On the Gennō-ishi.

By

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The present paper undertakes a comparison of Gennō-ishi (Hammer-stone), discovered in Shinano province, with Jarrowite from the Clyde Estuary of Scotland.

In 1897, the writer[1] briefly described this mineral, found in Shinano province, and judged it to be analogous to Pseudo-gaylussite, that is, calcite after gaylussite, because of their similar crystallographic and physical natures. From its shape it has been known to anthropologists as 'stone-axe.' A large number of isolated crystals are usually found here and there in intercalating parallel to the layers in augite andesite tuff and clayey shale of tertiary formation covered by dilluvium strata. The shale is greyish black in colour, and may be split into thin laminæ. Its most prominent locality is in Urazato-mura, south of Bessho hot spring, near Uyeda city. A large portion of this locality is thickly wooded, but the shale crops out on the hill sides, where a great amount of the crystals, together with the remains of fish, plant leaves, and also small quantities of vivianite and gypsum may be easily collected.

This mineral has been reported from many other localities in Japan; from tertiary shale in canal excavated through Ōkawazu near the city of Teradomari in the province of Echigo; from the Ponporonai, a tributary of the Ikushunbetsu river; and also from the Shikaribetsu, of the Yubari river, in the province of Ishikari.

In 1901, the Hōkōseki (square hollowed stone), found considerably in Kochihama and Tōnoura in Okachigori, in the province of Rikuzen, was

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1) Journal Geological Society Tokyo Vol. IV., p. 139.

discovered by Mr. Ōtsuki[1] of the Geological Survey. It prevails as gravel in the clayey shale of the mesozoic era. He states that the specimens have rhombic hollows of different dimensions on both sides, that the inner side of the longitudinal section of the hollows is slightly curved, with the marks of parallel sutures in oscillatory combination; that the hollows are monoclinic in symmetry, the inner angle always being from 112°–113°, and that often presents star-like outlines which may be evidence of crystal aggregates. From these facts, he concludes that the hollows are exuviæ of Gennō-ishi.

In 1902, Mr. Yabe[2] of the Tōhoku Imperial University wrote that the crystal was also found in the provinces of Echigo, Musashi and Shinano, and also in tertiary strata of Saghalin.

In the same year Mr. Fukuchi[3] secured the same mineral, 9–12 cm. long 1.5 cm. wide, in the shale of the pliocene era in Seigomura, in the province of Tokachi.

The specimens obtained in these localities were found for the most part in the tertiary formation, as has been the case foreign localities, though some observed in mesozoic formation in the province of Rikuzen.

A similar mineral called Jarrowite, was dredged from dark greyish clay in the Clyde estuary of Scotland, and described by Mr. C. O. Frechman[4] of England, in which he found it to be Pseudo-gaylussite after minute study.

Mr. Ōfuji of the Kyoto Imperial University brought this crystal to my attention; and through his courtesy, the comparison with Japanese crystals is made.

The Gennō-ishi from the province of Shinano are acute pyramidal or prismatic with very rough, curved surfaces. The crystal faces have deep parallel striations, which may be sutures of oscillatory combination, and are also covered with small eminences of sub-crystals, arranged in parallel posi-

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1) Journal Geological Society, Tokyo, Vol. VIII., p. 327.
2) „ „ „ „ Vol. XIII., p. 304.
3) „ „ „ „ „ p. 386.
4) Groth Zeits. f. Min. &c. Bd, 35. 1902.

tion, from which sometimes a crystal seem to have been found by an aggregate of many parallel individuals. The inner structure is always fine granular, without trace of cleavage.

The crystals are mostly simple, but there exist groups of two or more individuals, without any definite law of twin (Fig. 2, 3, 4, Pl. I.).

The simple crystals may be classified into two different types according to their crystallographic natures. One of them, simply pyramidal (Fig. 5, 6, Pl. I.), and the other a combination of prism and dome (Fig. 1, Pl. I.).

Although the crystal faces do not lend themselves to goniometric measurement, they may be roughly estimated as follows :

$$\infty P : \infty P = 112°$$
$$P : P = 113°$$
$$P\infty : P\infty = 110°$$

The length of the crystals varies from 5 cm. to 10 cm., while in Echigo and Hokkaidō they frequently measure 20 cm. or more.

The Clyde crystals (Fig. 1, 2, 3, 4, 5 & 6, Pl. II.) have close likeness to those to Shinano, and their rather long form resembles the Echigo type (Fig. 7, Pl. II.). The facial angles in the Clyde crystals, are much different :

$$P : P = 123°$$
$$P\infty : P\infty = 120°$$

One must bear in mind, however, that the Shinano crystals always have exceedingly rough surfaces because of corrosion on the lower side when intercalated in the strata, and have been subjected to pressure when the clay hardened into shale, so that the measured angles must always differ somewhat.

The colour of the crystals is also slightly different, the Clyde crystals being always a deep brown with a resinous luster, while the Shinano crystals are light brown with the same luster.

The percentage of composition is as follows:

	Shinano.	Clyde.	
		I.	II.
SiO_2	0.64	0.12	....
Fe_2O_3	3.44	5.36	...
Al_2O_3	1.00	0.12	...
CaO	52.33	46.60	47.63
MgO	0.48	4.94	4.21
CO_2	37.00	36.40	39.91
P_2O_5	...	...	2.23
Organic matter	...	...	5.94
	94.89	93.54	100.22

N.B. The analysis of 'Clyde II' is that given by the British Museum, in which may be observed a somewhat large amount of phosphoric acid and organic matter, while the analysis of 'Shinano' and 'Clyde I' does not determine the remaining percentage, which is probably also organic matter and insoluble residue.

The specimens from the Clyde contains considerable magnesia, phosphoric acid and organic compound, while that from Shinano has very little magnesia. Such difference may be due to the leaching of magnesium carbonate and phosphoric acid from the crystal, while embodied in the strata.

As we have observed, these two crystals closely resemble each other in their physical and chemical properties, though we find some difference in composition. Again, we may consider the origin of formation to be the same, because those condition in the shale of the tertiary formation are found in the same condition as in the clayey sediment of the Clyde estuary, so that we judge the crystals found in brackish sediments from the tertiary era to recent.

Fig. 1.

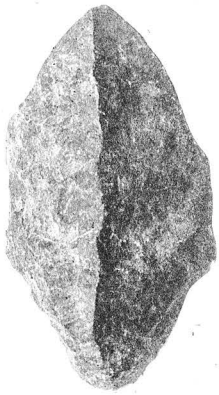


Fig. 4.

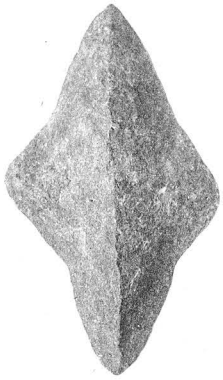


Fig. 2.

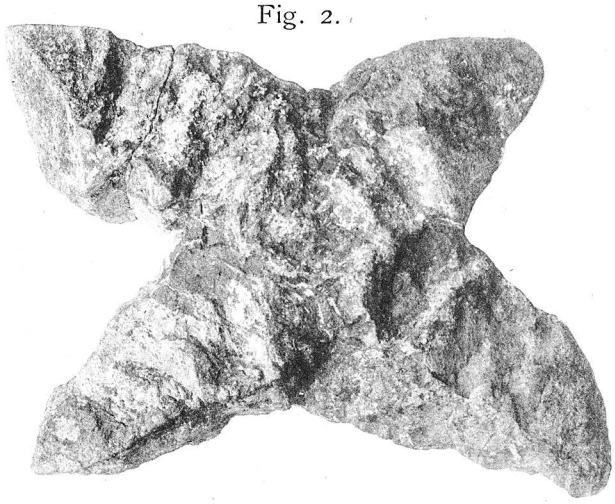
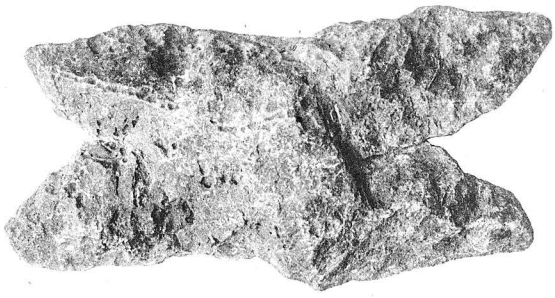


Fig. 5.

Fig. 6.

Fig. 3.



Natural size.

Fig. 1.

Fig. 2.

Fig. 5.

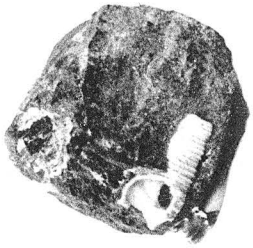


Fig. 7.

Fig. 6.

Fig. 3.

Fig. 4.

Natural size.