

THE AGE OF OPHIOLITE ROCKS IN THE TERRITORY OF THE REPUBLIC OF MACEDONIA

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Abstract: A number of localities with large complexes of ophiolite rocks have been determined as part of the inner Dinaride ophiolite belt in the Republic of Macedonia. The largest localities are the Radusa, Mrezicko-Rzanovo, Lojane and Rabrovo peridotite and the Demir Kapija-Gevgelija ophiolite complexes. The age of the rocks was determined as Jurassic.

Key words: Ophiolite, age, geochronology

The age determination of ophiolite rocks is a special challenge in geochronology. The constraints in the application of certain isotopic methods have made the issue even harder. The authors of the present paper included several geological assumptions in unravelling the issue of the age of the Demir Kapija-Gevgelija ophiolite complex. The geochronological assumptions are:

- the clear upper geological boundary,
- the presence of sedimentary micropackages with paleomicroflora,
- the associated acid magmatism of granite composition,
- the presence of coarse-grained gabbros that can be used in geochronological dating,
- the clear geological relationships of the ophiolite complex to the surrounding geological pattern.

The assumptions mentioned above make it possible to precisely determine the age of ophiolites in the complex. Additional data, regarding the age, will also be provided in the paper.

The interpretations of the geological map for the pages for Kozuf and Gevgelija (Pendzerkovski et al., 1963; Ivanovski, 1963) and the page for Kavadarci (Hristov et al., 1963) offer some data about the age of the magmatic rocks of the Demir Kapija - Gevgelija gabbro-diabase complex. Data point to the Jurassic age of the rocks. The terrigenous and carbonate sediments in the complex were determined

as Upper Jurassic (Tithonian) based on their transgressive relationship. The conclusion was drawn from the fact that gabbros intrude Triassic limestones in which silicification can also be noticed as a contact metasomatic event. The transgressive relationship between the Upper Jurassic terrigenous and carbonate formation was determined from the composition of the breccia-conglomerates in the Demir Kapija gorge. These conglomerates are regarded as basal made up of gabbro and diabase fragments. Fossils of Upper Jurassic age determined in the limestones of the complex include *Ellipsactinia ellipsoidea*, *Aphaeractinia cylindrica*, *Terebratula cf. Moravica*, *Rhynchonella sp.*, *Nerinea zeuscheri*, *Pnoneroptyxis cf. Austriaca*, *Lamellaptycus beyichi*, *Parasmilia cf. Jurassica*.

Paleontological investigations performed on the material collected (Dumurdzanov, 1991) determined that concordant and gradual transition between stratigraphically lower formation of spilitized pillow lava and upper pelagic sediments found as basalt-chert, flysch and carbonate formation are present in all geological cross-sections. Several geological formations occur alternatively to the west of the Demir Kapija gorge. The pillow lava formation is overlain by breccia conglomerates made up predominantly of pillow lava material, keratophyre, quartzkeratophyre, rhyolites and basalts that alternate marly limestones and marls with cherts, with blocks of limestone olistolites of several meters in dimensions. In the eastern part of the gorge pillow lavas are overlain by breccia conglomerates which grade vertically to slates and carbonate slates and these in platy limestones to stratified and massive limestones.

Based on the palinological investigations carried out on the flora of the complex and the geological and stratigraphic relationships it was determined (Dumurdzanov, 1988) that the Demir Kapija - Gevgelija ophiolite complex is of Jurassic age.

In order to carry out a detailed study of the issue the paper will provide some data about the geochronology of the associated granitoid magmatism. It will also offer data about the age of the regional high temperature metamorphism developed within the Vardar zone, particularly in the south parts.

The granitoid bodies in the Gurnicet massif (in the area of the Republic of Macedonia) and the Fanos granites (in the Republic of Greece) intrude the granitoid mass and form a belt of contact metamorphic rocks. The granitoid bodies can be classified as monzonite granites. The age of the granitoids was determined as 147 to 153 m.y. by Rb/Sr method (Borsi, Ferrara, Tongiorgi, 1966).

Several age determinations have been performed on the bulk rock of granitoids of Gurnicet by K/Ar method. The ages obtained range from 150 to 153 m.y. (Boev, Lepitkova, 1996).

The age of the associated granitoid magmatism in the area of Furka was determined as 156 to 165 m.y. by K/Ar method (Boev, Lepitkova, 1996).

Table 1 shows the results obtained from six determinations carried out in the laboratories of the University of Tübingen, Germany by A/Ar method on rocks of the ophiolite and associated rocks.

Data shown in the table justify the conclusion for the Jurassic age of the ophiolite rocks. They also offer additional information that the magmatic activity did not terminate in Jurassic but continued with, several intermittent periods, over the Cretaceous until the Paleogene.

The conclusion that the Demir Kapija ophiolite complex is of Jurassic age is supported by the determinations of the age of the metamorphic events within the Kriva Lakavica - Novo Selo block for which Jurassic age was also found (Boev, Stojanov, 1998). It was discovered that the carbonate rocks present as skarns in the block are part of the regional zone of metamorphic rocks developed in high temperature conditions.

Table 1. K/Ar age of individual rock types of the Vardar zone (Boev, Lepitkova, 2000).

Locality	Type of Rock	K %	^{40}Ar (rad) ccSTP/g	^{40}Ar (rad) ^{40}K (rad)	Age Ma $\pm\sigma$
Smokvica	syenite- porphyry	2.003	1.264×10^{-5}	0.822	155.4 \pm 5.9
Bogorodica	keratophyre	5.027	1.178×10^{-5}	0.889	59.3 \pm 2.3
Gradec	granite- porphyry	1.737	8.993×10^{-6}	0.680	128.5 \pm 4.9
Gradec	basalt	1.023	3.131×10^{-6}	0.693	77.1 \pm 3.0
Grciste	Monconite hb	0.926	2.959×10^{-6}	0.440	80.4 \pm 3.6
Selemlji	quartzlatite hb	1.863	4.359×10^{-7}	0.301	6.00 \pm 0.33

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