Anomalous Bioelectric Potential of Tree prior to '03.09.26 Hokkaido Tokachi offshore Earthquake in Japan

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Abstract

Since 1977 Tree Bioelectric Potential (TBP) has been measured at Suginami Tokyo, preceding earthquakes of magnitude 5 or above, anomalous potential changes were often observed. At three observation posts (Sapporo, Suginami Tokyo, Sagamihara Kanagawa) anomalous phenomena on TBP appeared prior to 2003/09/26 Hokkaido Tokachi offshore earthquake ($M=8.0_{JMA}$).

1. Measuring System

The system used to measure bioelectric potential of tree is shown in Fig.1. A silver electrode (diameter: 0.5mm, length: 50mm) is inserted into living tissue of the tree and another silver electrode (diameter: 0.5mm, length: 100mm) is buried at a depth of 1m into the ground at a point 1 or 1.5m from the tree. Both electrodes are connected with shielding wires to input terminals of a chart recorder. With this circuit, it is possible to observe the bioelectric potential of the tree under the influence of earth currents (TORIYAMA, 1994).

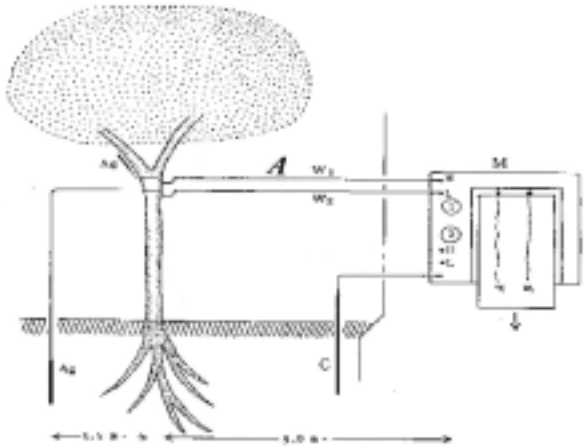

Fig.1 Tree Bioelectric Potential (TBP) Measuring System

2. Precursory phenomena at Sapporo observation post

A silk tree (*Albizzia Julibrissin*, NEMUNOKI) which had been growing and reached at the age of about 20 years in a field of house yard in the vicinity of Sapporo metropolis. The circuit used to measure its bioelectric potential was the same system used in previous investigation (TORIYAMA and KAWAGUCHI, 1987). Sapporo TBP observation post is located at about 270km from the epicenter.

TBP data was normal pattern till '03/07/31 as shown in Fig.2. Upper side of the chart is minus potential and lower is plus depending on the chart recorder specification.

Impulsive small signal with minus electrical potential of almost within –5mV appeared during '03/08/01 and '03/08/09. These impulsive signals may be caused by micro clucks. Typical data '03/08/04 is shown in Fig.3.

After '03/08/10 to '03/08/11 the noise base line raised up towards minus potential day by day. Since observed data was assumed to exceed the full scale, input range of the chart recorder was switched from 50mV to 100mV in order to reduce input sensitivity. Typical data which showed huge and long electrically charging curve like plateau on '03/08/10 is shown in Fig.4 and input range switched timing on '03/08/11 is shown in Fig.5.

After '03/08/12 to '03/08/28 TBP observed data was exceeded and kept at more than –100mV. Typical data on '03/08/26 is shown in Fig.6.

During '03/08/29 and '03/09/02 anomalous pattern like saw-tooth with 10mVp-p (peak to peak) appeared, typical data was observed on '03/08/30 as shown in Fig.7. The peak to peak value and frequency of appearance reduced towards

‘03/09/02.

After ‘03/09/03 observed data became normal pattern. A similar data shown in Fig.2 was obtained till ‘03/09/13. A similar data shown in Fig.6 was obtained between ‘03/09/14 to 09/26 and also after the main shock.

3. Precursory phenomena at Suginami observation post

A *Ulmus Keaki tree* (KEYAKI) which had been growing and reached at the age of about 40 years in a field of house yard at Suginami in the vicinity of Tokyo metropolis. The circuit used to measure its bioelectric potential was the same system used in previous investigation. Suginami TBP observation post is located at about 780km from the epicenter.

The TBP normal pattern till ‘03/09/03 is shown in Fig.8. Anomalous signal like saw-tooth as shown in Fig.9 was observed on ‘03/09/04 to 09/05. Peak voltage was almost +50mV.

4. Precursory phenomena at Sagamihara observation post

An *Osmanthus Fragnans* tree (KIN-MOKUSEI) which had been growing and had reached at the age of 13 years in a field of house yard at Sagamihara city in the vicinity of Tokyo metropolis. The Sagamihara observation post is located at about 800km from the epicenter. TBP is measured by digital system composed of A/D (Analogue to Digital) Converter and Personal Computer instead of Chart Recorder at this observation post.

Impulsive signal appeared three times with potential of –3, –12, –14mV at 18:25 on ’03/09/22, 12:25 and 13:00 JST on 09/23 respectively. Those anomalous potentials appeared on 4 and 3 days prior to the main shock as shown in Fig.10.

One of authors, SAITO announced a trial earthquake prediction from private Home Page (HP) as follows;

- A middle class earthquake will occur considering from potential value and impulsive waveform.
- Epicenter will be Ibaraki or northern part of Japan on the North American Plate considering from minus electrical potential
- Epicenter will be far from Sagamihara observation post, since discharging elapsed time which depends on capacitance of condenser phenomena was short.
- Small or middle scale earthquake will probably occur around Miyagi prefecture.

5-hours slow charging curve with –5.5mV peak voltage appeared from 23:00 JST on ‘03/09/24 as shown in Fig.11. Short time discharging might be caused by human error during checking observation system since the previous charging curve was misunderstood as some failure of the measuring equipment.

One of authors, SAITO announced a trial earthquake prediction from private Home Page (HP) as follows.

- An earthquake with middle class magnitude will occur considering from potential value and from long charging elapsed time.
- Epicenter will be Ibaraki or northern part of Japan on the North American Plate considering from minus electrical potential
- Epicenter will be near from Sagamihara observation post since anomalous period, which depends on capacitance of condenser phenomena, was long.
- Small-scale earthquake will probably occur at Ibaraki area or middle scale earthquake will occur around Miyagi prefecture.

Since about 12 hours before the main shock, observed TBP data was normal as shown in Fig.12.

Impulsive signal appeared often with potential of –4 to –14mV after ’03/09/27 as shown in Fig.13. Those impulsive signals were assumed to correspond to after shocks.

5. Conclusions

At Sagamihara observation post, we have been observed TBP from July 2002 to November 2003 on the preliminary level, however, the TBP anomalous signal provably corresponds to earthquakes with magnitude of more than 5. At Sagamihara observation post, minus anomalous signal provably corresponds to earthquakes occurred in and near Tohoku and Hokkaido district, however no signal sometimes appears before earthquakes. Plus anomalous signal provably corresponds to earthquakes occurred in and near south Kanto district and Izu Islands. The authors strongly emphasize the importance of parallel measurement of TBP and other Seismic Electro-Magnetic Signal (SEMS). Thus the performance of a long-term observation of the TBP which would cover wide area of Japan is deemed advisable, if we could observe SEMS in multiple methods at multiple points, we may contribute to the earthquake prediction.

References

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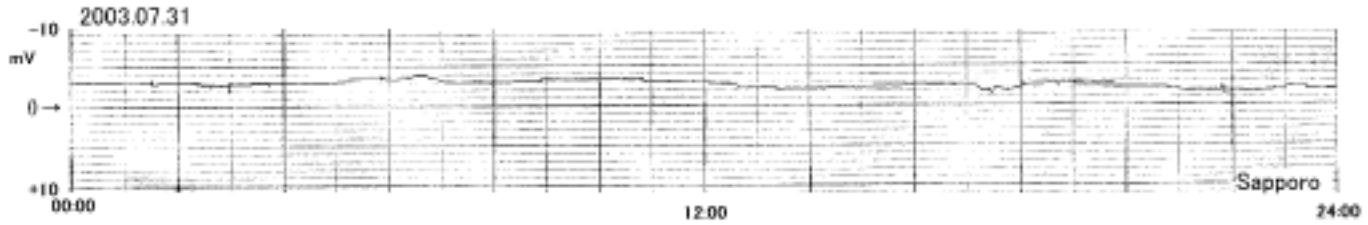

Fig.2 TBP normal pattern

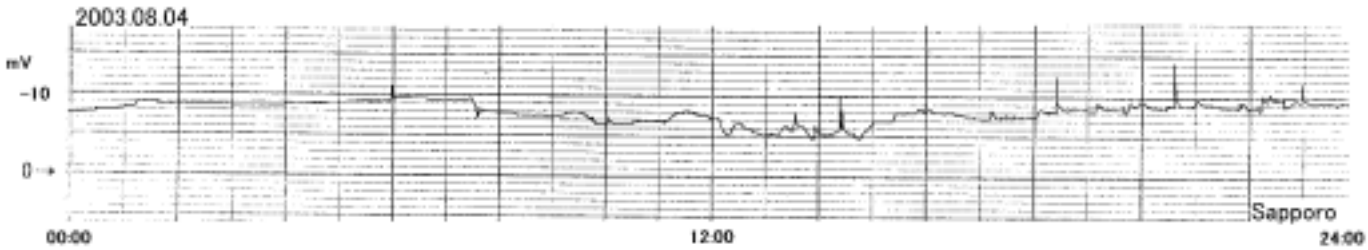

Fig.3 Typical impulsive signals

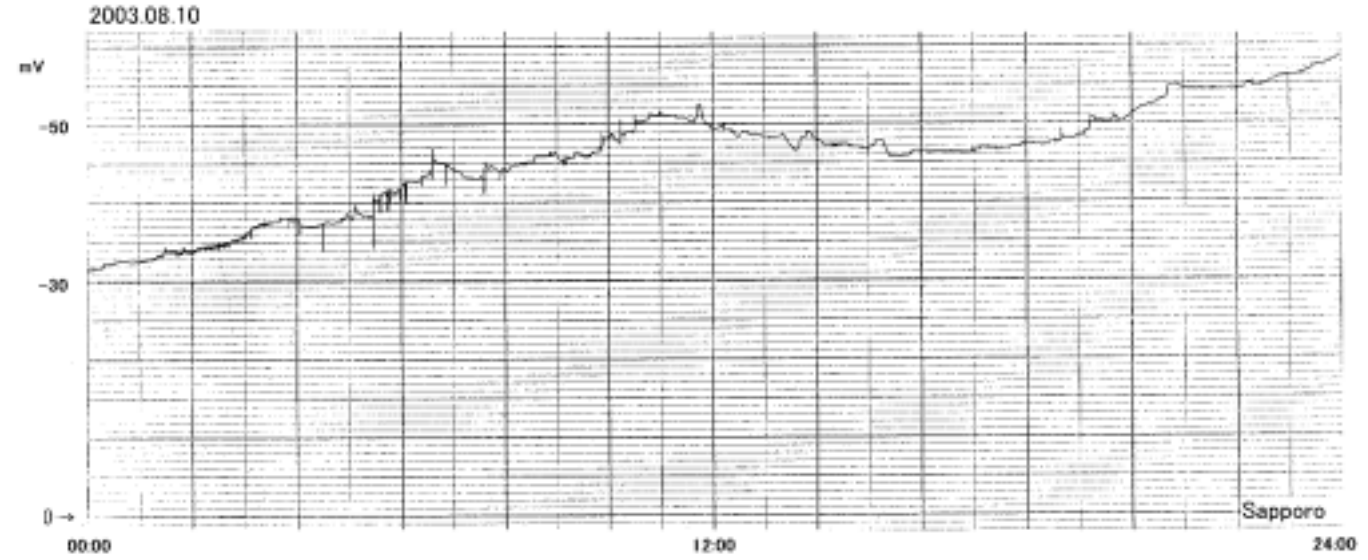

Fig.4 Typical high and long electrically charging curve

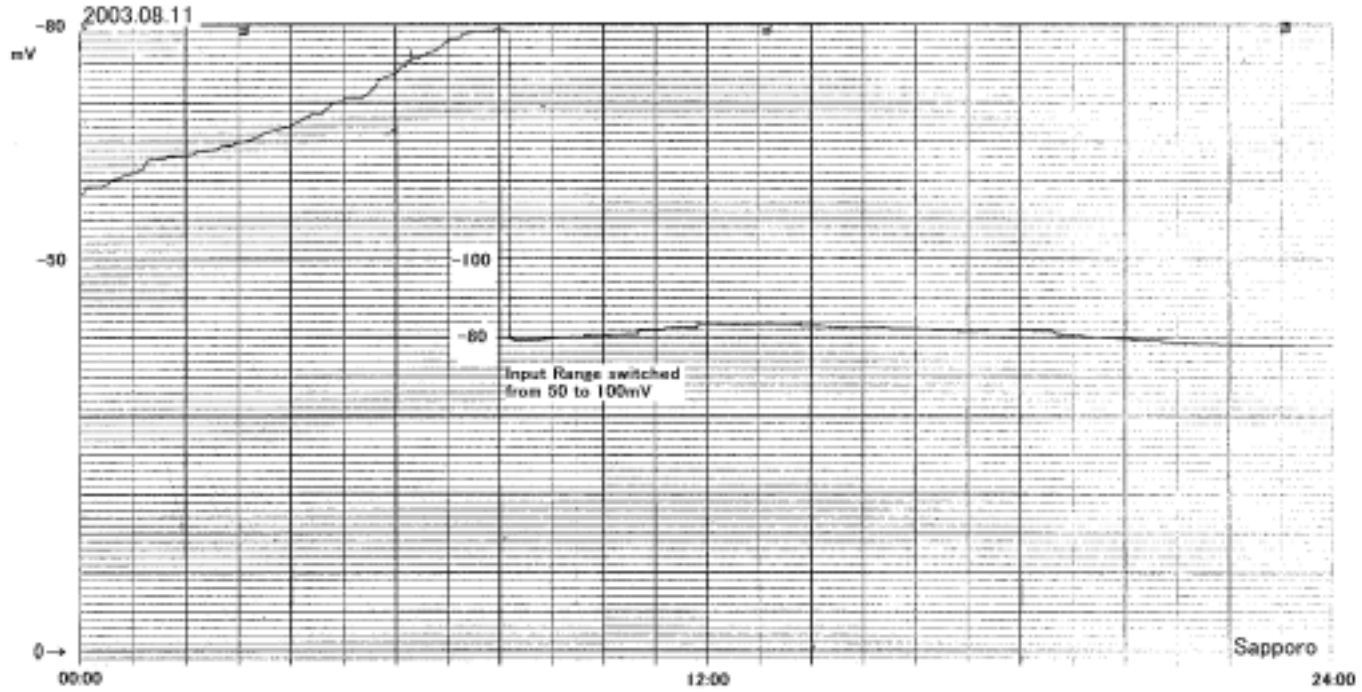

Fig.5 Input range switched from 50mV to 100mV

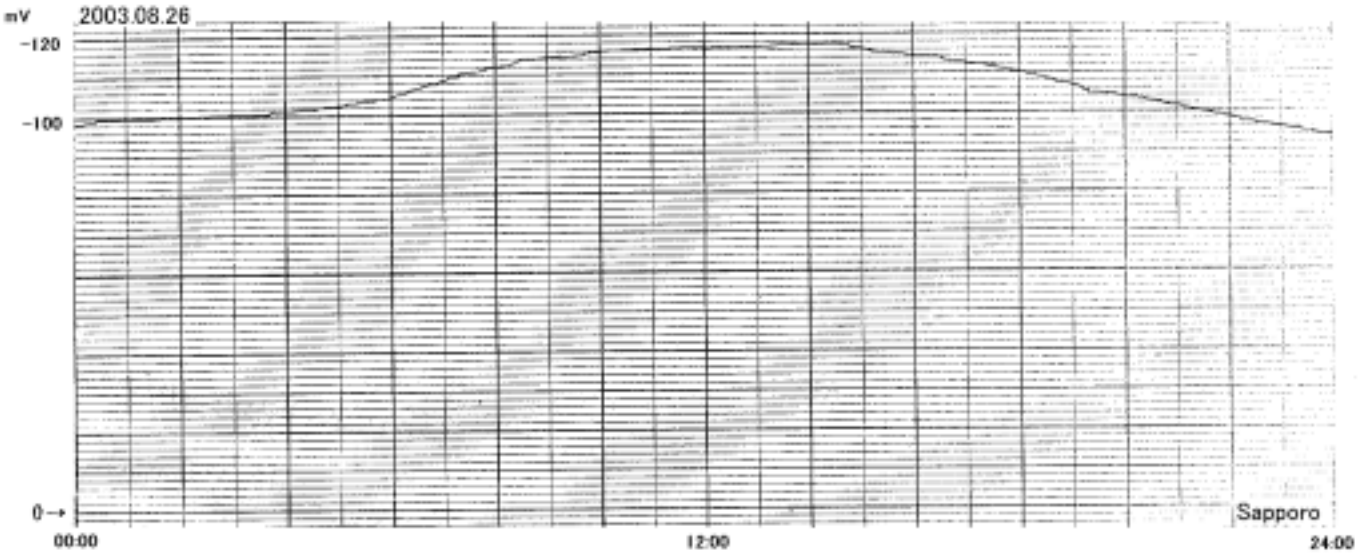

Fig.6 Typical TBP kept at more than –100mV

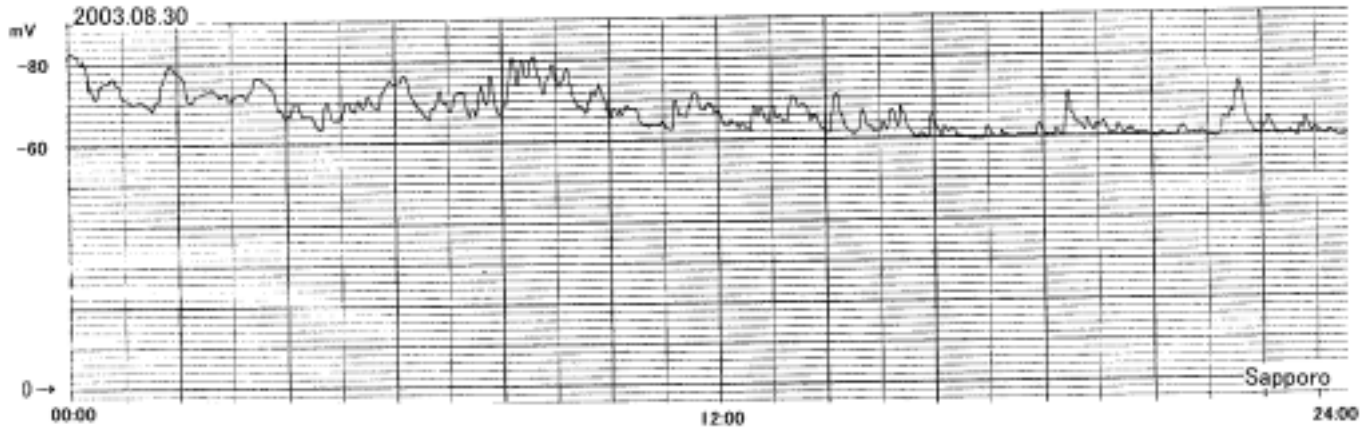

Fig.7 Saw-tooth pattern

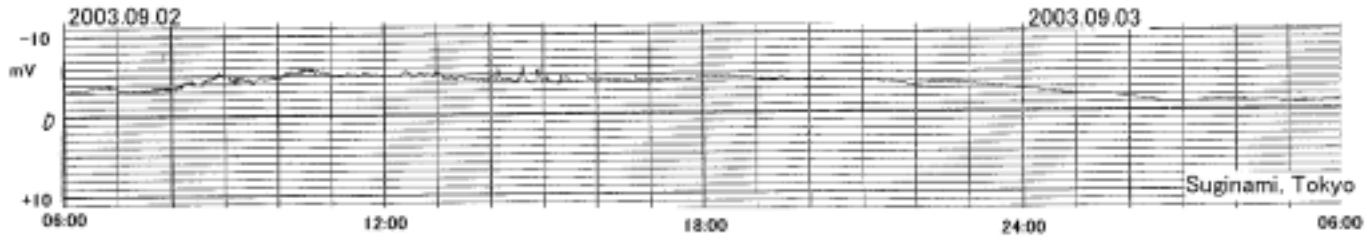

Fig.8 TBP normal pattern

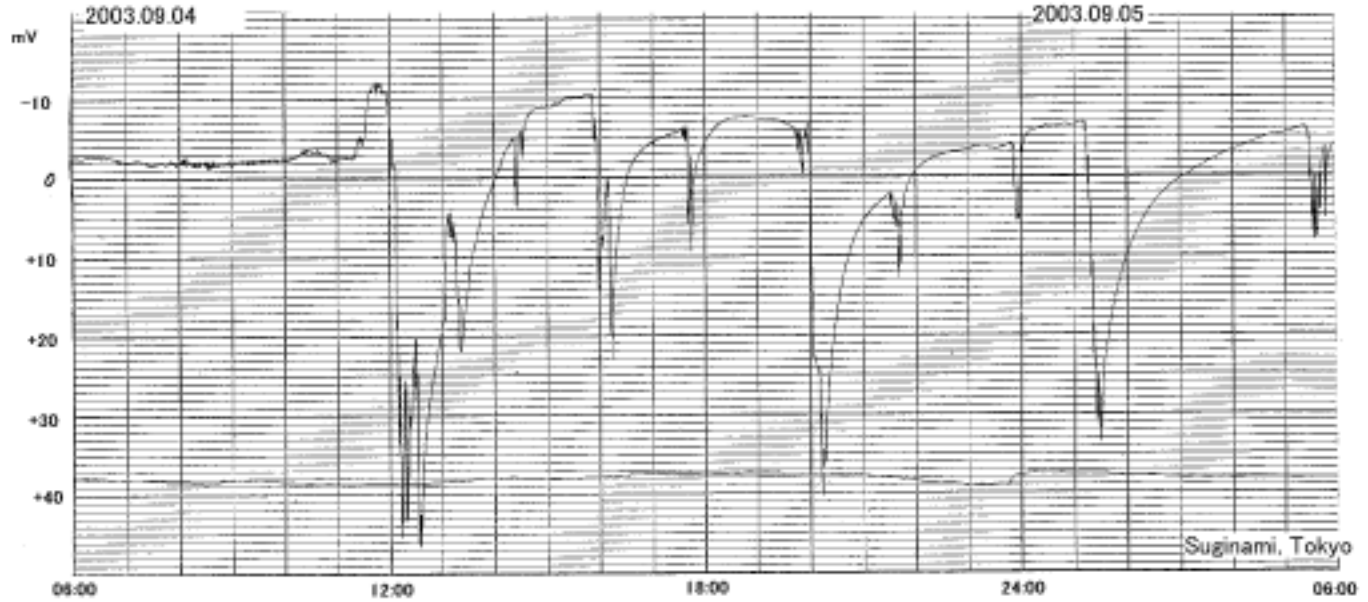

Fig.9 Anomalous saw-tooth signal

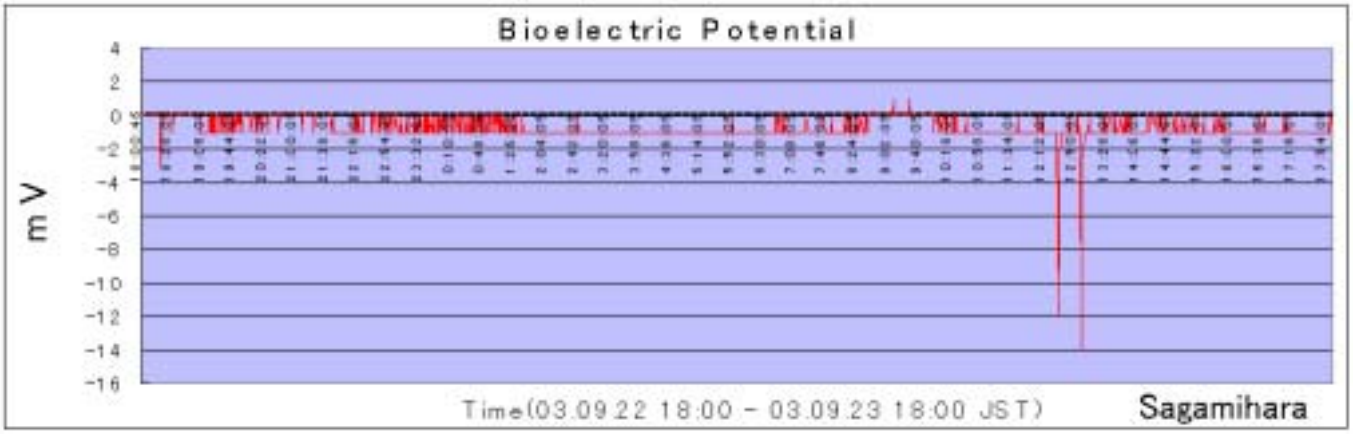

Fig.10 Anomalous data on 4 and 3 days prior to the main shock

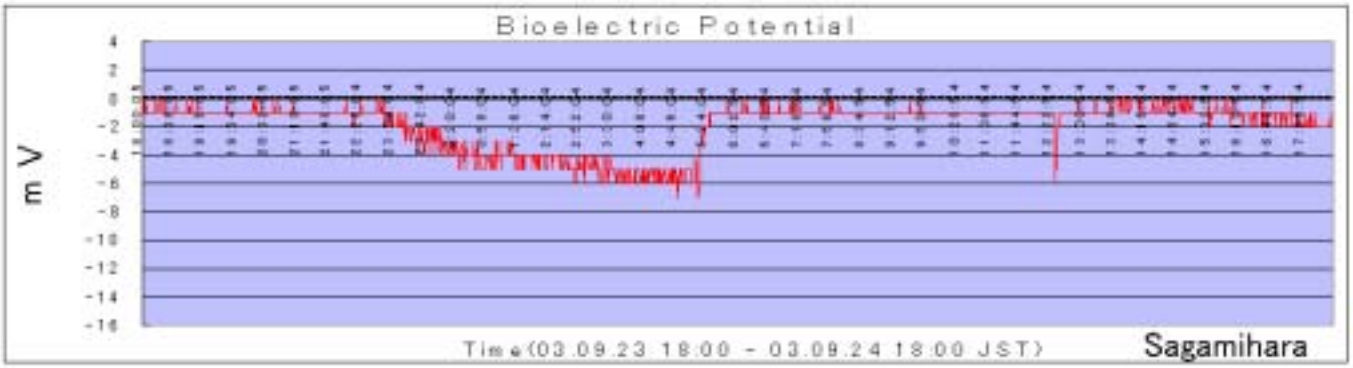

Fig.11 5-hours slow charging curve appeared on '03/09/23-24

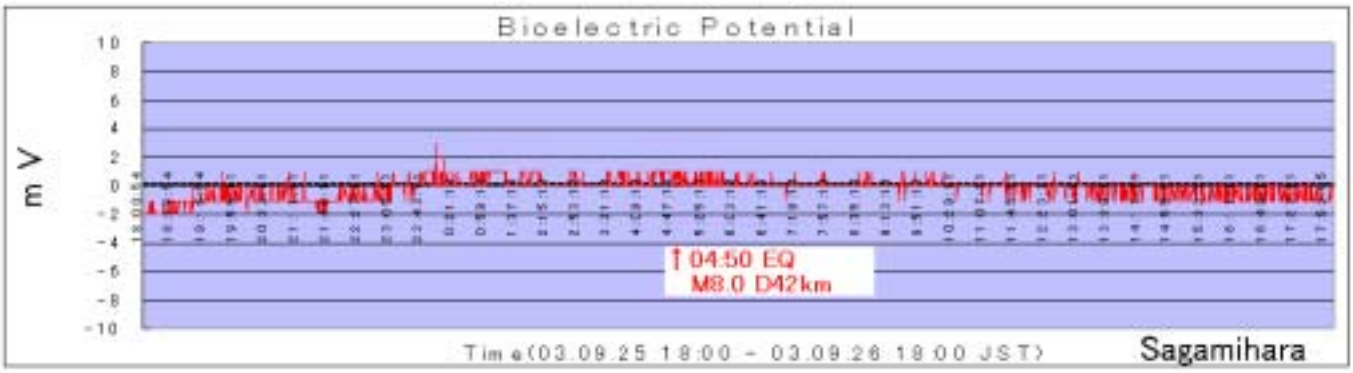

Fig.12 Normal pattern just before and after the Earthquake

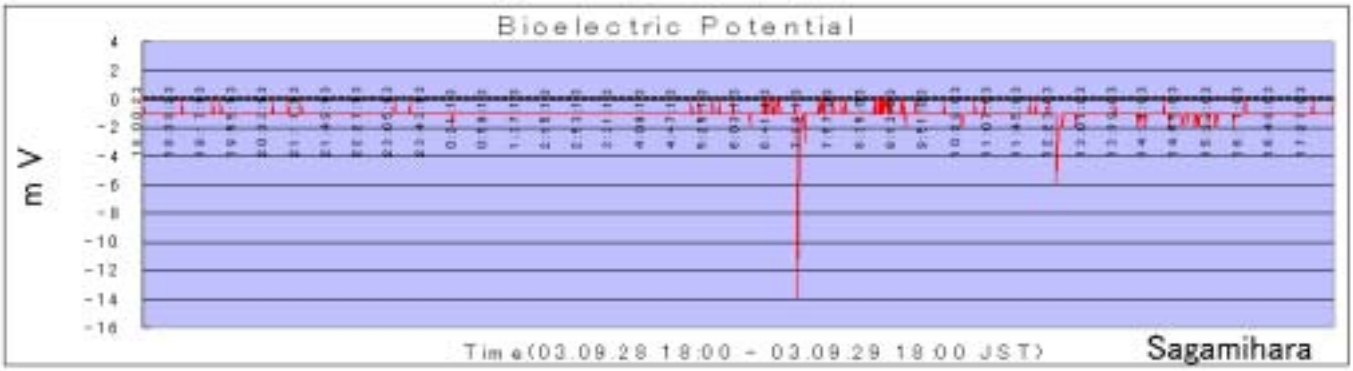

Fig.13 Impulsive signal appeared after the main shock