イタリアのドラマイラ岩体で発生した過剰アルゴン波
Excess argon wave in UHP metagranite from southern Dora-Maira Massif, Italy

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Biotites have sometimes complicated excess argon behavior in the thermally overprinted rocks near tectonic contacts and/or in contact aureoles. Hyodo and York (1993) found ‘discordant’ biotite $^{40}Ar/^{39}Ar$ ages significantly older than the age of the hosting lithology in a narrow zone of a contact aureole and called this phenomenon “Argonami” imaging “Tsunami”. This type of excess ^{40}Ar scenario derived from the possibility for minerals to incorporate the excess Ar through argon diffusion. Itaya et al. (2009) later named the same phenomenon as “Excess-Argon Wave”. Since then, the phenomenon of the trapping of “Excess-Argon Wave” by minerals has been increasingly observed in biotite, kyanite, white mica and K-feldspar from many types of lithologies.
During the laser step-heating $^{40}Ar/^{39}Ar$ analyses of individual biotite grains from metagranite in the Brossasco-Isasca UHP Unit of Dora-Maira Massif, Italy, we obtained ages three to four times older than that of the granite protolith. To our knowledge, this is the first report of extremely high excess argon as the first case from a regional metamorphic sequence worldwide. We describe laser step heating $^{40}Ar/^{39}Ar$ analyses of biotite crystals from two metagranite samples with the aim of revealing how the biotites acquired the extremely large inherited amount of excess argon.
Two undeformed metagranite samples were collected from the Brossasco-Isasca UHP Unit of southern Dora-Maira Massif, to carry out the laser step-heating $^{40}Ar/^{39}Ar$ analyses of individual biotite crystals. The metagranite samples still preserve their original medium- to coarse- grained igneous structure, consisting of K-feldspar, plagioclase, quartz and biotite. K-feldspar occurs often as a perthite. Quartz occurs as a fine-grained granoblastic aggregate, statically derived from inversion of coesite. Plagioclase is now replaced by a fine-grained (tens of microns) aggregate mainly consisting of albite and zoisite, and minor titanite, phengite and apatite. Biotite is surrounded and partly replaced by fine-grained phengite. EMP analyses revealed that K-feldspar has 94-97 % of orthoclase component. Biotite has Fe/(Fe+Mg) of 0.65-0.67 and Al=2.9-3.0 a.p.f.u. (on the basis of 11 oxygens). The fine-grained white micas replacing biotite are phengites with Si=3.2-3.4 a.p.f.u. (on the basis of 11 oxygens) and are therefore likely related to the Alpine HP/UHP metamorphism. Albite in the perthite and in the plagioclase pseudomorphs is nearly pure. Mineral chemistry is similar in the two metagranite samples.
Three biotite crystals from the first sample have similar age spectra showing 400 to 300 Ma except for the first fraction (500–1500 Ma). On the contrary, the age spectra of five biotite crystals from the second sample are significantly different from those of the first one. The samples showed saddle shape $^{40}Ar/^{39}Ar$ age spectra, except for one crystal. The oldest fractions have ages spanning between 800 and 1300 Ma, three to four times older than the granite protolith, which is late Permian. This extremely high intensity of excess argon could be due to an “Excess-Argon Wave” (EAW) phenomenon occurred during the quick exhumation of the Brossasco-Isasca Unit combined with the extremely short ductile deformation history. The observed variation of the biotites age spectra may reflect the different trapping processes of EAW and/or localized source of EAW.

References
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キーワード：ドラマイラ岩体、変成花崗岩、黒雲母Ａｒ－Ａｒ分析、過剰アルゴン波
Keywords: Dora-Maira Massif, Metagranite, Biotite Ar-Ar analyses, Excess argon wave

