Chemistry-age relations of white mica from the Piemonte calcschists in western Alps

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White micas are common in low to medium grade metamorphic rocks and have been ubiquitous in geochronological study to reveal cooling histories of host rocks. In particular, their systematic K-Ar age determinations have often made important constraints on understanding tectono-metamorphic history of orogenic belts because high potassium content and polished technique of white micas provided us comparatively reliable results. In the last decade, however, some serious discordant K-Ar white mica ages have been realized in the subduction-related metamorphic rocks of SW Japan (Itaya & Takasugi, 1988; Takami et al., 1993; Itaya & Fukui, 1994; Itaya & Fujino, 1999). Scaillet et al. (1992) and Scaillet (1996) also discussed variable white mica Ar-Ar ages due to their chemistry and excess argon in the Dora-Maira massif of western Alps.

The authors carried out K-Ar age determinations of white mica separates from fifty blueschist-facies calcschists collected systematically from the Piemonte zone of the Penninic domain in the western Alps. In the process of this project, the authors obtained variable K-Ar white mica ages ranging from 115 Ma to 41 Ma, and anomalously large chemical variations of white mica. This suggests there are some relationships between K-Ar ages and chemistry of white mica. This paper describes white mica chemistries of the high-pressure calcschists from the Piemonte in the internal western Alps, and discusses the causes of the large chemical variations and the discordant age relations of white mica from the calcschists.

Anomalously large chemical variations in muscovite-paragonite and muscovite-celadonite systems are observed in white micas from the Piemonte calcschists in the Chisone valley area, internal western Alps. The petrographical and chemical observations on white mica strongly suggest that most mica crystals with high Na/K ratio in the chlorite zone are of detrital origins and were derived from the pre-Alpine high-temperature metamorphic sequence such the Caledonian and/or Variscan.

Metamorphic mica is also very heterogeneous. The total range in Si content becomes wider with increasing of metamorphic grade: 3.22-3.39 pfu for the chlorite zone, 3.07-3.45 pfu for the chloritoid zone and 3.06-3.59 pfu for the rutile zone. This clearly indicates that some mica grains have disequilibrium chemistry with other metamorphic primary phases, suggesting that the micas have experienced significant retrogressive chemical reactions in cooling and exhumations of the host schists.

The detrital white mica in the chlorite zone has been not reset well during the Alpine subduction-related metamorphism. The wide range of the white mica ages from 115 to 41 Ma must be due to mixture of variable amount of detrital white mica in the separates. This feature is also observed in the chloritoid zone though the age variation is not so large in comparison with that in the chlorite zone. In contrast, white micas in the rutile zone, whose peak metamorphic temperature was higher than 450 degrees, has been reset completerly during the Alpine HP metamorphism.