

47. *On the So-called Mukuhira's Arc as the
Foreshadow of an Earthquake.*

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§1. *North Izu Earthquake.* At 12h 50m on November 25, 1930, Prof. M. Ishino¹⁾, dean of the Science Faculty of the Imperial University of Kyoto, received a telegram from an unknown young man, Mr. Hirokiti Mukuhira, of Eziri, near Miyazu, Kyoto Prefecture, reading:

"At about 4h tomorrow morning there will occur an earthquake in Izu province". The telegram was handed in for despatch at the Hasidate telegraph office at 12h 35m of the same day. As predicted, an earthquake occurred the next morning at 4h 03m in the north Izu district, killing 259 persons and demolishing 2,142 houses²⁾. Immediately afterward the story of Mukuhira's telegram was reported by the "Osaka-Mainiti", and the "Tokyo Nitiniti" two well known newspapers in Japan. Prof. T. Shida of Kyoto University" proceeded to Eziri to ascertain how the young man succeeded in forecasting the earthquake, but on his return to Kyoto he published nothing in regard to the matter. As gathered from descriptions in the newspapers, Mukuhira observed an optical phenomenon in the sky resembling a rainbow arc, and upon the basis of certain observed facts, made some sort of calculation and hit the time and place of the earthquake.

§2. *Mukuhira's Arc.* It is said that Mukuhira had been studying, rather in secret, this phenomenon since 1919, and was engaged on it all through the times of the great Kwanto earthquake of Sept. 1, 1913, of the Tazima earthquake of May 23, 1925, and of the Tango earthquake of March 7, 1927, etc.

Since then (1930) he published his earthquake forecasts, but as some of them were failures, the police forbade these forecasts. During this time his laboratory was closed to visitors, while his method of forecasting was strictly guarded as secrets from inquisitive people. In 1933, he removed to Tanabe, Wakayama prefecture, and there continued

1) The present writer wrote to Dean Ishino and received an answer affirming the time he received the telegram, and its contents.

2) There are many reports on this earthquake e.g. *Seismological Bulletin Cent. Met. Obs. Japan.*, 1930, *Bull. of the Earthq. Research Inst. Japan*, Vol. 9, etc.

his studies. Finally in August 1935, he published a small pamphlet in Japanese entitled "On the Precursors of Earthquakes and the Phenomenon of Mukuhira's Arc." According to this brochure, the number of arcs observed by him since 1919 totaled 449, of which the outstanding ones are shown in Fig. 1. The arc differs from the rainbow, or any kind of halo or corona or iridescent cloud. It is never the less dimly coloured. It appears, according to him, in a clear sky for a few minutes at sun-rise, sun-set, midday and midnight. From its duration he calculates the time of occurrence, and from its shape and orientation, the direction and distance of the earthquake focus. He has not yet published his method of calculation in detail, but declares he is willing to so some time in the future.

§3. *Kawati-Yamato Earthquake.* According to Mukuhira, many have observed similar phenomena, but it was since the Kawati-Yamato Earthquake that the phenomenon has been noticed by authorised meteorological observers. The Kitugawa meteorological station reported³⁾ as follows:—

"About sunset on Feb. 20, 1936, an optical phenomenon was observed by the Kitugawa Meteorological Station, Osaka, belonging to the Central Meteorological

Fig. 1
Mukuhira's arc (after Mukuhira)



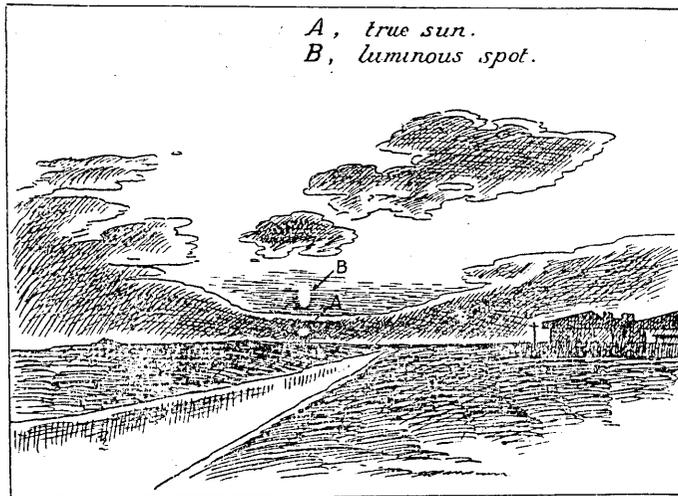
These Arcs appeared preceding respectively

- a The great Kwanto earthquake on Sept. 1, 1923.
 - b The strong Sagami earthquake on Jan. 15, 1924.
 - c The strong Tyûgoku earthquake on Jan. 9, 1934.
 - d The great Izu earthquake on Nov. 26, 1930.
 - e The violent Tango earthquake on Mar. 7, 1927.
 - f The strong Sagami earthquake on June 17, 1931.
 - g The violent Tazima earthquake on May 23, 1925.
 - h The great Sanriku earthquake on March 3, 1933.
 - i The strong Saitama earthquake on Sept. 21, 1931.
 - j The great T aiwan earthquake on April 21, 1935.
 - k The strong Kii earthquake on July 4, 1929.
 - l The strong Sendai earthquake on Aug. 6, 1927.
 - n The strong Hyûganada earthquake on Nov. 2, 1931.
- and m is the double arcs and o is the post arc.

3) Kisyoyoran (Monthly Geophysical Summary in Japanese issued by the Central Meteorological Observatory) 1936, Feb. p. 187.

Observatory of Japan. Ten minutes before sunset, an observer noticed nothing but an ordinary calmness around the sun with some evening red sky tinted on patches of stratocumulus. He then went into his room, but 4 minutes before sunset (17h 45m, 135° M.T.) he noticed through the window the peculiar bright spots above the western horizon, as shown in Fig. 2, in which A is the visible sun veiled by a thin bank

*Fig. 2. New Optical phenomenon Observed at
Kitugawa Meteorological Station, Osaka
17^h 45^m Feb. 20, 1936.*

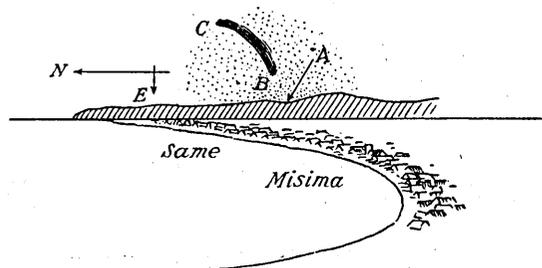


of cloud, and B a bright golden spot somewhat diffused at the upper edge. The observer rushed out doors at once and observed it carefully. The spot disappeared after 1 minute. At that time a moderate north wind 4.9 m/s, was blowing; the air temperature was 3.1°C; humidity 61%; sky clear, *Stcu. vesperalis* amount 1, with a thin haze hanging low over the bay. At 10h 8m the next morning (i.e. Feb. 21) there occurred a strong earthquake in the southeastern part of Osaka prefecture a-

*Fig. 3. New Optical arc observed
at Hatinohe Meteorological Station.*

6^h 15^m, Nov. 1, 1936.

*A, Point of Sun risc.
B C, Luminous Arc.*



round Mt. Nizyosan, as a result of which 9 persons were killed and 20 houses demolished.

§4. *Sanriku Earthquake.* The Hainohe Meteorological Station reported: "About a quarter past 6 in the morning of Nov. 1, 1936, an optical phenomenon was observed east of the Hainohe Meteorological Station (N 40°32', E 141°32'). As shown in Fig. 3, it hung from about 6° to about 10° above the horizon with a horizontal dimension of about 8°. It curved northward and resembled a rainbow, but it was not. The curve was rather parabolic with its width a little smaller than an ordinary rainbow. The principal colours were thin yellow and red with some tints of purple. It was very thin in the sunrise sky and only a very careful observer could accurately observe it. It lacked lustre. It lasted about 4 or 5 minutes. The sky was clear with spotted Cu. here and there and St. above the western horizon amounting to 1 as a whole. There was no cloud in the vicinity of sunrise. The wind was WSW 7.7 m/s; swell 3; wind-wave 3; air temperature 6.1°C, humidity 73%. The night preceding there was a thunder storm. The next morning but one, Nov. 3, an earthquake occurred at 5h 45m shaking the region over an area of 1,800 km diameter. The epicenter was located by the Central Meteorological Observatory at E long. 142.0°, N lat. 38.4°.

Since these two examples are quite authentic, it is certain that there is a new optical phenomenon which was hitherto unknown to us. It is, however, not yet certain whether the phenomenon is really correlated with earthquakes or not, nor do we know anything about its physical cause. Still there is some hope of finding the true nature of the phenomenon, which may serve as one of the means of forecasting earthquakes. At all event's, it behoves us to endeavour to search for more scientific data before drawing any hasty conclusions from it.

A similar example was reported by Mr. Tutui, lighthouse keeper at Himezima Island⁴⁾. At sunrise on Feb. 12, 1933, for 7 minutes he observed a mock sun, at first above the rising sun, and later below it for 3 minutes. On the 13th, about 6h am, two shocks occurred in the Volcano district of Mt. Aso, while on the 14th an earthquake was felt at Wakayama about noon.

Another example was reported by Mr. Y. Nakata⁵⁾, director of the Miyako meteorological station, with respect to the report of the director of the Fishery Institute of Iwate Prefecture at Kamaisi. On the

4) *Kisyo yoran*, Feb. 1933.

5) In a private communication to the writer Mr. Nakata inquired about the optical nature of the phenomenon, without any mention whatsoever of earthquakes.

morning of July 9 or 10, 1935, he observed from his boat at sea in the Pacific a golden mock sun above the true sun at sunrise. Never having witnessed such a phenomenon before, he mentioned it to Mr. Nakata upon his reaching shore. On the 11th, at 17h, 24m, an earthquake occurred in the vicinity of Sizuoka, where 9 persons were killed and 363 houses thrown down.

There are of course many examples of similar phenomena in Mukuhira's field notes, which he may publish in the future. The foregoing instances are those that were observed by reliable witnesses other than and independent of Mukuhira.

There are some who are inclined to look upon the phenomenon as one of electric nature, among whom is Mukuhira himself. In the present stage of our knowledge of the phenomenon, however, practically any hypothesis could be invoked to explain it, so that the real explanation must be left to future research.

47. 所謂棕平虹に就て

藤原 咲平

概要 棕平虹の由來、形象及棕平氏以外の観測を紹介す。
