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External form of kamiokite crystal

Yuji ENDO*, Yasuo KANAZAWA* and Akira SASAKI*

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Abstract : External form of kamiokite, $Fe_2Mo_3O_8$, a new mineral from the Kamioka mine, was determined by goniometric procedure. The basic form is hemimorphic pyramidal with dominant pyramidal faces $\{10\bar{1}1\}$ and a large $\{000\bar{1}\}$ base. Less developed prismatic faces $\{10\bar{1}0\}$ and negative pyramidal faces $\{10\bar{1}\bar{1}\}$ usually appear. The results agree well with the mineral's symmetry, $P6_3mc$, previously determined by X-ray studies.

Introduction

Kamiokite was described as a new mineral by SASAKI *et al.* (1975) from the Kamioka silver-lead-zinc mine, Gifu Prefecture, central Japan. It occurs with molybdenite in quartz veinlets traversing a granitic dyke which has been intruded into the Hida metamorphic complex. The mineral has the ideal chemical formula $Fe_2Mo_3O_8$ and belongs to the hexagonal system with unit cell parameters, $a=5.782$, $c=10.053$ Å and $Z=2$. Further details of the mineralogical properties are available in SASAKI *et al.* (1985). The crystal structure of kamiokite has been recently determined by KANAZAWA and SASAKI (1986), confirming the space group, $P6_3mc$, which had been suggested by the previous work (SASAKI *et al.*, 1975). In this supplemental note we present the result of a morphological study of the mineral, which was realized thanks to a lucky encounter with appropriate crystals.

Observation and results

Well-shaped two crystals of kamiokite, ca. 3 mm in size, were found to occur in a small cavity of vein quartz in one of the type hand specimens (Plate I–1). Their external form appeared thick tabular at first sight. But, a closer inspection revealed that both crystals had their one end buried in the host quartz and the true form might be hemimorphic pyramidal. It seemed too risky to try a complete isolation of the crystals for further examination because of their fragility. Fortunately, however, their form looked rather simple; besides, most of the main crystal faces came out visible after carefully chipping the specimen with a fine chisel. Thus, the crystals, still embedded in a small piece of host quartz, were used for goniometric measurement, using a GOLDSCHMIDT-type two circle reflecting goniometer.

Figure 1 is a schematic drawing of one of the crystals appearing in Plate I–1 (the right one). With this crystal, interfacial angles were measurable between eight faces as marked A to H in Fig. 1. The results are shown in Table 1.

As seen in Fig. 1, kamiokite has a well-developed hexagonal base $\{000\bar{1}\}$. Interfacial angles between probable faces calculated from the lattice parameters were compared with the measured values based on the $\{000\bar{1}\}$ base. Reasonable Miller indices were determined for each face marked in Fig. 1. Table 2 shows that the measued interfacial angle values are in fair agreement with the calculated

* Mineral Deposits Department.

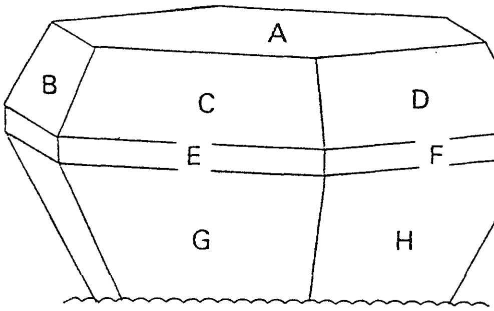

Fig. 1 Schematic drawing of a crystal used for measurement. Symbols A to H indicate faces used for goniometric measurements.

Table 1. Measured interfacial angles between possible pairs of faces in Fig. 1.

symbol of faces	measured values	mean values	symbol of faces	measured values	mean values
A∧B	64°05′		C∧E	25°41′	
A∧C	63°13′	63°40′	E∧G	27°01′	26°23′
A∧D	63°42′		D∧F	26°12′	
			F∧H	26°37′	
B∧C	52°48′				
C∧D	53°24′	53°09′	E∧F	60°18′	60°18′
G∧H	53°15′				

ones. Another crystal (the left in Plate I-1) was also examined in the same manner. The results were found to be consistent with those described above.

As the pyramidal portions of the crystals examined are still half buried in the host quartz, details remain uncertain about the form of this end. By luck, however, from examining several sliced chips of the kamiokite-bearing hand specimens, we happened to observe a bisected crystal clearly showing a steep apex on one end while a flat face on the opposite side, as shown in Plate I-2. Similar, though more obscured, outlines were recognized in a few additional crystals examined, but those indicating possible dipyramidal forms have never been found. From these observations, a full figure of the external form of kamiokite was drawn as Fig. 2, using the method by

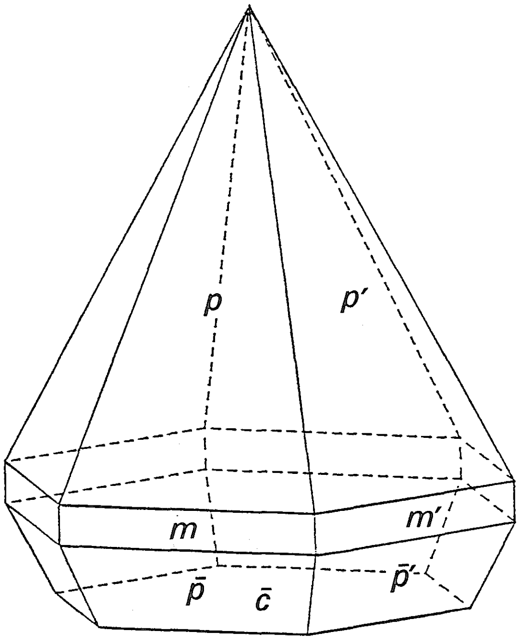

Fig. 2 Crystal form of kamiokite.

Table 2. Crystal faces and their interfacial angles of kamiokite.

facial indices	calc.	meas.	in Fig. 1
c̄(000$\bar{1}$)∧p̄(10$\bar{1}\bar{1}$)	63°31′	63°40′	A∧D
p(10$\bar{1}$1)∧m(10$\bar{1}$0)	26°29′	26°23′	H∧F
p(10$\bar{1}$1)∧p′(01$\bar{1}$1)	53°10′	53°09′	H∧G
m(10$\bar{1}$0)∧m′(01$\bar{1}$0)	60°00′	60°18′	F∧E

calc.: calculated values from lattice parameters.
meas.: mean measured values in Table 1.

KANAZAWA and ENDO (1981).

External form of any mineral crystal would be related with its crystal structure. The acentrosymmetric space group $P6_3mc$ of kamiokite is well consistent with the hemimorphic hexagonal pyramid obtained above.

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神岡鉱の結晶形態

遠藤祐二・金沢康夫・佐々木昭

要　旨

岐阜県神岡鉱山から発見された新鉱物神岡鉱について，原産地標本中から単結晶を選び出し，その結晶形態を調べた．結晶の形は良く発達した六方単錐に極く細い柱面と小さいながらも明瞭な反対側の錐面とが伴われている．この形は結晶構造解析により導かれた空間群 $P6_3mc$ を良く満足している．

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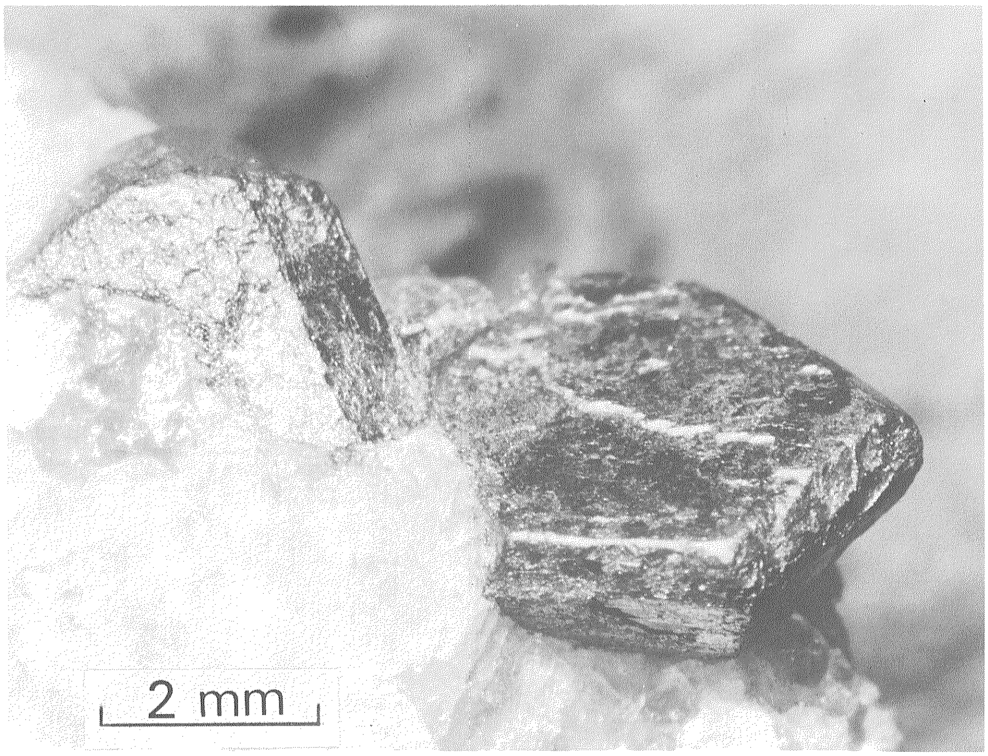
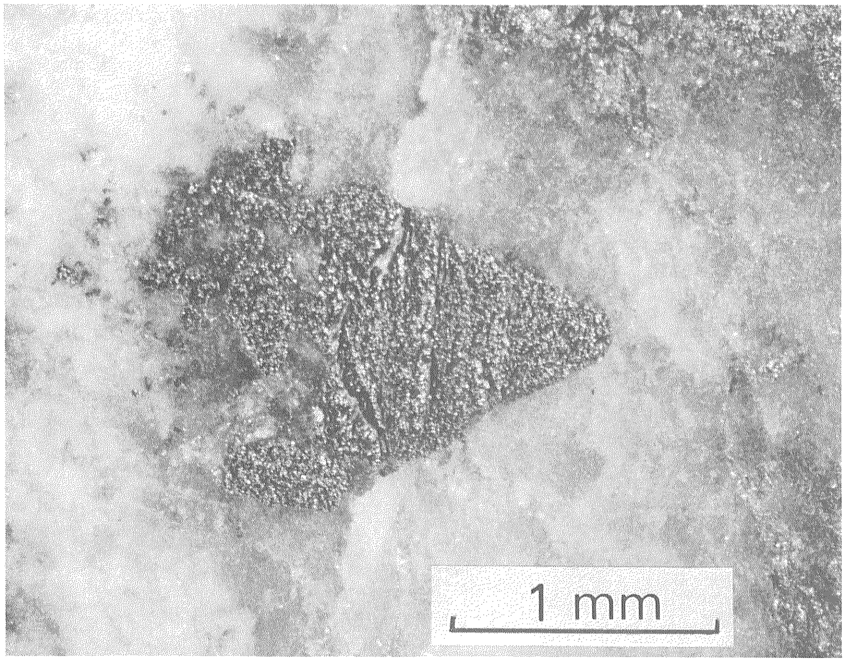


1. Crystals of kamiokite.



2. An example of kamiokite crystal showing steep pyramidal end on one side.