Thematic Article

Zircon U–Pb sensitive high mass-resolution ion microprobe dating of granitoids in the Ryoke metamorphic belt, Kinki District, Southwest Japan

TERUO WATANABE,1 TREVOR IRELAND,2* YOSHIKI TAINOSO3 AND YUTAKA NAKAI4
1Division of Earth and Planetary Sciences, Graduate School of Science, Hokkaido University, Kita-ku, Sapporo 060-0810, Japan (email: teruwata@ep.sci.hokudai.ac.jp), 2Research School of Earth Sciences, The Australian National University, ACT 2601, Australia, 3Department of Natural Environment, Kobe University, 3-11 Tsurukabuto, Nada-ku, Kobe 657-0011, Japan, 4Aichi University of Education, Igaya, Hirosawa, Kariya 448-8542, Japan

Abstract  Zircon U–Pb sensitive high mass-resolution ion microprobe dating was carried out on three types of granitic rock (gneissose biotite granodiorite, biotite granite and two-mica granite) from the Cretaceous Ryoke belt of the Kinki district, Southwest Japan. The results give the ages of granitic magmatism in the Shigi-san area of between 87 and 78 Ma and suggest extensive melting of the Cretaceous Ryoke granitic crust to form the two-mica granite, probably at ca 80 Ma. Discrimination into older and younger granites based on development of gneissosity does not appear to represent the sequence of magma generation, although there is some scope in the interpretation of the zircon U–Pb data that would allow all three granites to form at 83 Ma. Compilation of chemical Th-U-total Pb isochron dating method ages, whole rock Rb–Sr isotope ages and U–Pb isotope ages indicates that most Ryoke plutonism occurred from ca 70 Ma to ca 100 Ma. Younger (85 Ma–70 Ma) plutonism with the formation of two-mica granite occurred only in the eastern sector of the Ryoke belt, including the Kinki District.

Key words: U–Pb age, Ryoke belt, Kinki district, Cretaceous, two-mica granite, zircon, sensitive high mass-resolution ion microprobe.

INTRODUCTION

The Ryoke Belt is an 800 km-long structure that forms part of the northwest Pacific Cretaceous granitic province and is the inner side of the paired metamorphic belt of Miyashiro (1961); the pair is separated by the Median Tectonic Line. The Ryoke belt is characterized by high-temperature–low-pressure mineral assemblages; whereas, the Sanbagawa Belt is the high-pressure side of the pair; it is located to the outer (Pacific Ocean) side of the Ryoke Belt.

The Ryoke Belt consists primarily of Cretaceous granitoids, along with minor amounts of low-pressure metamorphic rocks. The Sanyo Belt, a second Cretaceous granite zone, runs along the inner side of the Ryoke Belt to the north. Kinoshita & Ito (1986, 1988) identified apparent migration (along-arc lateral variation) of isotope ages, is younging toward the east. These trends have been interpreted in relation to ridge migration. On the basis of a comprehensive compilation of isotope ages, Nakajima et al. (1990, 1994) refined the model and interpreted the along-arc variation and granitic magma production as an episodic event, such as the collision of a mid-oceanic ridge with the trench (Nakajima 1997). Nakajima (1994) considered that the Ryoke plutono-metamorphic belt represented a deeper crustal section of the Cretaceous Eurasian continental margin, and that the Sanyo zone to the north represented a shallower crustal section.

Rb–Sr mineral ages and K–Ar ages for hornblende and biotite constrain a trend ranging from 100 Ma to 110 Ma in the western margin, is young-