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Yôtarô SEKI* and Ichiro OGINO*: Notes on Rock-forming Minerals (15)
Pumellyite in Crystalline Schists from the Yaguki District, Hukusima Prefecture, Japan

Introduction

The crystalline schists of the Yaguki district are exposed along a large sheared zone running in the nearly N-S direction through the eastern part of the Abukuma Plateau. The schists are in fault contact with granitic intrusives on the eastern side. Thus, no contact metamorphism by these intrusives was observed. Granodiorites and pegmatites are intruded into the crystalline schists along the western margin of the Schists. Contact metamorphism by these granodiorites and pegmatites can be observed in the western part of the terrain of crystalline schists. Contact metamorphic minerals in pelitic and psammitic schists are andalusite, almandine, cordierite, biotite and muscovite. Hornblende, diopside and calcic plagioclase were formed in contact metamorphosed green schists. Ultramafic rocks associated with the crystalline schists were transformed into anthophyllite-, tremolite-, or talc-bearing rocks by the the intrusions of the granodioritic rocks.

These crystalline schists are in fault contact with a Paleozoic formation. The Paleozoic formation was metamorphosed also by the granodioritic intrusives into biotite, andalusite-, garnet- and cordierite-bearing hornfelses or into Cu- and Fe-ore-bearing skarns.

In this paper, the present writers intend to report the modes of occurrence and some properties of the pumpellyite that was recently found in the low-grade crystalline schists of the district. Some petrographical notes on glaucophane-bearing schists in this district will also be added. Detailed geological and petrological studies of this district will be described in an other paper.

Acknowledgements

The present study was greatly helped by Mr. Akira HIRAYAMA, a chief geologist of Yaguki Mine of Nittetsu-Kôgyô Co., to whom our sincere thanks are due. Thanks are also due to Dr. Akiho MIYASHIRO and Dr. Fumiko SHIDÔ of the University of Tokyo for their kind advices and criticisms.

Description of Pumpellyite

A geological map and localities of pumpellyite-bearing green schists are shown in Figure 1.

These pumpellyite-bearing schists are weakly schistose and dark green in color to the naked eye. Calcite-veins which are parallel or oblique to the schistosity plane are common.

Chief constituents are chlorite, titanite, pumpellyite, sodic plagioclase and quartz. The grains of these minerals are generally very small. Lenticular masses (0.3mm—1mm width on an average in thin sections cut perpendicular to schistosity plane) chiefly composed of fine-grained pumpellyite are developed parallel to the schistosity planes of the schists.

Optical properties of the pumpellyite are as follows. No difference in optical properties between the pumpellyite of the matrix and of the lenticular masses was noticed.

$\left.\begin{matrix}\alpha = 1.681 \pm 0.002 \\ \gamma = 1.692 \pm 0.002\end{matrix}\right\}$ $\gamma - \alpha = 0.011 \pm 0.002$

X = Greenish yellow

Y = Green

Z = Brownish yellow

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Indices of refraction were measured by the immersion method for Na-light. Optical angle is probably very small, but its accurate value could not be measured of its strong dispersion and very fine grain-size.

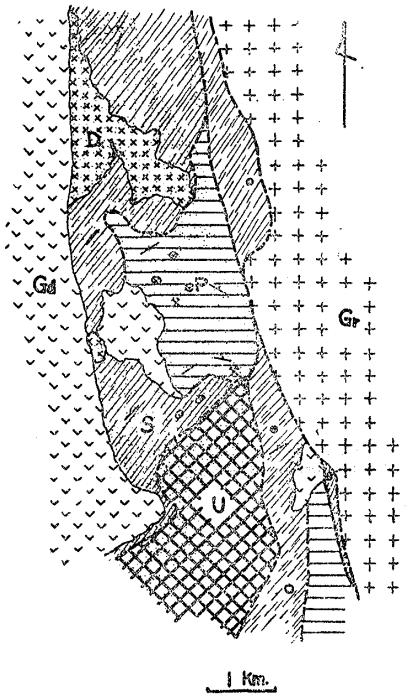

Figure 1. Geological map of the Yaguki districit with localities of pumpellyite- and glaucophane-bearing crystalline schists.
S: Crystalline schists.
P: Paleozoic formation.
U: Serpentinites
Gr: Granites.
D: Diabase.
Gd: Granodiorites.
Dotted areas show contact aureole by the granodioritic intrusives.
Open and black circle represent the localities of glaucophane- and pumpellyite-bearing schist respectively.

0.8 gram of almost pure pumpellyite with small amounts of titanite inclusions was separated from a schist (YSIO-59032802) by means of the isodynamic separator and Clerici solusion. The X-ray powder pattern of the pumpellyite is given in Table 1. The pattern was obtained by a Philips Geiger-counter X-ray diffractometer using Cu-radiation. In this Table, the reflections due to titanite inclusions were eliminated. These X-ray powder data are in accord with those of pumpellyites in low-grade green schists of the Kanto Mountains (Seki, 1958).

Table 1. X-ray powder pattern of pumpellyite in a green schist (YSIO-59032802) of the Yaguki district (Cu-Kα).

hkl	d (Å)	I
004	4.74	w
111	4.66	w
200	4.37	w
005	3.78	m
$20\bar{4}$	3.45	w
204	3.03	w
020	2.94	s
115	2.89	vs
$20\bar{6}$	2.733	s
$31\bar{1}$	2.644	s
024	2.513	m
220	2.456	s
222	2.327	m
125	2.207	m
$40\bar{1}$	2.090	w
118	2.070	w
424	1.595	s
$0.0.\bar{1}\bar{2}$	1.581	m

Note—w: weak, m: medium, s: strong
vs: very strong

On Glaucophane-Bearing Green Schists

In 1958, Iwao, though briefly, reported the occurrence of glaucophane-bearing crystalline schists from the Yaguki district. In the course of our study of the crystalline schists of the Yaguki district, we also found a glaucophane-bearing green schist from an exposure along the river near Yaguki Mine. The location of this schist is shown in Figure 1.

The glaucophane-bearing green schist is alternated with pelitic, psammitic and green schists without glaucophane. The chief constituent minerals of these pelitic and psammitic schists are chlorite, muscovite, graphite, quartz and sodic plagioclase. Accesory minerals in these black schists are titanite, apatite, calcite and tourmaline. Green schists associated with glaucophane-bearing schist are chiefly composed of actinolite, epidote, chlorite, muscovite, quartz and sodic plagioclase. Besides these, calcite and titanite occur in these green schists.

The glaucophane-bearing schist is moderately schistose and has light bluish green color to the naked eye.

Chief constituents of the glaucophane schist are chlorite, glaucophane, epidote, actinolite and sodic plagioclase. As an accesory mineral, fine-grained crystals of titanite were observed.

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The optical angle over X of the associated epidote is 81—83°. The glaucophane is usually surrounded by chlorite and/or actinolite. Zoned crystals with a glaucophane core and an actinolite rim were also present.

Optical properties of the actinolite are as follows:

$\left.\begin{matrix}\alpha=1.610\pm0.002\\ \beta=1.626\pm0.002\\ \gamma=1.631\pm0.002\end{matrix}\right\}$ $\gamma-\alpha=0.021\pm0.002$

(−) $2V=69-71°$, b=Y, c∧Z=18°.

Almost colorless in thin sections.

Optical properties of the glaucophane are as follows:

$\left.\begin{matrix}\alpha=1.610\pm0.002\\ \beta=1.617\pm0.002\\ \gamma=1.620\pm0.002\end{matrix}\right\}$ $\beta-\alpha=0.010\pm0.002$

(−) $2V=12-14°$, b=Y, c∧Z=11°.

Dispersion r<v, weak.

X=Colorless.
Y=Pale violet.
Z=Violet.

Discussion

As stated before in this paper, the crystalline schists of the western part of the Yaguki district were moderately metamorphosed by the contact effect of granodioritic intrusives. The serpentinite associated with these crystalline schists also suffered contact metamorphism.

Both pumpellyite and glaucophane, however, were found in the crystalline schists of the eastern part of the present district, which is devoid of the contact metamorphism. These crystalline schists grade into the contact metamorposed schists toward the west.

These facts are believed to show that the metamorphic rocks of this district were originally low-grade schists, characterized by the stable presence of chlorite, sericite, glaucophane, actinolite, epidote and pumpellyite before the intrusion of granodioritic rocks.

As shown by Seki (1958), glaucophane and pumpellyite are characteristic minerals of the low-grade part of the Sanbagawa metamorphic belt in central and south western Japan. Such a regional metamorphic belt has not been found in north-eastern Japan.

The discoveries of glaucophane and pumpellyite from crystalline schists of the Yaguki district by Iwao and the present writers would show the presence of glaucophanitic metamorphism in the Abukuma Plateau and throw some lights on the problem of the geological relation between south-western and north-eastern Japan.

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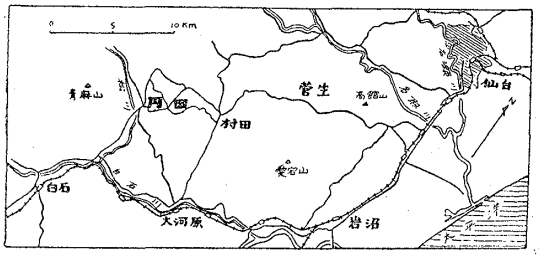
青葉山団研グループ*: 円田層の層位学的位置

宮城県蔵王町円田付近に分布し（第1図），珪藻土を含む円田層は田山利三郎（1936）により更新統とされ，その後，奥津春生（1950, 1955）は古植物学的に研究し更新統であると主張した．また半沢正四郎ら（1953）も仙台付近の地質を総括的に述べた際にも，従来の考えに従つて円田層を更新統であるとしている．

われわれは，1958 年から仙台周辺の第四系の研究をすすめているが，1959 年 8 月から 9 月にかけて，円田周辺を調査した際，円田層は従来考えられていたような更新統のものではなく，明らかに第三系であつて，仙台付近でいわれている“白沢層”の一部であることが明らかになつたので報告する．



第1図

珪藻土を含む一連の地層の層序は第2図のとおりである．下限は *Makiyama chitanii* を含む暗青色シルト岩と不整合状に重なり，上限は著るしい不整合をも

* 中川久夫・相馬寛吉・鈴木養身・小川貞子・若生克雄・石田琢二・飯田八郎・粕谷和生・鎌田端子・菅野美穂子・藤田至則・青木直昭・小林巌雄

** 1959 年 10 月 3 日，地質学会東北支部総会に発表の一部．

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