grains and Radiocicelapses sterni RADOIČIĆ, Nezzatinella cf. picardi (HENSON), Hemicyclamina sigali MAYNC, Salpingoporella urladanasi CONRAD, PEYBERNES & RADOIČIĆ, Aeolisacus sp. and Glomospira sp. The macrofauna is represented by gastropod fragments (Cassiope sp.).

Samples from the upper portion of the parasequence revealed an increase of fine-grained sandstone, gradually transforming to lithic sandstone. Clasts are represented with quartz, chert, pyroxene, serpentine, peridotite and siliceous rocks in spary cement or a microsparitic matrix. Birds-eye structures as well as fenestrated fabrics, which can be observed in the thin section, indicate a shallow environment with sporadic exposure to open air, i.e., deposition at the high water tide level. The general characteristics of the fine-grained sandstone shows a gradual shallowing which is terminated with a sudden contact. Relatively deeper nodular limestone is situated on top of the shallow fine-grained sandstone located below the surface. Small scale erosion can be observed at this surface (FS2), similar to one at the previous flooding surface (FS1).

Uroševići Member – Parasequence 2

The lower portion of the second parasequence is represented with an approximately 20 cm thick bed of nodular limestone with mollusc shell fragments. Its lower boundary is designated as a second flooding surface (FS2) that marks the base of the second parasequence. The nodular limestone of this parasequence is fossiliferous packstone and wackestone with peloidal and biogenic intraclasts in a micritic and microsparitic matrix.
In the upper portion of the parasequence, the nodular limestone alternates with ophiolithic coarse-grained reddish sandstone.

Marly bioclastic packstone creates the next level in the parasequence. Gastropod or bivalve shells can frequently be found, especially in the marly beds between the thicker limestone beds. At some levels, there is a transition to wackestone, *i.e.*, biomicrite with unsorted angular shell fragments deposited within a microcrystalline calcite matrix. Besides shell fragments, charophyte girogonitids and ostracods can be found, indicating intermittent fresh water influx. It is followed by decayed, lumpy limestone that is characterized by the presence of thin mollusc shell fragments. It is predominantly biomicrite with sporadic foraminifera and abundant iron matter. At some places within these limestone beds, the shell accumulations indicate storm beds. Bioclastic wackestone, as well as bioclastic rudstone can also be found at this portion of the parasequence. In the upper portion, a blunt transition to marly mudstone can be observed.

Fine-grained sandstone represents the uppermost portion of this parasequence. The described sediments correspond to biogenic gravelly sand to biogenic sand which was deposited between low and high water tide levels.

(LARSONNEUR 1975).

**Jatare Member**

The fine-grained sandstone of the Uroševići Mb. is overlain by thin-bedded nodular bioclastic limestone belonging to the third member, the Jatare Mb. Calcareous and silty marlstones in some places contain abundant microfauna associations, which are represented by: *Aeolisacus inconstans* RAĐOČIĆ, *Ovalveolina maccagnae* DE CASTRO and *Rhapidionina laurinensis* DE CASTRO. Macrofauna was discovered at numerous localities, sometimes forming coquina beds. It is represented by mollusc fragments: bivalvs *Amphidonte conicum* (SOWERBY), *Ostrea callimorphe* COQUAND and *O. cucumella* SEELEY, and the gastropods *Pseudomesalia teniacostata* (HACOBJAN), *P. multicoastata* (HACOBJAN), *Pirenella cf. levadhiae* KOLLMANN, *Paraglauconia lujani* (DE VERNEUIL & COLOMB), *Bicarinella bicornata* (PČELINCEV) and *Cassiope kotromanensis* BANJAC. Thin-bedded nodular bioclastic limestone with the
aforementioned association of fauna corresponds to sediments deposited at a subtidal shelf or outer shelf with increased carbonate production. In the upper portion, they gradually transfer to the thin-bedded, marly limestone of the so-called hemipelagic series.

Conclusions

An attempt was made to investigate the presence of parasequences in the Cretaceous deposits known as the Kotroman Formation according to type locality and type section at the Kotroman Village in western Serbia.

The investigations of the sediments at the Kotroman locality imply two parasequences within the Uroševići Mb.: Parasequence 1 and Parasequence 2. The parasequences were formed during the Albian transgression and represent a gradual deepening of the wider area. Well-developed flooding surfaces with prominent deepening, indicated to retrogradational stacking of certain transgressive system tract and reflect the landward movement of a shoreline. The beds overlying the Uroševići Mb. indicate a new rise in the relative sea level. They are represented by thin-bedded nodular bioclastic limestone belonging to the Jatare Mb.

The insufficient data does not allow the results to be compared with the eustatic sea level curve (HAQ et al. 1987). It can only be approximately estimated (based on fossil age) that the described parasequences belong to the earliest Supercycle of the Upper Zuni A set (UZA 1).

Acknowledgments

We are very thankful to Platon Tchoumatchenko (Geological Institute, BAS, Sofia), as well as an anonymous critic who reviewed the paper. The work was supported by the Ministry of Education and Science of the Republic of Serbia (Project No. 176015).

References

AMPFERER, O. 1928. Zur Tektonik und Morphologie des Zlatibormassivs. Denkschriften der kaiserlichen Akademie der Wissenschaften mathematisch-naturwissenschaftliche Klasse, 101: 361–424.

BANJAC, N. 1994. Contribution to the study of the Upper Cretaceous fauna at Mokra Gora, western Serbia. Radovi Geoinstituta, 30: 167–171 (in Serbian).

BANJAC, N. 1994a. The Upper Cretaceous gastropod genus Vernedia from the Mokra Gora area, western Serbia. Vesnik, Geologija, hidrogeologija i inženjerska geologija, 45: 47–54.

BANJAC, N. 2000. Contribution to the Upper Cretaceous stratigraphy in western Serbia (Postenje Stream locality – Mokra Gora). Vesnik, Geologija, hidrogeologija i inženjerska geologija, 50: 75–82.

BANJAC, N., BANDEL, K. & KIEL, S. 2007. Cassiopid gastropods from the Cretaceous of western Serbia. Geološki anali Balkanskoga poluostrova, 68: 71–81.

BANJAC, N., JOVANOVIĆ, D., DULIĆ, I. & LJUBOVIĆ-OBRADOVIĆ, D. 2008. The Albian–Cenomanian Kotroman Formation of Mokra Gora (western Serbia). Geološki anali Balkanskoga poluostrova, 69: 31–38.

BORTOLOTTI, V., MARRONI, M., PANDOLFI, L. & PRINCIPI, G. 2005. Mesozoic to Tertiary tectonic history of the Mirdita ophiolites, northern Albania. The Island Arc, 14: 471–493.

DRAKULIĆ, D. & DEDIĆ, Lj. 1963. Structural composition of the Upper Cretaceous sediments of Mokra Gora and Beli Rzav. Tehnika, 18 (10): 230–236.

DULIĆ, I. 2003. Palinomorphes from the Albian and Cenomanian deposits of Yugoslavia. Unpublished Ph.D. dissertation. 231 pp. University of Belgrade, Faculty of Mining and Geology. (in Serbian).

FOTIĆ, V. 1965. Geological composition and tectonic structure of the Mokra Gora Basin with special regards to the oolitic iron ore. Vesnik, Geologija (A), 22 (23): 117–129 (in Serbian).

HAQ, B.U., HARDENBOL, J. & VAIL, P.R. 1987. Chronology of fluctuating sea levels since the Triassic (250 million years ago to present). Science, 235: 1156–1167.

JOVANOVIĆ, D., LJUBOVIĆ-OBRADOVIĆ, D., ĐAZJić, S., STEVANOVIĆ, S., BANJAC, N. & BLAGOJEVIĆ, B., 2004. Cretaceous formations of the western Serbia (Mokra Gora). Geological Survey of Serbia, Internal report, 15 pp. (In Serbian).

LARSONNEUR, C. 1975. Tidal deposits, Mont Saint-Michel Bay, France. In: GINSBURG, R.N. (ed.), Tidal Deposits – A casebook of recent examples and fossil counterparts, 21–30. Springer Verlag, Berlin.

LÖCZY, L. sen. 1924. Geologische Studien im westlichen Serbien, 146 pp. Walter de Gruyter & Co., Berlin.

MENNA, F., NARTA, G., FAZZU-OLI, M., GARFAGNOLI, F. & PRINCIPI, G. 2008. Sedimentary Records of the Cretaceous Transgression in the Dinaric Orogen: The Mokra Gora Section (western Serbia) Preliminary data, 26th IAH Meeting of Sedimentology, Poster, Bochum, Germany.

MILOVANOVIĆ, B. 1933. Contribution to the geology of western Serbia – Upper Cretaceous of the Mokra Gora Basin. Geološki anali Balkanskoga poluostrova, 11: 132–160 (in Serbian).

MILOVANOVIĆ, B. 1935. Zur Stratigraphie und Tektonik des Zlatibormassivs (Westserbien). Mitteilungen der Geologischen Gesellschaft in Wien, 28: 115–129.

MITROVIĆ-PETROVIĆ, J. 1966. Cretaceous and Miocene echinoids of Serbia. Geološki anali Balkanskoga poluostrova, 32: 87–164, (in Serbian).

MITROVIĆ-PETROVIĆ, J. & ANDELKOVIĆ, M. 1989. Paleooecology of Serbia – Cretaceous. 158 pp. University of Belgrade, Faculty of Mining and Geology, Belgrade (in Serbian).
Mousilović, S., Baklajić, D., Đoković, I. & Avramović, V., 1978. *Explanatory book for the basic geologic map, scale 1:100 000*, sheet “Titovo Užice”. 50 pp. Federal Geologic Survey, Belgrade (in Serbian, English summary).

Nirta, G., Menina, F., Fazzulli, M., Garfagnoli, F., Bortolotti, V. & Principi, G., 2008. Cretaceous transgressive deposits above an obducted ophiolitic nappe: The Mokra Gora sequence (western Serbia), 33rd International Geological Congress (IHP-01 General contributions to stratigraphy), Poster, Oslo, Norway.

Olujić, J. & Karović, J., 1986. *Explanatory book for the basic geologic map, scale 1:100 000, sheet “Višegrad”*. 55 pp. Federal Geologic Survey, Belgrade (in Serbian, English summary).

Petrović, D. & Radić, R., 1971. Über die Stratigraphie der Kreideserie der Mokra Gora. *Bulletin Scientifique du Conseil des Academies des Sciences et des arts de la RSF de Yugoslavia*, Sect. A, 16 (7–8), p. 138.

Petrović, D. & Radić, R., 1973. *Sratigraphy of the Vlasenica roof bauxite series*. II Jugoslavenski simpozijum o istraživanju i eksploataciji boksita, 1–8, (in Serbian).

Petrović, D. & Radić, R., 1974. *Biostratigraphic investigation of the Cretaceous of Mokra Gora*. Geological Survey of Serbia, Internal report, 13 pp. (in Serbian).

Petković, V., 1925. *Historical geology (Stratigraphy)*. 365 pp. Državna štamparija Kraljevine Srba Hrvata i Slovenaca, Beograd (in Serbian).

Radić, R., 1984. The age of sediments overlaying Ni–Fe deposits in the Inner Dinarides (western Serbia, Kosovo, Macedonia). *Radovi Geoinstituta*, 17: 133–136 (in Serbian).

Radić, R., 1995. Contribution to the study of Cretaceous biostratigraphy of the Zlatibor Mountain. *Radovi Geoinstituta*, 31: 17–30 (in Serbian).

Radić, R. & Schlagintweit, F., 2007. *Neomeris monogrenensis* sp. nov. (Calcareaous alga, Dasycladales) from the Cretaceous of Serbia, Montenegro and the Northern Calcareous Alps, (Gosau Group, Austria). *Geologiški anali Balkanskoga poluostrva*, 68: 39–51.

Živković, M., 1905. About the genus *Pejović*, D. & Radić, R., 1971. *Über die Stratigraphie der Kreideserie der Mokra Gora*. *Bulletin Scientifique du Conseil des Academies des Sciences et des arts de la RSF de Yugoslavia*, Sect. A, 16 (7–8), p. 138.

Živković, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

Živković, J., 1893. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

Živković, J. 1893. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

RADOIĆIĆ, R., 1995. *Contribution to the study of Cretaceous biostratigraphy of the Zlatibor Mountain*. *Radovi Geoinstituta*, 31: 17–30 (in Serbian).

RADOIĆIĆ, R. & SCHLAGINTWEIT, F. 2007. *Neomeris monogrenensis* sp. nov. (Calcareaous alga, Dasycladales) from the Cretaceous of Serbia, Montenegro and the Northern Calcareous Alps, (Gosau Group, Austria). *Geologiški anali Balkanskoga poluostrva*, 68: 39–51.

ŽIVKOVIC, M. 1905. About the genus *Pejović*, D. & Radić, R., 1971. *Über die Stratigraphie der Kreideserie der Mokra Gora*. *Bulletin Scientifique du Conseil des Academies des Sciences et des arts de la RSF de Yugoslavia*, Sect. A, 16 (7–8), p. 138.

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC J. 1893. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M. 1905. About the genus *Pejović*, D. & Radić, R., 1971. *Über die Stratigraphie der Kreideserie der Mokra Gora*. *Bulletin Scientifique du Conseil des Academies des Sciences et des arts de la RSF de Yugoslavia*, Sect. A, 16 (7–8), p. 138.

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC J. 1893. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M. 1905. About the genus *Pejović*, D. & Radić, R., 1971. *Über die Stratigraphie der Kreideserie der Mokra Gora*. *Bulletin Scientifique du Conseil des Academies des Sciences et des arts de la RSF de Yugoslavia*, Sect. A, 16 (7–8), p. 138.

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC J. 1893. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M. 1905. About the genus *Pejović*, D. & Radić, R., 1971. *Über die Stratigraphie der Kreideserie der Mokra Gora*. *Bulletin Scientifique du Conseil des Academies des Sciences et des arts de la RSF de Yugoslavia*, Sect. A, 16 (7–8), p. 138.

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC J. 1893. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M. 1905. About the genus *Pejović*, D. & Radić, R., 1971. *Über die Stratigraphie der Kreideserie der Mokra Gora*. *Bulletin Scientifique du Conseil des Academies des Sciences et des arts de la RSF de Yugoslavia*, Sect. A, 16 (7–8), p. 138.

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC J. 1893. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M. 1905. About the genus *Pejović*, D. & Radić, R., 1971. *Über die Stratigraphie der Kreideserie der Mokra Gora*. *Bulletin Scientifique du Conseil des Academies des Sciences et des arts de la RSF de Yugoslavia*, Sect. A, 16 (7–8), p. 138.

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC J. 1893. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC, M. 1905. About the genus *Pejović*, D. & Radić, R., 1971. *Über die Stratigraphie der Kreideserie der Mokra Gora*. *Bulletin Scientifique du Conseil des Academies des Sciences et des arts de la RSF de Yugoslavia*, Sect. A, 16 (7–8), p. 138.

ŽIVKOVIC, M., 1908. Geology at the vicinity of Užice. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).

ŽIVKOVIC J. 1893. *Izveštaj Užičke gimnazije za 1907–8*, 24 pp. (in Serbian).