PRELIMINARY NOTES ON THE COMPOSITION AND STRUCTURE OF THE FIRST SPECIMEN OF METEORIC STONE RECEIVED BY THE GEOLOGICAL SURVEY OF CHINA.

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In spite of the immense records of meteoric fall kept in many of the Chinese books, specimens of real meteorite were very seldom found. Perhaps the first found of iron meteorite was from Inner Mongolia described by two Japanese geologists in the China Mining Journal of 1921. As to the meteoric stone, so far as the writer knows, nothing has been found. The present contribution therefore will be the first description of a real meteoric stone undoubtfully of the Chinese origin.

The stone described below was presented to the Geological Survey of China by Mr. Yuan-Wen-Shou (袁雯壽). It is only a small fragment knocked down from a big stone found in Tao Ho Hsien (導河縣), southeastern Kansu. Already in 1920 the writer while travelling through the Kansu province heard about the story of a meteoric fall. Efforts were immediately made in order to get hold of the stone, but without success. Meantime a letter was sent to Mr. Yen, (閻樑) the magistrate chief of the Tao Ho district, asking for all informations regarding this meteoric fall. Mr. Yen wrote me back as follows:

"The locality of the fall is called Nan Yang Pao, a small village situated about 60 li south of the city. At about 12 o'clock noon on July 11, 1917, the fall was taken place. At first, sound came like that of a great cannon, and houses were shaking. Then, the sound changed to that of a beating drum, lasting about five or six minutes. A white light also accompanied the falling, seen by many people who were very much frightened. The stone fell into the loess ground a little more than one foot deep. No damage of any sort was affected by the fall. The stone has the shape of a cow head and is black in color. When knocked it sounds like metal. It is very hard and seems to contain iron. The weight of the whole stone is about 87 caties (117 lbs.)

This is all we know about the fall of the meteorite. It is interesting to note that although I have not seen the whole stone, by the description of Mr. Yeu, it may indicates that the shape of the stone is very much nearly conical in form which is so characteristic of meteorite.

Megascopically, the stone is greenish gray in color, and is rather compact and heavy. The polished surface shows a very distinct chondritic structure with numerous flecks of metals. The chondri are seemingly of two colors; one is brownish yellow and the other is grayish white. Both of them are hard and compact and are not break with the matrix. The surface of the stone is coated with a thin layer of black crust, about one millimeter in thickness.

Under the microscope, the thin section of the stone shows a still more evident chondritic structure (fig. 1). The constituent minerals are essentially of five kinds; named in the order of abundance, they are enstatite, chrysolite, nickel iron, pyrrhotite, magnetite and perhaps a little anorthite and apatite.

Enstatite is the most abundant mineral, forms usually oval-shaped chondrules embeded in a ground mass made up of small fragments of enstatite and chrysolite. The chondrules show a very characteristic fibrous structure, with fibers either radiating from an eccentric point thus resembling the shape of a fan or arranged in a very comfused way (fig. 2). Fragementary or tabular crystals and small grains are also found. The mineral is identified by its parallel extinction, moderate relief, rather low birifringence and positive elongation. The largest chondrules seen on the polished surface are about 2-3 mm in diameter.

Chrysolite is as a whole less abundant than enstatites, but in some section it is predominating. In form it varies from small grains to tabular and corroded crystals. Aggregated mass of large size is also common. It is usually colorless, but a considerable part of which is stained yellow. The mineral shows a high relief, brilliant interference color and parallel extinction.

Nickel iron, pyrrhotite, and magnetite constitute the metallic portion of the stone. The exact proportion between the metallic minerals and silicates has not been determined. A glance at the polished surface reveals

that the percentage of the metallic minerals is rather high. All these minerals assume an irregular shape and small grains (fig. 3). No chondritic form is observed.

Nickel iron is identified by its steel gray color, shining luster and magnetic and malleable characters. It is the most abundant among the metallic minerals and forms usually large flecks (fig. 3).

Pyrrhotite forms irregular grains and fragments generally of smaller size as compared with the nickel iron. In color it is bronze yellow which is rather characteristic for that mineral. Since it is very brittle so the polished surface generally shows a very rough and pitted appearence. It is not magnetic or only slightly so.

Magnetite is the least abundant among the three opaque minerals. In the crust, however, this is not true, since almost the whole mass of it is made up of that mineral (fig. 4). It is identified by its black color, and slight magnetic character. Small patches of nickel iron and pyrrhotite are also sometimes found in the crust. Zonal structure of the crust such as those described by Tschermak is not observed.

A preliminary chemical analysis made by Mr. C. T. Wang (王季點) of the Industrial Laboratory Ministry of Agriculture and Commerce is as follows:

SiO_2	50.16	Cr_2O	0.63
Al_2O_3	0.49	Ni	1.58
CaO	2.15	Co	0.17
Mgo	26.01	S	2.25
FeO	15.71	P	0.21
		Alkalis not determined	
		Total.....93.36	

The above analysis shows the existence of alumina and calcium oxide; these two probably combined to form the mineral anorthite which owing to its minuteness and scarcity, may not be detected under the microscope. The remaining calcium oxide is probably combined with phosphorus to form apatite which is also too small to be detected in the slide.

1.

2.

3.

4.

Fig. 1. Microscopic section showing the general appearance of the meteorite and its characteristic chondritic structure with enstatite, chrysolite and dessiminated grains of metallic minerals. Magnification x 12 (approximate).

Fig. 2. Microscopic section of a big chondrus of enstatite showing the fibrous character with fibers arranged in a very confused way. Crossed Nicols. Magnification x 38 (approximate).

Fig. 3. Microscopic section showing the irregular forms of the metallic minerals of the meteorite, the largest fragment shown being a piece of nickel iron (N), the smaller one is pyrrotite (P), magnetite (M) and also nickel iron. Magnification x 38 (approximate).

Fig. 4. Microscopic section showing a portion of the crust which is composed almost entirely of magnetite (M) with a little nickel iron (N) and pyrrotite (P), the latter two minerals forming small fragments are also seen in the ground mass. Magnification x 38.