

AGE OF THE VELES "SCHISTES LUSTRES" FORMATION FROM THE VARDAR OCEAN

A. GRUBIĆ and M. ERCEGOVAC

¹ *Faculty of Mining and Geology, Džušina 7, 11000 Belgrade, Yugoslavia*

Abstract: Devonian and Lower-Middle Carboniferous age of the "schistes lustres" Veles Formation has been determined with great certainty according to palynomorphs. The Formation originated on the deep floor of the Vardar Ocean. This is the fact which should be taken into consideration when making paleogeographic and palynspastic reconstructions of SE Europe.

Key words: "Schistes lustres", palynomorphs, Carboniferous, Vardar Ocean, Veles Formation, Macedonia.

Before Kossmat (1924) separated the Veles Formation and emphasized their presence and significance in the Vardar Zone, Cvijić (1907, p. 274) ascertained, with great reliability, that these are "schistes lustres"-type deposits. Afterwards, a lot of papers have been written about these rocks, and all the authors placed these rocks in the Lower Paleozoic. New facts were presented by Grubić and Ercegovac (1974). The Veles Formation are discussed here as a separate formation for the first time.

In the geological section of the stratotype near Veles (Macedonia), the following sets can be distinguished (Fig. 1): 1) Amphibolites, metadiabases and greenschists, which lie on serpentinites; 2) Phyllites, metamorphosed limestones, metacherts and quartzites are in the middle; 3) Upper levels are mostly made of marbles and metamorphosed limestones. The mentioned deposits derived from volcano-clastics, diabases, spilites, silts, argillites, micrites, cherty micrites and cherts, deposited in the deep floor of the Vardar Ocean. They have been metamorphosed afterwards, under high-pressure conditions. Glaucofanite has also been found in the region of Plačkovica.



Fig. 1. Geographic position and geological column of the Veles Formation, based on the geological section between the Vardar River and the St. Ilija ridge.

Legend: 1. serpentinites; 2. amphibolites; 3. phyllitoids; 4 and 5. amphibolites and chlorite schists; 6. phyllitoids and calci-schists; 7. dolomitic calci-schists; 8 and 9. phyllitoids; 10. lance of metamorphosed marble with quartzite inclusions; 11. phyllitoids with remains of microflora; 12. microcrystalline limestones; 13. greenschists and microcrystalline limestones; 14. quartzites; 15. sacharoidal marbles; 16. calci-schists and phyllitoids with rare remains of microflora; 17. lances of metamorphosed limestone; 17. metamorphosed limestone with quartzite inclusions; 18. phyllitoids with lances of metamorphosed limestone; 19. metamorphosed limestone with inclusions of microflora-bearing quartzite; 20. phyllitoid rubble 21. microcrystalline limestones; 22. phyllitoids with quartzite lances; 23. microcrystalline limestones and phyllitoids alternating with microflora; 24. quartz-sericite schists; 25. phyllitoids; 26. microcrystalline limestones with calci-schists and phyllitoids with microflora; 27. greenschists; 28. microcrystalline limestones; 29. calci-schists and chlorite schists in alternation; 30. chlorite-sericite schists, calci-schists, cipolins and quartzites in alternation; 31. marbles; 32. chlorite-sericite schists, quartzites, cipolins and marbles; 33. marbles; 34. chlorite-sericite schists, amphibolites and quartzites; 35-40. marbles.

Relatively diverse palynologic spectrum was found in all three sets (see Grubić and Ercegovac, 1974., p 189-190). According to the presence of sphenopsid and pteropsid trilete spores (*Leiotriletes minor*, *L. gulaferus*, *Laevigatosporites medius*, *Granulatisporites granulatus*, *Corbulispora cf. subalveolatus*, *Densosporites sphaerotriangularis*, *Calamospora cf. laevigata*, *C. minima* and *Knoxisporites sp.*, as well as the pollen of primitive conifers (*Cordaitina cordata*, *Florinites antiquus*, etc.), Carboniferous age of the Veles “schistes lustres” Formation is determined with certainty. Monosulcate and bisaccate pollen grains are conspicuously absent, which leads to a probable conclusion that the Upper Carboniferous is not present in the Veles Formation.

Finding of identical paleopalynologic material within this formation in other parts of Macedonia (Stojanović, 1978) was an incontestable proof of the discovery presented by Grubić and Ercegovac (1974). Besides, rare Carboniferous fossils in the equivalents of the Veles deposits show an identical situation in the northern parts of the Vardar Zone (Kopaonik, Bukulja).

In the lower part of the Veles Formation near Dojran, the microfloral material (spheromorphic and acanthomorphic acritarchs: *Leiosphaeridia sp.*, *Gorgonisphaeridium sp.*, *Lophosphaeridium sp.* and others, as well as carbonized spores of *Pteridophytes*: *Dictyotriletes sp.*, *Aneurospora sp.* and *Retusotriletes sp.*), and remnants of tissues which belong to the primitive vascular plants have been found, pointing to the presence of the Lower Paleozoic (most probably the Lower Devonian).

From all we know today, it seems that the opening of the Vardar Ocean was going on during the Upper Devonian and Lower and Middle Carboniferous, while its partial closure occurred in the Upper Carboniferous. New spreading of the Mesozoic Vardar Ocean started at the end of the Permian and the beginning of the Triassic, when the “schistes lustres “ were formed again in the wider Kopaonik area (Grubić and Ercegovac, 1974, Fig. 3; Grubić, 1995).

References

- Cvijić, J., 1907. About Scientific Work and Our University. In: Autobiography and Other Documents, p 271-323. Serbian Literary Collective, 394, Belgrade, 1965.
- Grubić, A., 1995. Schistes lustres in the Kopaonik area. Geology and Metallogeny of Kopaonik Mt, p. 159-168, Belgrade.
- Grubić, A. and Ercegovac M., 1974. L'âge des couches de Veles et leurs importance pour l'explication de l'évolution de la zone du Vardar. Compte rendus des séances Soc. serbe de géologie, p. 183-201, Belgrade, 1975.
- Kossmat, F., 1924. Geologie der Zentralen Balkanhalbinsel. Die Kriegsschauplatze 1914-1918, geol. dargestellt, H. 12, Berlin.
- Stojanović, M., 1978. Geological Composition and Tectonics of the Terrain T. Veles - Klepa Mt., the Rajac River (SR Macedonia). Doctoral dissertation defended at the Faculty of Mining and Geology in Belgrade, p. 31-46, Belgrade.