

## **On the earthquake prediction method invented in France and Japan during 1850's**

Yuji Enomoto<sup>1)</sup>, Roman Jordan<sup>2)</sup>, Taira Sawada<sup>3)</sup>

- 1) *Toyama Industrial Technology Center, 150 Futagami, Takaoka, Toyama, 933-0981 JAPAN*
- 2) *University of Kyoto, Graduate School of Human and Environmental Studies, Yoshida-nihonmatsu-cho, Sakyo-ku, Kyoto 606-8501 JAPAN*
- 3) *Wakagaku-kai, 4-21-10 Oo-Imazato, Higashinari-ku, Osaka, 537-0013 JAPAN*

The present paper is a retrospective study about an earthquake prediction method which was invented during 1850's in France and Japan, independently.

In "The Year-book of Facts in Science and Art" published in London, 1853<sup>1)</sup>, the report is presented as follows: "*How the approach of an earthquake may be known. M. Rati-Menton has communicated to the Paris Academy of Sciences, a paper stating an earthquake indicator to consist of a magnet, to which is suspended by magnetic attraction a little fragment of iron. Shortly before the occurrence of an earthquake, the magnet temporarily loses its power, and hence the iron falls. According to M. Rati-Menton, the accuracy of this indicative sign has been thoroughly tested by an Argentine officer, Colonel Espinosa, during a residence of many years at Ariquepa - a region where earthquakes are very frequent.*"

This news was remarked by a Japanese Dutch scholar, *Genboku Ito* in Kyushu, who read the original book of Netherlands version; possibly entitled the "*Natuurlijke Tijdschrift*" as judged from translation in the Japanese book: The corresponding original book has, however, not yet been found), and he informed this news to certain Dutch scholars in *Edo* (now Tokyo). The above-mentioned western report was then translated, and introduced in the Japanese books; called the "*Dai-jisin rekinen-ko*, 1856" and the "*Shinrai Ko-setsu* 1856". The earthquake indicators illustrated in these books are shown in Fig.1 (a) and (b). As at that time of 1850's, several large earthquakes occurred in Japan and as the information about this prediction method has then spread over Japan, and, which led to attract an attention in earthquake prediction, the price of natural magnet has jumped up three times than before (*Ansei-Inotou-Jisin-kibun*). In turn, Shozan Sakuma has improved the apparatus employing an artificial horseshoe magnet in 1856 or 1857 as shown in Fig. 2. He learned from "*Huishoudelijk Woordenboek*" (N. Chomel, 1778-1786) about how to make electro-magnet.

On the other hand, the similar magnetic anomaly happened in 1855 destructive *Ansei-Edo* earthquake

of  $M \approx 6.9$ : Two hours before the earthquake, an owner of the spectacle shop (*G. Ohsumi*), observed that a magnet dropped some pieces of iron which had been attached it. The “*Ansei-Kenmon-Shi*” published in 1856 describes that the observation led to the design of a magnetic seismoscope (Fig. 3)<sup>2)</sup>, of which the workmanship is exquisite using a clock mechanism.

One of the authors (T.S) found an original broken magnetic seismoscope (*c.f.* Fig. 4 (a)) , of which the mechanism was further improved as compared to that of Fig. 3, at a Japanese antique store: It was reconstructed as shown in Fig. 4 (b)

The reason, why the above-mentioned magnetic phenomena have occurred associated with earthquakes, might be attributed to the seismic ground-level-electrification. Surprisingly, there was a Japanese scientist *Sohkichi Hashimoto* (1763-1836) who conducted the labo-experiment related to seismic magnetic phenomena and discussed in relation to earthquake occurrence, about 40 years before the 1855 *Ansei-Edo* earthquake (*cf.* Fig. 5: by S. Hashimoto, 1811 in *Elekitelu Kyurigen* 1811). He believed that the temperature difference between atmosphere and lithosphere may cause electricity which leads to earthquake.

Some historical apparatuses related to the present topics will be demonstrated at the EMSEV2012 symposium.

## References

[1] see p.113 in

[http://books.google.co.jp/books?id=\\_1oAAAAAMAAJ&printsec=frontcover&hl=ja&source=gbs\\_ge\\_summary\\_r&cad=0#v=onepage&q&f=false](http://books.google.co.jp/books?id=_1oAAAAAMAAJ&printsec=frontcover&hl=ja&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false)

[2] Milne, J., Earthquakes in connection with electric and magnetic phenomena, Trans. Seism. Soc. Japan, 15, 135-162, 1890; <http://repository.dl.itc.u-tokyo.ac.jp/dspace/bitstream/2261/25207/1/tssj015012.pdf>

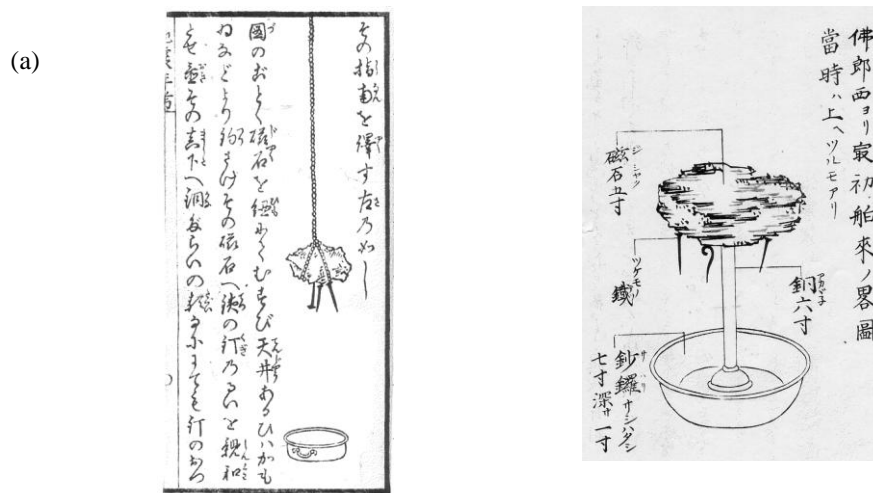


Fig.1 Earthquake indicator invented in France, found in (a) *Dai-jisin rekinen ko* and (b) *Sin-rai kosetsu*



Fig.2 Horse-shoe type earthquake  
 Indicator made by S. Sakuma



Fig.3 Magnetic seismoscope invented in Japan,  
 as illustrated in *Ansei-Kenmon-shi*

(a) (b)



Fig.4 (a) Original seismoscope: Upper; front-side  
 view: Lower; back-side view,  
 (b) Reconstructed work by T.Sawada.



Fig. 5 Labo-experiment showing a magnet  
 drops iron nails drop due to electrification.  
 (Hashimoto 1811)