

STRATIGRAPHIC POSITION OF THE NOVO SELO – KRIVA LAKAVICA RIVER CARBONACEOUS COMPLEX IN THE WIDER GEOLOGICAL SEQUENCE OF THE MOCHARNIK – DAMJAN – KRIVA LAKAVICA AREA (GEOCHRONOLOGICAL DATA)

Blažo Boev and Risto Stojanov

Faculty of Mining and Geology, Štip, Republic of Macedonia

Abstract: This paper presents the recent geochronological data about the age of the Novo Selo–Kriva Lakavica River carbonaceous complex obtained by lead-lead isotope method. Previous assumptions about the age of the complex were that it probably had been Paleozoic. The application of the most adequate isotope methods determined that the complex is of Jurassic age.

Key words: geochronology; isotope age; lead-lead method

INTRODUCTION

The Novo Selo – Kriva Lakavica River carbonaceous complex has been the subject of several investigations and polemics. Generally, all assumptions lead to the conclusions put forward by Ivanov (1987) that it is a carbonaceous complex and those of Stojanov (1985) that it is a metamorphic complex and the rocks present can be classified as skarns. The present authors do not intend to prove the assumptions but to unravel the issue of the position of the complex in the geological structure of the terrain based on data obtained by isotope method of investigation.

The first data on the geological composition of the area can be found in the papers of Cvijić (1906) in which he mentions the occurrences of crystalline schists, granitoids, Paleogene flysch and andesites. Tučan (1926) reports on the petrographic features of the rocks. Pavlović (1939) gives data of Cretaceous sediments in the vicinity of Mocharnik. Izmajlov (1951) presents data related to the stratigraphy, tectonics and ore occurrences in the area. The papers of SAN (1954) also provide data related to

the stratigraphy of the Cretaceous sediments at Mocharnik. The papers of Hristov and Karajanović (1973) present detailed information on the geology and stratigraphy of the area and together with Temkova have determined Paleogene sediments for the first time.

Detailed data related to the stratigraphy, tectonics, and metallogeny can also be found in the papers of Ivanov (1966, 1987) defining it as a carbonaceous complex. Investigations carried out by Ivanov and Dumurdzanov (1983) give a lot of data on the geology, tectonic and stratigraphy indicating the presence of a carbonaceous complex in the Novo Selo–Kriva Lakavica River. Stojanov (1985) reports on the occurrence of metamorphic rocks in the vicinity of Madenska River presented as skarns and metamorphosed basic and ultrabasic magmatic rocks. In his papers Stojanov also reports on geochronological data related to the age of the vein granitoid rocks in the vicinity of Madenska River and determines them as Cretaceous.

GEOLOGICAL STRUCTURE OF THE TERRAIN

Detailed data on the geological structure of the Vardar zone can be found in the papers of Popvasilev (1987). The main lithologic members that comprise the general geologic pattern of the area are: Precambrian

metamorphic rocks, Old Paleozoic metamorphic rocks, Jurassic ultramafics and granitoids, Alb-Cenomanian and Upper Eocene sediments, Neogene volcanics and Pliocene and Quaternary occurrences (Fig. 1).

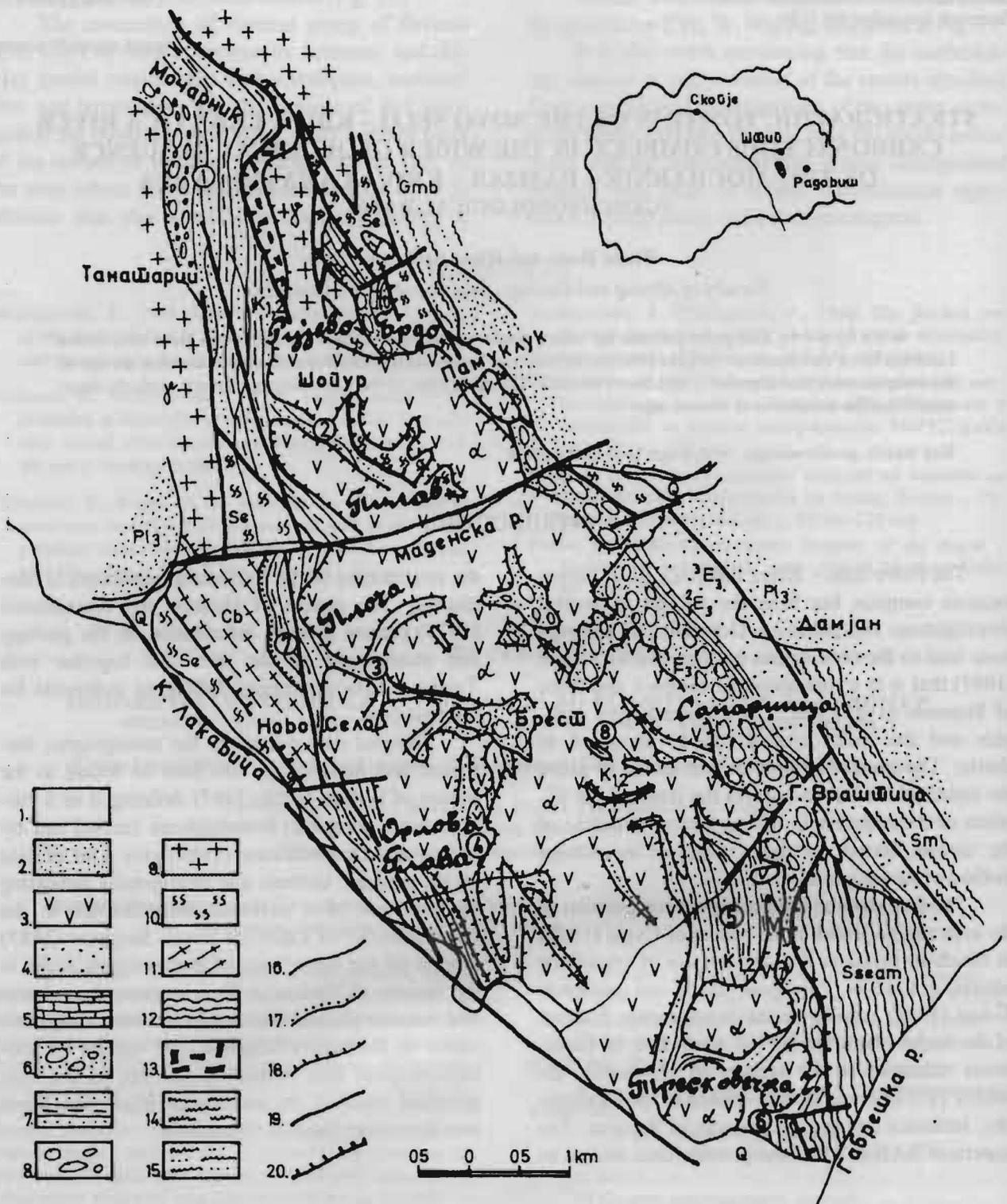


Fig. 1. Geological map of the Mocharnik–Damjan–Kriva Lakavica River area (Pop Vasilev, 1986).

Explanation: 1. Quaternary layers. 2. Pliocene sediments. 3. Andesites. 4. Flysch. 5. Limestones. 6. Basal conglomerates. 7. Sandstones, slates and marls. 8. Conglomerates. 9. Granites. 10. Serpentinities. 11. Skarns. 12. Chlorite-sericite-amphibolitic schists. 13. Amphibolites. 14. Micaschists. 15. Muscovite-biotite gneisses. 16. Regular boundary. 17. Erosion tectonic boundary. 18. Intrusion of magmatic body. 19. Fault. 20. Front of thrust

Precambrian rocks are present as micaschists of NNW–SSE extension in the southern parts of the village of Damjan.

Old Paleozoic occurrences are present as chlorite-sericitic and amphibolitic schists with thin marble intercalations. They are developed in the vicinity of the village of Gorna Vrashtica where they overthrust Upper Eocene sediments. A complex of carbonaceous rocks was found in the vicinity of Novo Selo close to the flow of Madenska River into Kriva Lakavica River. Ivanov (1966) determines them as carbonatites, whereas Stojanov (1985) believes that they represent skarns. The age of the complex is not clear and poses a problem in solving the stratigraphy of the complex with no concern to the issue of the genesis. The text will throw some more light on the stratigraphy in view of the data obtained for the isotope age.

Jurassic ultramafics occur as separate lenses and bands close to Pilav Tepe, the village of Tana-

arci and to the right of Kriva Lakavica River. There are multistage intrusions of Jurassic granitoids in the western part of the terrain.

Alb-Cenomanian sediments are represented by a facies of basal conglomerates and a facies of sandstones and slates. They transgressively overlie the granites and Paleozoic rocks. They are found in the area to the north and south of Madenska River of NW–SE strike.

Upper Eocene sediments are presented as basal conglomerates, limestones and flysch sediments transgressively overlying Paleozoic and Alb-Cenomanian sediments in the eastern part of the terrain.

Oligo-Miocene volcanics and subvolcanic rocks are presented as various types of latites, andesites, quartzlatites and trachytes. They intrude older geological formations.

Pliocene and Quaternary occurrences are presented as various types of sands developed in the area of the Lakavica and Radovish graben.

GEOLOGICAL POSITION OF THE CARBONACEOUS COMPLEX

The Novo Selo–Kriva Lakavica River carbonaceous complex was discovered in the Kriva Lakavica valley and its tributary Madenska River. The largest outcrops can be seen near the villages of Korachina and Novo Selo. Several smaller outcrops were found on the left bank of Kriva Lakavica River (Ivanov, 1987). The size and shape of this carbonaceous complex is difficult to define as it is mostly covered by younger geological structures.

Based on geophysical data given by Bilibajkić (1965) it can be concluded that it is a large complex elliptical in shape of NNW–SSE strike. Many rocks comprise the geological composition of the complex such as carbonaceous rocks, pyroxenites, granites etc. This paper does not intend to deal with the genesis, but rather more with the isotopic age of the complex.

METHOD OF WORK AND RESULTS OBTAINED

The age of this carbonaceous complex was determined by lead-lead isotope method. Measurements were carried out by Wolfgang Todt in the

Max Planck Institute in Mainz, Germany. Results obtained are shown in Table 1 and Fig. 2.

Table 1

Isotopic ratios of lead in the Novo Selo–Kriva Lakavica River carbonaceous complex

Probe	8/4 m	8/4 err	7/4 m	7/4 err	6/4 m	6/4 err	8/4 corr	7/4 corr	6/4 corr
0 982 (1.43)		0,0003		0,0005		0,0003	36,7551	17,1637	36,7485
1 M56	38,5878	0,0087	15,6296	0,0038	19,0244	0,0044	38,8085	15,6967	19,0788
2 M81	38,7347	0,0073	15,6424	0,0024	19,2167	0,0022	38,9563	15,7095	19,2717
3 M86	38,4906	0,0121	15,6207	0,0037	18,8619	0,0027	38,7108	15,6877	18,9158
4 M116	38,6261	0,0122	15,6472	0,0035	19,2837	0,0038	38,8470	15,7143	19,3389
5 M142	39,5371	0,0105	15,7783	0,0040	22,0576	0,0050	39,7633	15,8460	22,1207
6 m57	38,7777	0,0053	15,6713	0,0021	19,4869	0,0022	38,9995	15,7385	19,5426
7 m62	38,6018	0,0840	15,6142	0,0330	19,3056	0,0350	38,8226	15,6812	19,3608

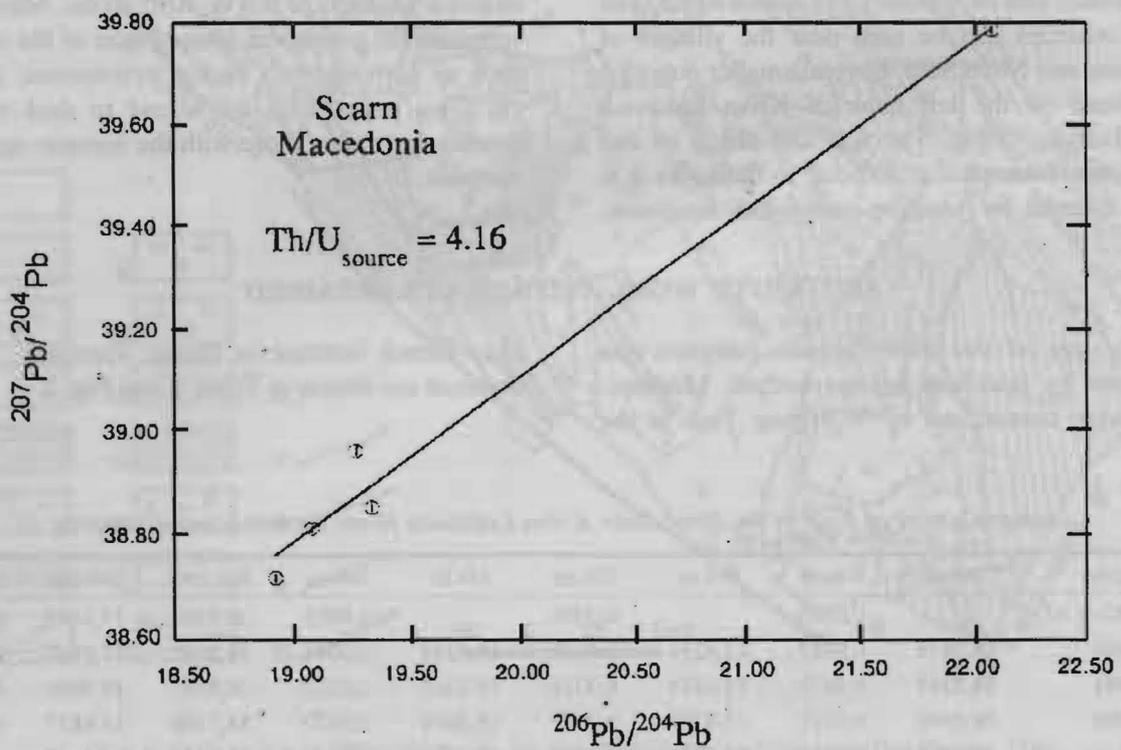
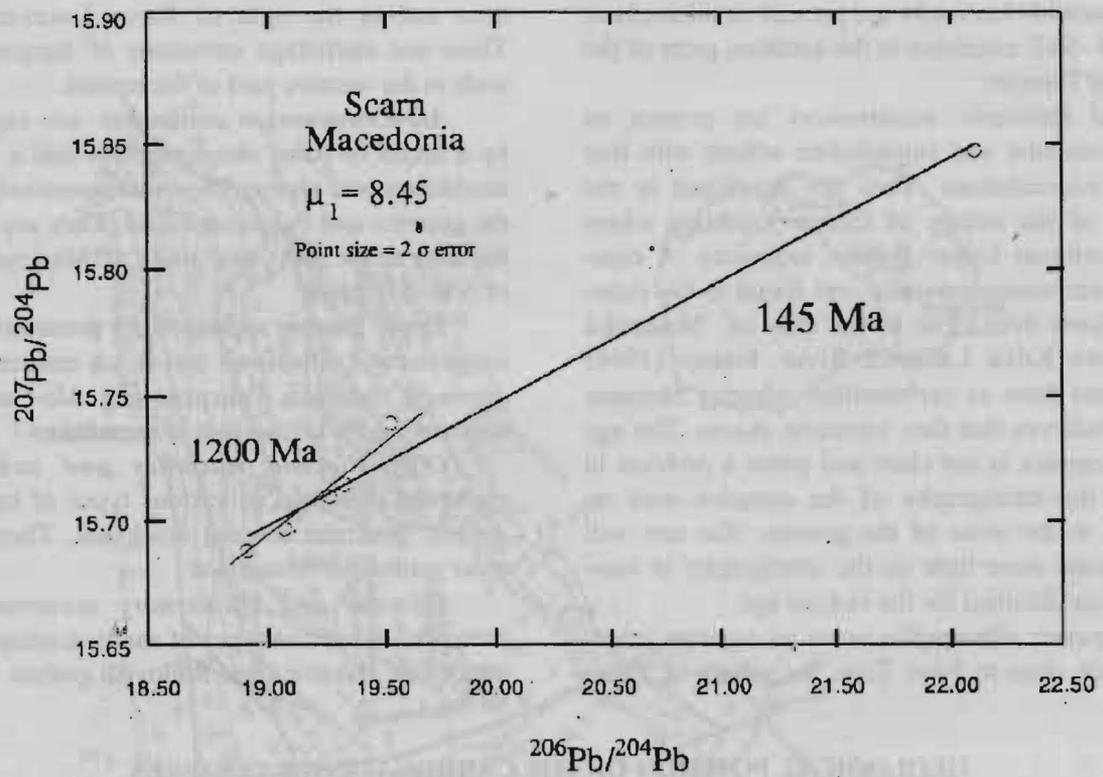


Fig. 2. Isotopic ratios of lead in the Noyo Selo-Kriva Lakavica River carbonaceous complex

CONCLUSION

Based on data reported by Pendžerkovski, Temkova and Pavlovski (1973, 1978) Cretaceous sediments lie transgressively in relation to the metamorphic complex in the eastern parts of the Vardar zone and are of Alb Cenomanian age. Later tectonic, post Eocene movements placed the Cretaceous and Upper Eocene sediments in tectonic relation to the rocks of the metamorphic complex.

Transgression over ophiolite complex of diabase-chert formation in the eastern and middle part of the Vardar zone began in Upper Jurassic. These transgressive structures are presented as thick conglomerates composed of limestones of Tithonian-Neocomian age (the eastern parts of Skopska Crna Gora between Katlanovo and Veles, between Veles and Crna River and at Demir Kapija).

In Madenska River and at Mocharnik in the north, the Alb-Cenomanian sediments begin with conglomerates composed of Shtip granite fragments and the metamorphic basement which clearly illustrates that the metamorphic carbonaceous-silicate complex is of pre-Alb Cenomanian age.

In terms of present day relationships between the carbonaceous and ophiolite part of the complex as well as the younger sedimentary Cretaceous and Upper Eocene flysch formations rather complex relationships can be noticed. They were conditioned by the development of orogeny tectonic movements in Jurassic, Cretaceous and Tertiary and were particularly complicated by the youngest overthrust structures of post Upper Eocene age.

So far the metamorphic rocks of the carbonaceous silicate complex have not been fully investi-

gated in terms of their stratigraphic affiliation and are considered to be older than the Alb-Cenomanian sediments transgressively overlying them. The Shtip granites intruding the rocks of the metamorphic complex are of Upper Jurassic age (Šoptrajanova, 1967) (155 m.y.) and those at Madenska River of 146±5 m.y. (Stojanov, Svešnikova, 1981).

The carbonaceous-silicate metamorphic complex in the eastern parts of the Vardar zone, to which the uncovered part between the Madenska River and Kriva Lakavica River belongs, has regional appearance of south-east strike south of Shtip as far as the border with Greece. Based on data reported by Mussallam and Jung (1986), and Dickson and Dimitriadis (1985), later by Dimitriadis and Zachariadou (1995) these rocks can be encountered in the territory of North-east Greece in the Peonias zone as well as in the vicinity of Thessaloniki in the Vardar zone. Upper Permian-Triassic, Lower Jurassic and Middle Jurassic metasedimentary rocks with ophiolites are determined between Cassandra and Sitonia on Chalkidiki.

Based on available data on geological relationships and isotope measurements it can be concluded that the development of carbonaceous-silicate complex in Madenska River is of Upper Jurassic age (145 m.y.). Isotope measurements that are in progress and preliminary results most probably will yield data indicating that this complex underwent additional metamorphic processes younger than Upper Jurassic.

REFERENCES

- Денковски, Ѓ., Иванов Т., Думурданов, Н. 1983: *Конечен извештај за геолошкије испиражувања на рудниот реон Бучим-Дамјан-Боров Дол*, Стр. фонд на Геолошкиот завод, Скопје.
- Dixon, J. E., and Dimitriadis, S., 1985: *Metamorphosed ophiolitic rocks from the Serbo-Macedonian massif, near lake Volvi, North-East Greece*. Spec. Publication of the Geological Society, No 17, Blackwell Scientific Publications, Oxford.
- Zachariadou, S., Dimitriadis, S., 1995: *Aspects of the tectono-magmatic evolution of the Late Jurassic Guevgueli complex, Macedonia, Greece*. Geol. Soc. Greece, Spec. Publ. No 4, 1995. Proceedings of the XV Congress of the Carpatho-Balkan Geological Association, Sept. 1995, Athens, Greece.
- Zachariadou, S. and Dimitriadis, S. (in press): *Crustal extension and partial melting possibly related to the opening of a marginal basin. The pelitic magmatites of Piyand Karathodoro, Guevgeli complex, Macedonia, Greece*. XXIX / Bull. Geol. Soc. Greece.
- Иванов, Т., 1966: *Извештај за геолошката града на рудниот реон Дамјан*. Стр. фонд на Геол. завод, Скопје.
- Иванов, Т., 1987: *Металогеенија вардарске зоне*. Реферати VI саветовања, Т. II, Охрид.
- Измајлов, Н., 1951: *Геолозија околинe Шойура, Бучима и Дамјана (Македонија)*. Гл. Пр. муз. срп. зем. Сер. А. Књ. IV, Београд.
- Mussallam, K. and Jung, D., 1986: *Petrology and geotectonic significance of Salic Rocks*. Proceedings, Ophi-

- lites in the Eastern Vardar Zone, Greece. *TMPM, Tscher maks Min. Petr. Mitt.* (1986) 35:217–242, Springer-Verlag, 1986.
- Павловић, М., 1939: *Извештај о прегледном геолошком испитивању на листу Шпаниј 1:100 000*. Год. Геол. инст. Краљ. Југ., књ. VI, Београд.
- САН (колективни рад), 1954: *Геолошки састав и тектонска ситуација једног дела Овчег поља и Тиквеша са палеонтолошким документацијом*. Трудови на Геол. завод НРМ, св. 4.
- Stojanov, R., Svešnikova, E. V., 1985: *Granites and contact-metamorphic rocks in Madenska Reka on the way Štip-Radoviš (SR Macedonia)*. *Rud.-geol. fac. – Shtip, Geologica Macedonica*, Vol. I. Fasc. 2, Shtip.
- Тучан, Ф., 1926: *Минералошко-географска проучавања у Јужној Србији, III. Рудинија Дамјана у околини Радовиша*. Гл. Ск. научног друштва, I, Скопје.
- Христов, С., Карајановиќ, М., 1973: *Основна геолошка карта 1:100 000. Толкувач на листови Кавадарци, К 34–93*, Белград.
- Цвијић, Ј., 1906: *Основи за географију и геологију Македоније и Сјаре Србије*. Књ. I. Београд.

Резиме

СТРАТИГРАФСКА ПОЛОЖБА НА КАРБОНАТНИОТ КОМПЛЕКС НОВО СЕЛО–КРИВА ЛАКАВИЦА ВО ПОШИРОКИОТ ГЕОЛОШКИ СКЛОП НА ПОДРАЧЈЕТО МОЧАРНИК–ДАМЈАН–КРИВА ЛАКАВИЦА (ГЕОХРОНОЛОШКИ ПОДАТОЦИ)

Блажо Боев и Ристо Стојанов

Рударско-геолошки факултет, Шпаниј, Република Македонија

Клучни зборови: геохронологија; изотопска старост; метод олово-олово

Во овој труд се прикажани најновите геохролошки податоци кои се однесуваат на староста на карбонатниот комплекс Ново Село–Крива Лакавица добиени со изотопскиот метод олово-олово. Досега се сметаше дека овој комплекс е, најверојатно, со па-

леозојска старост. Меѓутоа, со примена на соодветна методологија на работа, односно со примена на изотопски методи за одредување на староста, се дојде до заклучок дека карбонатниот комплекс Ново Село–Крива Лакавица сепак има јурска старост.