報　文

550.93 : 550.3+.4(26)

Further K-Ar dating of tonalite dredged from the Komahashi-daini Seamount*

Ken SHIBATA**, Atsuyuki MIZUNO***, Makoto YUASA***, Shigeru UCHIUMI**
and Tadao NAKAGAWA**

Abstract

K-Ar dating was done on tonalite dredged from the Komahashi-daini Seamount during the GH74-7 cruise in 1974. An age of 37.5±1.9 m.y. on a mixture of biotite and hornblende is identical to that previously obtained on a whole-rock sample of granitic rock from nearly the same site. The age results indicate that the plutonic activity represented by the granitic rocks from the Komahashi-daini Seamount constituted a part of major events prior to the formation of the Shikoku Basin.

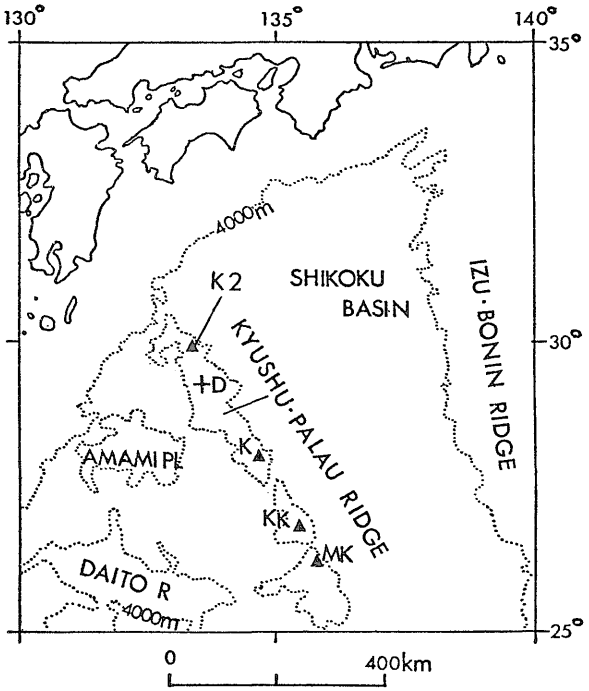
1. Introduction

During the GDP-8 cruise in 1973, many manganese nodules were dredged from the eastern slope of the Komahashi-daini Seamount, which is situated in the northernmost part of the Kyushu-Palau Ridge (SHIKI *et al.*, 1974). Most of the nodules are granitic rocks coated with manganese crusts. K-Ar whole-rock age determination was done on one of these granitic rocks from the dredge hauls at site GDP-8-12 (29°55.6′-29°55.0′N, 133°18.5′–133°20.0′E, depth 2250–2280 m), and an age of 37.4±6.4 m.y. was obtained (SHIBATA and OKUDA, 1975). In 1974, the GH74-7 cruise obtained again many granitic rocks coated with manganese crusts from the same seamount (MIZUNO *et al.*, 1975). In an attempt to know a more precise age of formation for these granitic rocks, we carried out further K-Ar dating on a mineral separate.

2. Analyzed sample

The sample used for K-Ar dating, St. 150-1-11, was obtained at site GH74-7-150-1 (29°52.0′N, 133°17.0′E, depth 1070–1040 m) by means of chain-bag dredge. The site is on the western slope of the Komahashi-daini Seamount and is approximately 7.5 km southwest of the site of GDP-8-12 (Fig. 1). The dredge hauls were represented by many angular blocks and fragments of granitic rocks coated with manganese layer or film, together with foraminiferal coarse sand. Petrographic description of the dated rock sample after the cruise report (KINOSHITA *et al.*, in preparation) is given in the following and the modal composition in Table 1.

* G.S.J. Marine Geology Research Note No. 3
** Geochemistry and Technical Service Department
*** Marine Geology Department



K2: Komahashi-daini Seamount
K: Komahashi Seamount
KK: Kita-koho Seamount
MK: Minami-koho Seamount
D: DSDP site 296

Fig. 1 Index map showing the Kyushu-Palau Ridge and sample locality.

Table 1 Modal composition of the dated rock sample.

Quartz	34.7
Plagioclase	54.7
K-feldspar	4.4
Hornblende (chlorite)	1.6
Biotite (chlorite)	1.3
Opaque minerals	1.2
Others	2.1
	100%

The rock is medium-grained biotite-hornblende tonalite, and is rather extensively altered. Almost all crystals of plagioclase are altered, producing fine micaceous minerals. Potassium feldspar, also altered, exists in a small amount filling interstices of quartz and plagioclase crystals. Biotite and hornblende, constituting only about 3% of the rock, are severely chloritized, but cleavage structure is remaining in some of hornblende grains. Other minor minerals are epidote, sphene, apatite, and opaque minerals.

Minerals for K-Ar dating were separated from the size fraction of 80–100 mesh after crushing and sieving of the rock sample. It was impossible to separate biotite from hornblende as both were chloritized. Microscopic and X-ray diffraction analyses of the mineral separate indicate that it consists of nearly equal amount of biotite and hornblende.

K-Ar age determinations were made on the mineral separate. The sample was

Table 2 K-Ar age of tonalite dredged from the Komahashi-daini Seamount.

Sample No.	Mineral	K_2O (%)	^{40}Ar rad (10^{-6}ccSTP/g)	Atmospheric ^{40}Ar (%)	Age (m.y.)
St. 150-1-11	biotite+hornblende	1.25, 1.26	1.57	61.5	37.5±1.9

fused in a pyrex high vacuum system at about 1300°C for 30 minutes, and argon was purified with titanium sponge. Isotopic ratios of argon were measured on a Reynolds-type mass spectrometer. Potassium concentration was determined by atomic absorption analysis. The decay constants used for age calculation are: $\lambda_\beta=4.72\times10^{-10}$/y, $\lambda_e=0.584\times10^{-10}$/y, $^{40}K/K=0.0119$ atom%. The analytical result is given in Table 2.

3. Result and discussion

As shown in Table 2, the K-Ar age of tonalite from the Komahashi-daini Seamount is 37.5±1.9 m.y. The age is identical to that of 37.4±6.4 m.y. previously obtained on a granitic rock collected from nearly the same site by GDP-8 cruise (SHIBATA and OKUDA, 1975). The previous result was obtained on a whole-rock sample of tronjhemite, which is composed mostly of quartz and plagioclase with very small amount of mafic minerals. Potassium in the rock (0.3% K_2O) is contained mostly in plagioclase, and hence the obtained age can be interpreted to represent that of plagioclase. The age therefore leaves some uncertainty, because plagioclase does not always give a reliable K-Ar age. The present age, on the contrary, is obtained on a mixture of biotite and hornblende. Although both the minerals are severely chloritized, it is remarkable that the mineral age agrees quite well with the previous whole rock age. It may therefore be concluded that these ages are reliable and represent the time of intrusion. The age results further suggest that the alteration occurred in a relatively short period subsequent to the intrusion.

The age of 37.5 m.y. coincides exactly with the Eocene-Oligocene boundary according to the time scale of BERGGREN (1972). During the GH74-7 cruise volcaniclastic materials were obtained from the Komahashi Seamount, south of the Komahashi-daini Seamount. They are identified as part of the J Formation and are assigned to the Oligocene (MIZUNO *et al.*, 1975), because they are similar in various aspects to the Oligocene volcaniclastic materials collected at the DSDP site 296 (INGLE, KARIG *et al.*, 1975). In the Bonin Islands K-Ar ages of 26 m.y. and 40 m.y. are reported for andesites from Chichi-jima and Haha-jima respectively (KANEOKA and ISSHIKI, 1970). MIZUNO *et al.*, (1976) consider that the younger volcanic activity in the Oligocene age represents a major event related to the formation of the Shikoku Basin. The plutonic activity represented by the granitic rocks from the Komahashi-daini Seamount may have also been an important event associated with the earlier phase of the igneous activity.

References

BERGGREN, W. A. (1972) A Cenozoic time-scale—some implications for regional geology

and paleobiogeography. *Lethaia*, vol. 5, p. 195–215.

INGLE, J. C., Jr., KARIG, D. E. *et al.* (1975) Site 296, *in* KARIG, D. E., INGLE, J. C., Jr. *et al.*, *Initial Reports of the Deep Sea Drilling Project*, U.S. Gov. Printing Office, Washington, D. C., vol. 31, p. 191–274.

KANEOKA, I. and ISSHIKI, N. (1970) K-Ar ages of the Izu-Bonin Islands. *Geochem. J.*, vol. 4, p. 53–60.

KINOSHITA, Y., NOHARA, M., YUASA, M. and NAKAJIMA, N. Basement rocks dredged from the topographic highs, *in* MIZUNO, A. ed., Deep sea mineral resources investigation in the Daito Ridges area, Nov.–Dec. 1974 (GH74–7 cruise). *Geol. Surv. Japan Cruise Rept.* (in preparation).

MIZUNO, A., OKUDA, Y. and TAMAKI, K. (1976) Some problems on geology of the Daito Ridges region and its origin. *in* KIZAKI, K. ed., Geological studies of the Ryukyu Islands, vol. 1, p. 177–198 (in Japanese).

——, ——, ——, KINOSHITA, Y., NOHARA, M., YUASA, M., NAKAJIMA, N., MURAKAMI, F., TERASHIMA, S. and ISHIBASHI, K. (1975) Marine geology and geologic history of the Daito Ridges area, northwestern Philippine Sea. *Marine Sciences/Monthly*, vol. 7, p. 484–491; p. 543–548 (in Japanese).

SHIBATA, K. and OKUDA, Y. (1975) K-Ar age of a granite fragment dredged from the 2nd Komahashi Seamount. *Bull. Geol. Surv. J.*, vol. 26, p. 71–72 (in Japanese).

SHIKI, T., AOKI, H., SUZUKI, H., MUSASHINO, M. and OKUDA, Y. (1974) Geological and petrological results of the GDP 8th cruise in the Philippine Sea. *Marine Sciences/Monthly*, vol. 6, p. 555–560 (in Japanese).

再び駒橋第二海山からのトーナル岩の K–Ar 年代について

柴田 賢・水野篤行・湯浅真人・内海 茂・中川忠夫

要 旨

地質調査所 GH 74–7 航海 (1974 年) の際に採取された，駒橋第二海山のトーナル岩について，K–Ar 年代の測定を実施した．緑泥石化した黒雲母・角閃石混合試料について求められた 37.5±1.9 m.y. という年代は，丁度始新世—漸新世境界にあたり，また同海山の全岩試料について前回測定された結果と一致する．この年代は九州—パラオ海嶺における四国海盆形成以前の深成活動の時期を示すものである．

(受付: 1976 年 8 月 4 日; 受理: 1976 年 11 月 12 日)