

K-Ar Age of the Nihonkoku Gneiss, Northeast Japan

By

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Abstract

The K-Ar age measured on a biotite separated from the Nihonkoku gneiss is 92 million years. The age indicates that the Nihonkoku gneiss may possibly belong to the plutonism which prevailed in the middle Cretaceous age throughout the Northeast Japan.

Geological setting

The "Nihonkoku gneiss" is a small mass of metamorphic rocks in the Neogene Tertiary region in Northeast Japan. It is covered by the "Green tuff" of Neogene age in some part and is in contact with non-gneissose granitic rocks in other parts. Its exposure is so narrow as about 15 km long and 5 km wide and is isolated from other regional metamorphic areas (CHIHARA, K., 1963).

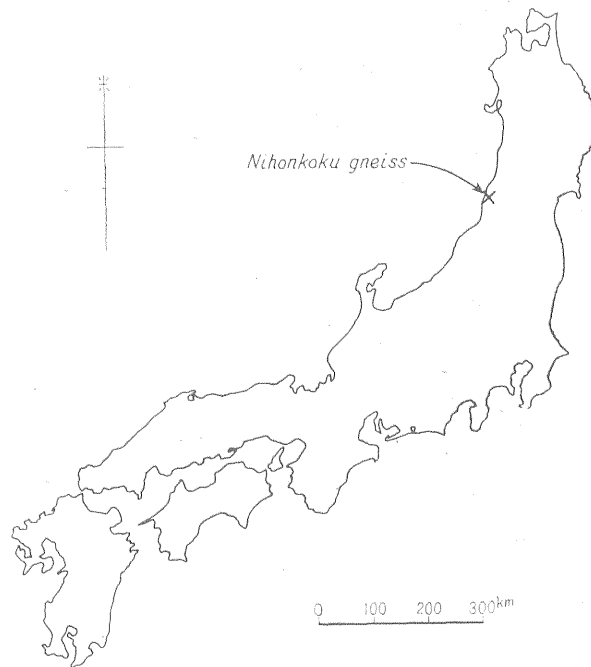


Fig. 1 Index to the Nihonkoku gneiss area

The Nihonkoku gneiss is composed mainly of schist, granitic gneiss and mylonite. Schist is small in quantity and is something like "septa" in gneiss and mylonite. They are mainly of quartzose schist accompanying small quantity of chlorite schist. Granitic gneiss is often strongly mylonitic and is mainly biotite granodioritic gneiss accompanying small quantity of hornblende biotite quartzdioritic gneiss. Mylonite develops in various fashion, but is mostly granitic in composition.

The structure of the Nihonkoku gneiss, precisely speaking, structure of schist and

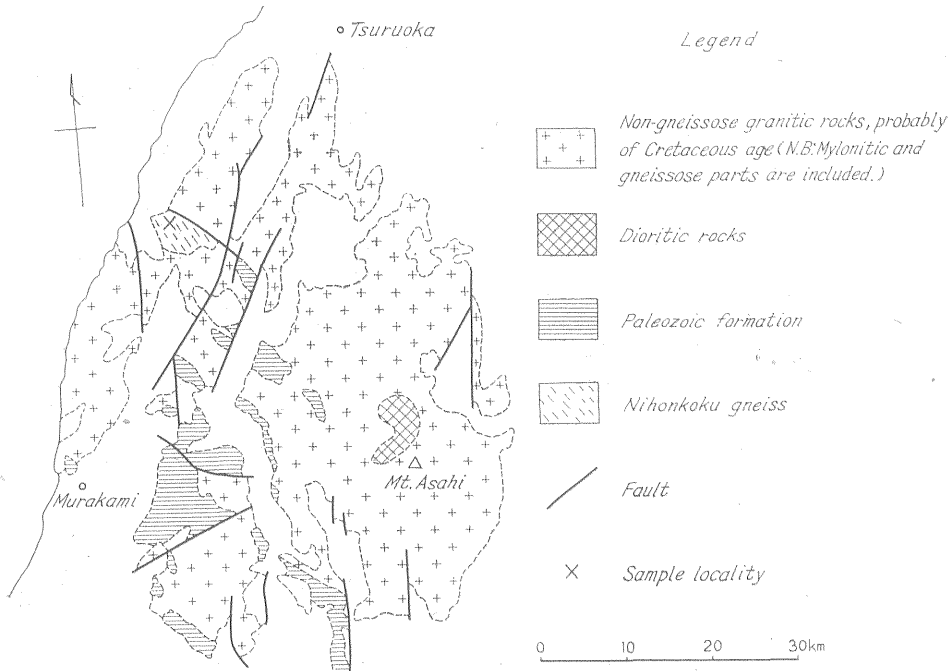


Fig. 2 Geologic map of basement rocks in the Nihonkoku area and sample locality (Quoted from Shimazu's, 1964, modified by the writers)

gneiss and direction of mylonitization go nearly together from northwest to southeast.

Non-gneissose granitic rocks enclosing the Nihonkoku gneiss are intruded into the Paleozoic formation probably of Permian age. According to oral communication by Y. KAWACHI, some part of the non-gneissose granitic rocks is mylonitized in the same direction as the Nihonkoku gneiss at a distant area on the extension of the structural direction of the Nihonkoku gneiss. However, the direct relation between the Nihonkoku gneiss and the non-gneissose granitic rocks is not settled yet.

Description of the determined sample

Biotite microcline plagioclase quartz gneiss (TN 61120106)

Komata, Yamakita-mura, Iwafune-gun, Niigata pref.

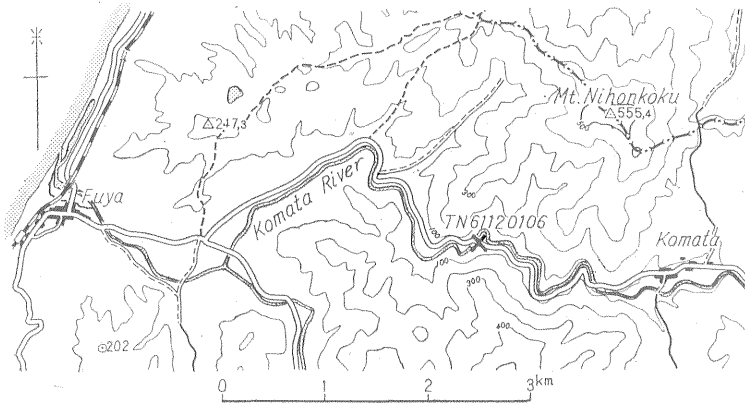


Fig. 3 Sample locality on the 1/50,000 topographic map, Atsumi

It was taken from the granitic gneiss which is, in some part, in fault contact with schist and, in other part, in contact with quartzose granitic gneiss with which direct relation is not observed but probably may be gradual transition.

It is light-colored, medium-grained and strongly gneissose with porphyritic appearance. Under the microscope, the gneissose structure turns out mylonitic structure. Blastoporphyritic crystals of plagioclase and microcline which are broken on their periphery and rounded are embedded in fine-grained matrix. In the matrix, quartz is elongated as if it were torn, and fine grains of biotite, quartz and feldspar are arranged to surround the blastoporphyritic crystals with rotation and crushing structure.

It is composed mainly of biotite, microcline, plagioclase and quartz. Small quantities of allanite, sphene, apatite, iron ore and zircon are contained. Chlorite and muscovite are yielded, replacing biotite and feldspar, only in a small quantity. Rarely small quantity of hornblende is contained partly. Biotite is mostly fine-grained, 0.3-1.0 mm across, but in some case, flaky, up to 3 mm across, giving pleochroism, X: colorless or pale brown, Y,Z: brown. Alteration of biotite is quite weak, yielding chlorite. Quartz is not crushed but elongated, 1-4 mm long. Blastoporphyritic plagioclase is idiomorphic, prismatic, 0.5-1.2 mm long, zoned repeatedly and its composition is nearly andesine. Microcline is also mostly blastoporphyritic, round, idiomorphic, 0.3-1.0 mm across, with beautiful microcline structure accompanying perthite blebs. Matrix is fine-grained and is strongly mylonitized. Matrix is composed mainly of quartz and feldspar, 0.1-0.3 mm across. Allanite often appears as beautiful idiomorphic crystals, 5-6 mm long. Hornblende is rarely included and is irregular in shape, 0.5-1.0 mm across, commonly accompanied by biotite. Hornblende gives pleochroism, X: pale green or nearly colorless, Y,Z: pale grass green.

Experimental procedures

K-Ar age determination was made on the biotite separated from the rock sample, using the isotope dilution technique.

Separation of the biotite was carried out with an isodynamic separator after crushing and sieving. Argon extraction and purification were made in the pyrex high vacuum system. The biotite in a molybdenum crucible was fused at about 1300°C for 30 minutes with an induction heater. The Ar³⁸ spike was added during fusion, and evolved gases were purified by hot titanium sponge and CuO. The isotopic ratios of argon were measured with the Hitachi RMU-5B mass spectrometer by the flow method.

Potassium determination was made by flame photometry. The biotite was digested with HF and HCl, the residue was dissolved in HCl and diluted to a standard volume, and potassium content was measured with the Hitachi EPU-2 flame photometer.

The results of K-Ar age determination are given in Table 1.

Table 1 K-Ar Age of the Nihonkoku gneiss, Northeast Japan

Sample No.	Mineral	K ₂ O (%)	Atmospheric contamination (%)	Age and error (million years)
TN61120106	biotite	7.11	17.0	92±6

$$\lambda_{\beta}=4.72 \times 10^{-10} \text{ yr.}^{-1}, \lambda_{\alpha}=0.584 \times 10^{-10} \text{ yr.}^{-1}$$

Geological meaning of the result

The result, 92 million years is correlated to middle Cretaceous age. In Northeast Japan, the Tertiary formation covers predominantly most of the basement rocks. Basement rocks are exposed in small quantity and only sporadically. The mutual relation of these isolated granites and metamorphic rock masses, including the Nihonkoku gneiss, is difficult to explain. However, K-Ar ages of the granitic rocks in Northeast Japan are mostly middle Cretaceous (KAWANO, K. and UEDA, Y., 1965). So, it seems reasonable to consider that the Nihonkoku gneiss, or at least its granitic gneiss, may possibly belong to the plutonism which prevailed in middle Cretaceous age throughout Northeast Japan.

Acknowledgements

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“日本国”片麻岩の K-Ar 年代

柴田 賢 野沢 保

要 旨

新潟県岩船郡山北村小俣産の“日本国”片麻岩から分離した黒雲母について K-Ar 法により地質年代測定を実施した。求められた年令 92×10^6 年は白堊紀中期を示し，“日本国”片麻岩の生成はほぼ同時期に東北日本全域にわたって起った深成活動に関係づけられる。