Genesis and geotectonic setting of the Mt Papikion pluton (Central Rhodope, Greece)

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The evolution of the Rhodope massif has been extensively studied and its basement in the Greek part has been divided into two tectonic units: the Lower Tectonic Unit (LTU), also known as Pangaion, and the Upper Tectonic Unit (UTU) also known as Sidironero. The LTU is exposed as tectonic windows in the UTU. In the eastern Rhodopes, LTU is exposed as a string of four separated domes: the Chepinska, Arda, Kesebir-Kardamos, and Biela Reka (Burg, 2012).

The Mt. Papikion pluton stretches East-West from Iasmos to Komotini, and South-North from the Xanthi-Komotini fault to the Greek-Bulgarian border. The pluton, with characteristic gneissic texture, covers about 100 km^2, intrudes the SW parts of Kesebir-Kardamos Dome (Figure 1), and it is in contact with gneisses to NE and marbles to SW, representing the lower and the intermediate unit of Kesebir-Kardamos Dome, respectively (Bonev *et al.*, 2006).

In this paper we focus on the genesis and the geotectonic setting of the Mt. Papikion pluton.

Mt. Papikion pluton consists mainly of five rock types which have been classified on the basis of field observations, mineralogical composition and Q'-ANOR classification. These types are hornblende diorite (Hbl-Dr), biotite hornblende diorite (Bt-Hbl-Dr), hornblende granodiorite (Hbl-Grd), biotite hornblende granodiorite (Bt-Hbl-Grd) and biotite granodiorite (Bt-Grd).

Based on field observations, isotopes and trace elements behavior, evolution of the plutonic rocks can be attributed to an assimilation with simultaneous fractional crystallization process (AFC) (Figure 2). The rock types of the Mt Papikion pluton are essentially the result of the fractional crystallization process of two dioritic melts having small geochemical differences, which assimilate the rocks into which they intrude, namely gneiss and meta-SnGr (meta-syenogranite). The model proposed on the basis of trace elements and verified by isotopes takes into consideration two initial dioritic magmas. The bulk distribution coefficients calculated by the AFC models are in agreement with the crystallization of plagioclase + K-feldspar + hornblende + biotite + apatite + zircon + allanite + titanite + magnetite, as determined by the variation of the major elements, trace elements and rare earth elements. The deviations that many of the samples of the Mt Papikion pluton show from these curves are probably due to the fact that these rocks do not represent pure melts but are the result of an incomplete separation between the residual liquid and the crystalline solid.

U-Pb method in zircons gave an age of 236±8 Ma (Drakoulis *et al.*, 2013) which considered as the age of crystallization as well as the age of the pluton intrusion, suggesting a magmatic episode in the Upper-Middle Triassic. Despite the fact that the pluton is located in the Rhodope Massif, it differs from the extended Eocene-Miocene magmatism of the area and it is even very different from that of Xanthi, which is located only few kilometers west. Plutons of similar age are not mentioned in the literature for the Rhodope Massif, while older ages have been reported for metagranites. However, plutons of similar ages (Poli *et al.*, 2009; Bonev et *al.*, 2018) have been found in the Serbo-Macedonian Massif which is part of the UTU.

The presence of basic rocks in Mt. Papikion pluton, suggests that a mantle component had a significant role in the genesis and evolution of the pluton. This feature in combination with petrotectonic and spider diagrams, suggest a volcanic arc magmatism. The lower unit of the Kardamos Dome consists of high metamorphic grade rocks, orthogneiss and migmatites, which also suggests its continental origin. The pluton of Mt Papikion intrudes mainly the orthogneiss, which indicates an environment of an active continental margin, in accordance to the geochemical data.

The pluton's emplacement occurs in the Middle Triassic. Geochemical characteristics show that the intrusion took place in an active continental margin. During the Middle Triassic, as various researchers state, the ocean of Paleo-Tethys closed and the ocean plate subducted under individual parts of Eurasian continental blocks (active continental margins) (Fig. 3).

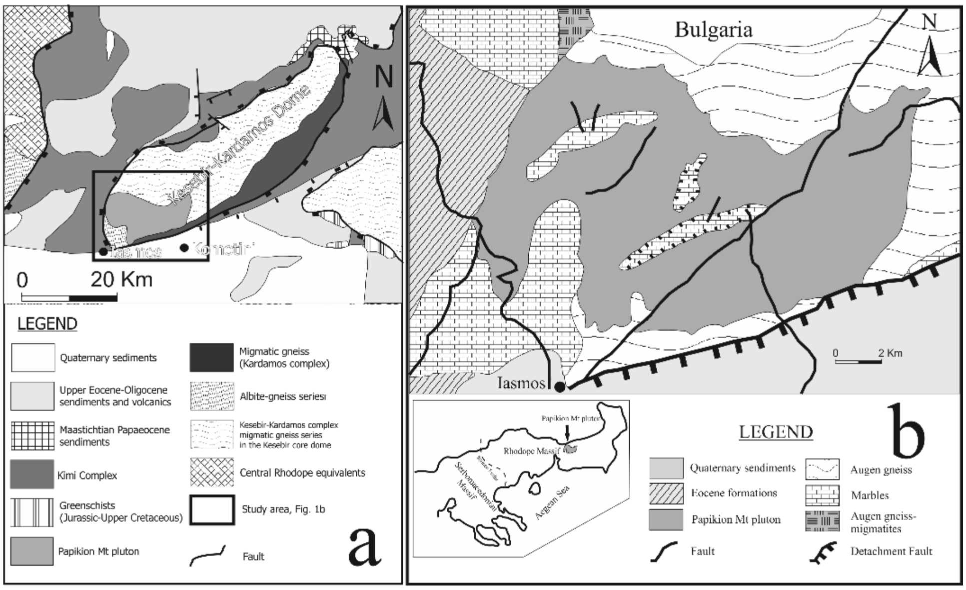

Figure 1. a: Geological map of Kesebir-Kardamos Dome (modified after Bonev *et al.*, 2006), b: Geological map of Mt Papikion pluton (modified after Dimadis and Zachos, 1986).

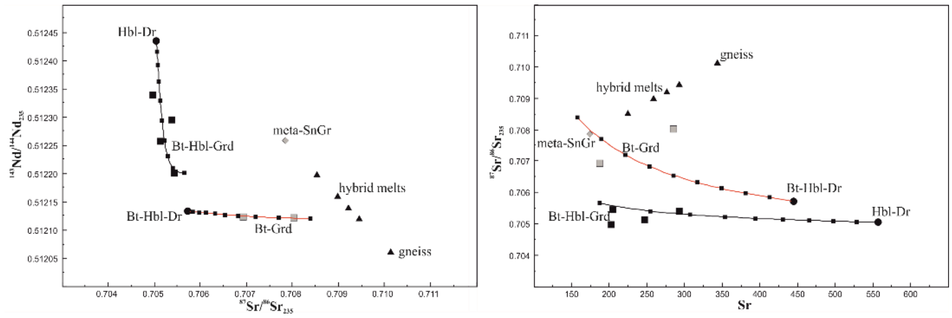

Figure 2. $^{143}Nd/^{144}Nd_{235}$ vs $^{87}Sr/^{86}Sr_{235}$ and $^{87}Sr/^{86}Sr_{235}$ vs Sr plots. Isotope modelling of AFC process of the Mt Papikion pluton evolution.

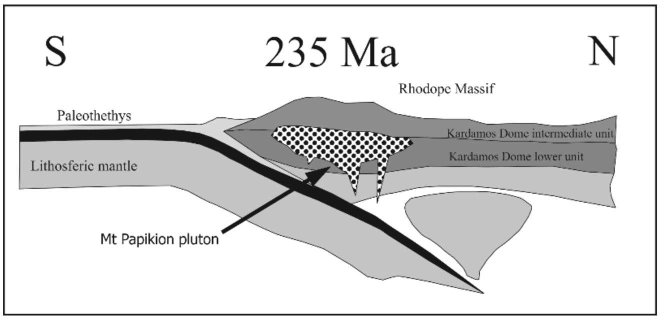

Figure 3. Geotectonic setting of Mt Papikion pluton emplacement (Active continental margin).

References

Bonev, N., Burg, J.-P., Ivanov, Z., 2006. Mesozoic-Tertiary structural evolution of an extensional gneiss dome–the Kesebir-Kardamos dome, eastern Rhodope (Bulgaria-Greece). Int. J. Earth. Sci., 95 (2), 318-340.

Bonev, N., Moritz, R., Borisova, M., Filipov, P., 2018. Therma-Volvi-Gomati complex of the Serbo-Macedonian Massif, Northern Greece: A Middle Triassic continental margin ophiolite of Neotethyan origin. Journal of the Geological Society, DOI: https://doi.org/10.1144/jgs2017-130.

Burg, J-P, 2012. Rhodope: From Mesozoic convergence to Cenozoic extension, in: Skourtsos E., Gordon S. Lister (Eds.), The Geology of Greece. Review of petro-structural data in the geochronological frame Journal of the Virtual Explorer, Electronic Edition, ISSN 1441-8142, 42, paper 1.

Dimades, E., Zachos, S. 1986.Geological map of Rhodope 1:200.000. IGME.

Drakoulis, A., Koroneos, A., Poli G., Soldatos, A., Papadopoulou, L., Murata, M., Eliwa, H., 2013. U-Pb zircon dating of the Mt. Papikion pluton (Central Rhodope, Greece): New constraints on the evolution of Kesebir-Kardamos Dome. Acta Vulcanologica 25, 1-2, 83-98.

Poli, G., Christofides, G., Koroneos, A., Soldatos, T., Perugini, D., Lagone A., 2009. Early triassic granitic magmatism – Arnea and Kerkini granitic complexes – in the Vertiskos unit (Serbo-macedoniam massif, north-eastern Greece) and its significance in the geodynamic volution of the area. Acta Vulcanologica, 20/21, 4770.