Bull. Natn. Sci. Mus., Tokyo, Ser. C, 18 (4), pp. 113–116, December 22, 1992

Yokokawagawa metamorphic rocks, north of Lake Suwa, central Japan

By

Kazumi YOKOYAMA

Department of Geology, National Science Museum 3–23–1, Hyakunin-cho, Shinjuku-ku, Tokyo, 169

Abstract Yokokawagawa metamorphic rocks are different from the Sanbagawa metamorphic rocks. They are not associated with any member of Chichihu and Shimanto groups. Chert and limestone, or their metamorphosed equivalents, do not occur in the Yokokawagawa metamorphic rocks. Furthermore, garnets in pelitic rocks are more Mn-rich than those in the Sanbagawa metamorphic rocks. K-Ar ages, so far obtained, are also different from those in the Sanbagawa metamorphic rocks.

Introduction

In the Fossa Magna region, metamorphic rocks with schistose texture occur along the Yokokawagawa river. They have long been considered to be an extension of the Sanbagawa metamorphic rocks in the Akaishi Mountains and to connect with the metamorphic rocks in the Kanto Mountains to the east (*e. g.*, KAWACHI, *et al.*, 1966; YOSHINO, 1976). The Yokokawagawa metamorphic rocks are in contact with early to middle Miocene sedimentary rocks by fault at the western margin. YOSHINO (1976) suggested that the fault is an extension of the Median Tectonic Line. Based on similarity of the Yokokawagawa and Sanbagawa metamorphic rocks, KAWACHI *et al.* (1966) and YOSHINO (1976) estimated lateral displacement of the rocks along the Itoigawa-Shizuoka Tectonic Line as about 12 km. In this short note, the author describes the metamorphic rocks briefly and reports their K-Ar ages.

Petrography and K-Ar age

Yokokawagawa metamorphic rocks are bounded by a high angle fault at the western side and are widely covered at the other sides by late Miocene and early Pleistocene volcanics (Fig. 1). They consist mainly of pelitic rock with a subordinate amount of greenschist. Ultramafic rock occurs mainly along the fault and sporadically as small bodies in the metamorphic rocks.

The pelitic rocks are composed of muscovite, albite, chlorite and quartz with trace amounts of epidote, graphite and sphene. Greenschist is composed mainly of albite, chlorite, epidote and muscovite with trace amounts of amphibole and sphene. Albite and amphibole are always pure albite and actinolite, respectively. Based on

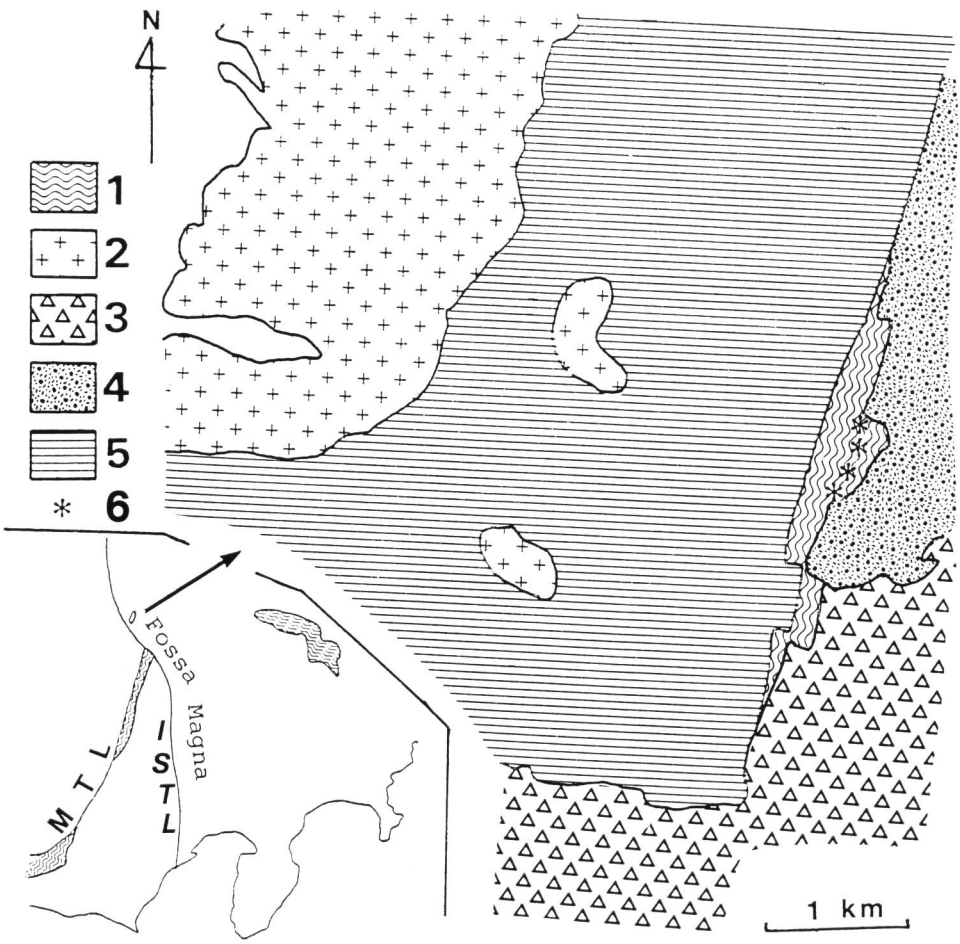

Fig. 1. Geological map with localities of the analysed samples (simplified from Yoshino, 1982). 1; metamorphic rocks, 2; granitic rocks, 3; Enrei Group (early Pleistocene), 4; Ikurasawa Formation (late Miocene), 5; Takaboccpi Group (early to middle Miocene), 6; sample locality. MTL; Median Tectonic Line, ISTL; Itoigawa-Shizuoka Tectonic Line.

appearance of albite porphyroblast, these rocks are divided into two zones, non-spotted and spotted zones, as those in the Sanbagawa metamorphic rocks (KAWACHI *et al.*, 1966). Spotted schist is commonly sheared and occurs along the fault. Spotted pelitic schist sometimes contains garnet. Although chemical zoning is observed in the garnet, the compositional variation is narrow ranging from 75 to 65 as a spessartine component. Ultramafic rocks are mostly serpentinites. Olivine (Fo>90) and orthopyroxene (En>90) occur as relict phases in some samples.

These rocks have been suffered from weak metamorphism probably by the in-

Table 1. K-Ar ages of the Yokokawagawa metamorphic rocks (analyzed by Teledyne).

Sample No.	Material analyzed	K_2O (%)	Rad ^{40}Ar (sec/gm $\times 10^{-5}$)	Rad ^{40}Ar (%)	Age (Ma)
118918	whole rock	2.11	.233	48.1	27.8±1.4
		2.11	.227	53.2	
118919	whole rock	2.81	.264	49.2	23.7±1.2
		2.84	.259	53.0	
118921	whole rock	2.62	.281	63.5	27.8±1.4
		2.64	.292	71.9	
118920	whole rock	3.71	.407	77.5	28.4±1.4
		3.70	.417	73.6	
118920	muscovite	5.39	.856	69.6	40.5±2.0
	(chl+gra)	5.36	.856	67.2	

trusion of late Miocene granitic rocks (YOSHINO, 1982). K-Ar ages of the granitic rocks are 7–9 Ma (KAWANO and UEDA, 1966; SHIBATA *et al.*, 1976). The thermal metamorphism produced locally aduralia and epidote veins. Grossular and andradite occur rarely along the veins in the greenschists.

K-Ar ages of four whole rocks and one muscovite were analyzed by Teledyne Isotope Laboratory. Three K-Ar ages of the whole rocks (Table 1) are 28 Ma and the other one is 24 Ma. The pelitic rocks analysed are non-spotted schist far from the granitic rocks and they seemed to be free from the later stage alteration. Even though they may be suffered from the thermal metamorphism by the granitic intrusions, the metamorphic grade, the prehnite zone or lower than that (YOSHINO, 1982), should be too low to affect the K-Ar ages (JAGER, 1979). However, muscovite age obtained is 40 Ma, much higher than the whole rock ages. These data suggest that later stage adularia veins occur in the whole rock samples analysed.

Discussion

The petrographical characteristics of the Yokokawagawa metamorphic rocks are apparently similar to the Sanbagawa metamorphic rocks as suggested by KAWACHI *et al.* (1966). Although further detailed studies such as Ar-Ar age of muscovite, is neccessary, K-Ar age of muscovite, so far obtained from the Yokokawagawa metamorphic rock, is younger than the isotope ages, 65 Ma to 120 Ma, of Sanbagawa metamorphic rocks (Itaya and Takasugi, 1988). There are some differences of the mineral proportions and compositions between the Yokokawagawa and Sanbagawa metamorphic rocks. Amphibole is trace in greenschists and is always actinolite. Tourmaline is scarce in the Yokokawagawa metamorphic rocks. Spessartine content in garnet is more than 65. In the Sanbagawa metamorphic rocks, such Mn-rich garnet is present only in its core (BANNO *et al.*, 1986). Differences are also found

in the rock-types. Chert and limestones or their metamorphic equivalent, common in the Sanbagawa belt, have not been found in the Yokokawagawa metamorphic rocks. Ultramafic rock with orthopyroxene is scarce in the Sanbagawa metamorphic rocks (RGPI, 1967).

Ultramafic rocks occur along the fault that was concluded as an extension of the Median Tectonic Line by YOSHINO (1976). However, ultramafic rock has not been described along the Median Tectonic Line. In the Akaishi and Kanto Mountains, Chichibu and Shimanto groups develop more widely than the Sanbagawa metamorphic rocks. In spite of such wide occurrences of the groups, any constituent member of the groups has not been recognized in the Fossa Magna region. Hence, it is not probable that the Sanbagawa metamorphic rocks only crop out in a narrow zone without association of any member of the Shimanto and Chichibu groups.

Presences of pure albite and absence of biotite suggest that the Yokokawagawa metamorphic rocks were metamorphosed relatively at high pressure conditions as the Sanbagawa metamorphic rocks. Although it is so far difficult to indicate a metamorphic rock similar to the Yokokawagawa metamorphic rocks, it is probable that they are not a missing ring between the Sanbagawa metamorphic rocks of Akaishi and Kanto Mountains and the fault at its western margin is not the Median Tectonic Line.

References

BANNO, S., SAKAI, C. & HIGASHINO, T. 1986. Pressure-temperature trajectory of the Sanbagawa metamorphism deduced from garnet zoning. *Lithos*, **19**: 51–63.

JAGER, E. 1979. Introduction to geoeochronology. In Lectures in isotope geology. (Jager, E. and Hunziker, J. C. Eds.), Springer, Berlin, Heidelberg. New York, 1–12.

ITAYA, T. & TAKASUGI, H. 1988. Muscovite K-Ar ages of Sanbagawa schists, Japan and argon depletion during cooling and deformation. *Contrib. Mineral. Petrol.*, **100**: 281–290.

KAWACHI, Y., YAMADA, T. & YOKOTA, Y. 1966. Crystalline schists of Yokokawagawa district (Yokokawagawa metamorphic rocks), north of Lake Suwa, Central Japan. *Japan. Assoc. Mineral. Petrol. Econ. Geol.*, **56**: 21–29.*

KAWANO, Y. & UEDA, Y. 1966. K-Ar dating on the igneous rocks in Japan (IV)-granitic rocks in northeastern Japan. *Japan. Assoc. Mineral. Petrol. Econ. Geol.*, **56**: 41–55.*

RGPI (Research Group of Peridotite Intrusion), 1967. Ultrabasic rocks in Japan. *J. Geol. Soc. Japan*, **73**: 543–553.

SHIBATA, K., AOKI, M., KAWACHI, S., YAMAZAKI, T. & KOBAYASHI, T. 1976. Description and K-Ar age of pegmatite in the Tertiary quartz diorite from Wada-mura, Nagano Prefecture, Central Japan. *Bull. Geol. Survey, Japan.*, **27**: 509–516.*

YOSHINO, H., 1976. The Median Tectonic Line in the north and south of Lake Suwa, Central Japan-especially on the fault movements since Miocene. *Memoir of Geol. Soc. Japan*, **13**: 61–72.*

YOSHINO, H. 1982. Neogene system around the Lake Suwa, Nagano Prefecture. *Chikyukagaku*, **36**: 128–149.*

* in Japanese with English abstract.