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# The Upper Jurassic Monopigadon pluton related to the Vardar-Axios ophiolites and its geotectonic significance

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The ophiolite complex exposed in the NW-SE trending Vardar-Axios Zone is characterized by granitic rocks associated with it. In central Macedonia (Northern Greece), it is intruded by the Upper Jurassic Fanos granite and Monopigadon pluton. The origin, evolution and geotectonic setting of the latter are studied. The pluton is composed of slightly peraluminous to peraluminous high-K calc-alkaline biotite granodiorite (BGrd), biotite granite (BGr), leucogranite (LGr) and aplites (Apl). Enclosed rocks (Enc) are mostly xenoliths, surmicaceous enclaves and biotite clots occurring frequently in BGrd and BGr indicating an extensive incorporation of country rocks in the magma, whereas their variability implies that the magma intruded an inhomogeneous crust. In addition, a serpentinite body as well as amphibolite and calc-silicate hornfelses are exposed as inliers in the pluton. The granitoids are characterized by relatively high-K, low Sr contents (<180 ppm), and low Sr/Y ratio (0.4-6.4). REE are enriched in all granitic rocks (LaCN=89-148, LuCN=6-25. The (La/Lu)CN ratio ranges from 10.5 to 4.9 in BGrd, from 11.1 to 3.8 in BGr, and from 11.3 to 25.7 in LGr. The BGrd and BGr show similar LILE-enriched, and spiked patterns with negative anomalies at Ba, Ta, Nb, Sr and Ti and a positive anomaly at Pb, whereas the patterns of LGr show higher Ta, Nb, Sr and Ti negative anomalies. The Sr initial isotopic ratios, typical of the Earth's crust, vary from 0.7147 to 0.7174 in BGrd, are relatively constant at 0.7105 - 0.7113 in BGr, and range from 0.7213 to 0.7340 in LGr, whereas they are lower in the enclaves (0.7087 to 0.7094). BGrd shows the lowest Nd values (-8.31 to -6.43), while it ranges from -6.11 to -4.26 in BGr and from -3.37 to -0.89 in LGr. Late Triassic to Late Jurassic intrusion zircon ages are reported for the Monopigadon pluton which is unconformably overlain by Kimmeridgian – Tithonian limestones and fragments of the plutonic rocks occur in the limestones. The geochemical data imply that the evolution in BGr must be considered as independent of BGrd, and that LGr generate by partial melting of crustal material. The geochemical variability of the BGrd is reproduced by two different AFC models having the same parental magma and assimilation/fractionation ratio but different assimilant. Geochemical modeling suggests that the BGr variability could be reproduced by two different FC models having the same parental magma but with different fractionating assemblages. Comparison of BGrd and BGr with experimental data obtained by melting experiments of crustal protoliths The comparison indicates that the BGrd and BGr have similar sources and they are likely originated by partial melting of middle-lower crustal rocks with intermediate-basaltic compositions, such as amphibolites, andesites and basalts. In both cases (BGrd and BGr) any sedimentary source is precluded. Felsic garnet granulites and metapelites are candidate source rocks for LGr. The geochemical data, used in order to clarify the geotectonic setting of the Monopigadon pluton, the relationship of the latter with the ophiolites, along with the suggested source and evolution process, support magma genesis by melting of an inhomogeneous middle to lower crust due to mantle-derived magmas underplating. The latter which had not mixed/mingled with the crustal melts are related with a volcanic arc environment. The inhomogenous crust explains both the diversity of the sources for BGrd+BGr and LGr as well as the different kinds of xenoliths. The 159[U+F0B1]1 Ma age of Monopigadon, similar to Fanos (158 Ma), fits well with the following scenario: emplacement of the East Vardar ophiolites in the Late Jurassic; partial melting of an inhomogenous crust originating the different Monopigadon magmas; high-temperature collision processes; Fanos pluton genesis representing the Late Jurassic closure of the ocean.