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He-Ar isotope signatures of the Mesozoic granitoids in South Korea

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Noble gas isotopic ratios such as helium(3He/4He) and argon(40Ar/36Ar) in the Mesozoic granites of the Korean peninsula which belongs to a continental margin of the Southeast Eurasian plate were analyzed to investigate the origin of the granitic magma. Noble gases for isotopic analysis were extracted from fluid inclusions in quartz of granitic rocks. Helium isotopic ratios (3He/4He) range from 0.002 to 0.522 RA (av. 0.095RA, 1RA=1.40×10-6) for Jurassic Daebo granites and from 0.013 to 1.267 RA (av. 0.365RA) for Cretaceous Bulguksa granites. Mantle helium has been traced in Mesozoic I-type granites from South Korea, of which Cretaceous granites in the Gyongsang basin were significantly enriched in mantle helium. Helium isotopic ratios of Jurassic granites are similar to the continental crustal value of 0.02RA, due to radiogonic 4He generated by U(Th) of the metasedimentary crustal rocks. It suggests that the granitic magma be derived from the partial melting product of the subcontinental lithospheric material with an high radiogenic helium in relation to the subduction of the Izanagi sea plate. Meanwhile, Cretaceous granites contained the dominant mantle helium were formed by upper mantle source materials. Argon isotopic ratios (av. 40Ar/36Ar = 1040±17) of the fluid inclusion in quartz for Jurassic granites are considerably higher than those in Cretaceous granites (av. 40Ar/36Ar = 423.8±1.2), indicating an ageing effect. The crustal helium predominates over all of the Jurassic granites in the Korean peninsula and the Cretaceous granites in the Okcheon zone. It accords well with the result of Nd-Sr isotope characteristics that implies Jurassic granites in the peninsula and Cretaceous granites in the Okcheon zone are deriverd from the crustal source magma. Our He-Ar noble gas isotopic signatures in terms of the source of granitic magma are consistented well with the previous results of O-Nd-Sr isotopes and CO2 and CH4 geochemistry in fluid inclusion of Mesozoic granites, South Korea.