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News and Views

The 2011 Tohoku Earthquake and Devastating Tsunami

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At 14:46 on March 11, 2011, the magnitude-9.0 earthquake attacked Sendai and neighboring cities distributed along the northeast coast of Honshu Island, Japan. Its epicenter is located 130 km east of Sendai (Fig. 1). Unfortunately, the strong earthquake generated devastating tsunamis that destroyed many towns and villages near the seashore in Iwate, Miyagi, and Fukushima prefectures. The natural catastrophe was followed by the secondary disaster, nuclear radiation from damaged reactors in Fukushima.

As a witness of this natural catastrophe, I report the severity of the 2011 Tohoku Earthquake and the tragic consequences of the killer tsunami. The Japan Meteorological Agency named this earthquake "The 2011 off the Pacific coast of Tohoku Earthquake," but mass media also named "The Tohoku-Kanto Great Earthquake" or "The East Japan Great Earthquake." For simplicity, here, I use the name, the 2011 Tohoku Earthquake.

First of all, I express my heartfelt condolences to family members of the victims of the catastrophe. I also express my profound sympathy for people who lost their homes and communities by the earthquake and following tsunamis.

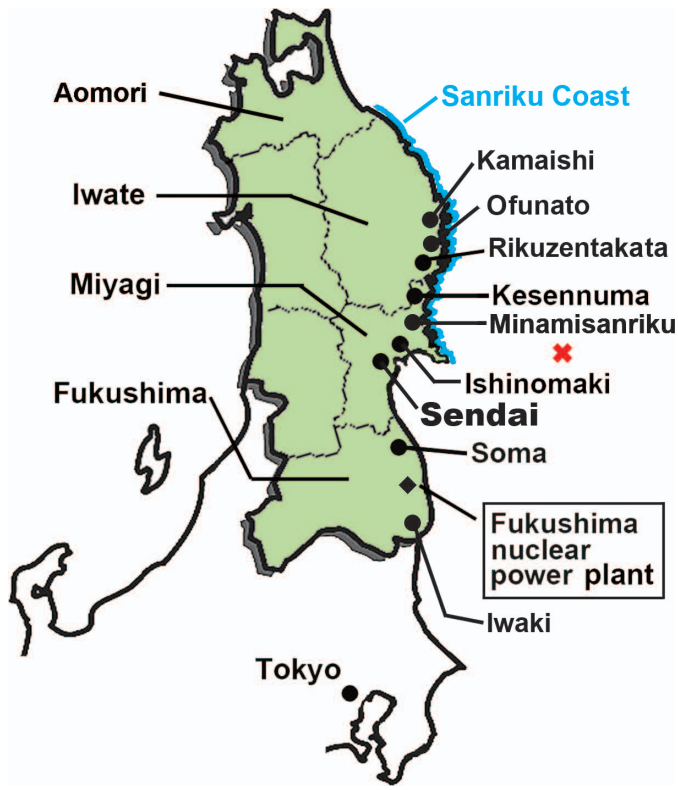

Fig. 1. Sanriku coast of Iwate and Miyagi prefectures.
Shown are Sendai and neighboring cities that were attacked by the 2011 Tohoku Earthquake and devastating tsunami. Its epicenter is schematically indicated (red). The Tohoku region is shown as green. Sanriku coast is shaded along the seacoast of about 600 km (blue).

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The 2011 Tohoku Earthquake and personal observations

Shown below is the summary of the official data concerning the 2011 Tohoku Earthquake announced by the Japan Meteorological Agency (JMA).

• Magnitude: 9.0 (interim value)

• Hypocenter: 130 km off the Pacific coast of Tohoku region, from Iwate to Ibaraki Prefectures, 24-km depth

• JMA Seismic Intensity: 7 (Max) Kurihara City of Miyagi Prefecture, and 6+ in Sendai and other cities in Miyagi, Fukushima, Ibaraki, and Tochigi Prefectures.

Despite the greatest earthquake recorded in Japan, there was a limited number of human damage that was directly caused by the collapse of buildings or houses. Definitely, our quake-resistant buildings saved a large number of human lives. In fact, my office on 7th floor of Building 1, Tohoku University School of Medicine, shook greatly for 2-3 min. Because of its unusually long duration, I was able to see my room swinging with awful creaking sound. At that moment, however, I never thought that the earthquake would trigger such devastating tsunami.

The earthquake caused the full-scale blackout in Sendai and large areas of the Tohoku region. At the night of March 11, it was very cold and clear in Sendai, with many shining stars in the sky. In the darkness, only Tohoku University Hospital appeared retaining its ordinary functions with its own electricity. In fact, after the earthquake, many critical patients were transported from the seacoast areas to Tohoku University Hospital.

A long history of fighting with devastating tsunamis in northeast coast of Japan

According to the Metropolitan Police Department, the number of dead and missing persons exceeded 28,500 (as of March 28, 2011). Almost all of the victims were killed by tsunamis. In fact, the 2011 tsunami with waves of more than 10 m high wiped out everything in their paths (Figs. 2 and 3). Especially, in the seacoast areas of Iwate, Miyagi, and Fukushima prefectures, many people were carried off by the tsunami, with the largest number of dead and missing persons in Miyagi (more than 10,000). As of March 27, 2011, about 200,000 people have been forced to live in uncomfortable environments after evacuation (the daily minimum temperature, around 0°C), without electricity. I admire the patience and politeness of those people (the Tohoku Spirit!).

The entire seacoast area of Iwate prefecture and the northeast coast of Miyagi prefecture are known as Sanriku coast (Fig. 1) and have been frequently invaded by tsunami. For example, the 1896 Meiji Sanriku Tsunami killed about 20,000 people, and the 1933 Showa Sanriku Tsunami killed about 3,000 (Satake et al. 2008). Accordingly, people living in Sanriku coast areas have been well trained for tsunami-evacuation procedures upon earthquake. However, the 2011 tsunami, which was much greater than that ever expected, wiped out people who evacuated to the official refuge place, such as high building. Surprisingly, the 2011 tsunami also attacked the seacoast areas of Sendai and other cities in Miyagi as well as Soma and Iwaki cities in Fukushima (Fig. 1) probably after a 1,000-year interval (Minoura et al. 2001).

A mission of the Tohoku Journal of Experimental Medicine toward disaster prevention

Experiencing the natural catastrophe in the Tohoku region, I, as Editor-in-Chief of *the Tohoku Journal of Experimental Medicine* (TJEM), have realized that TJEM should also cover the fields of disaster prevention medicine and earthquake/tsunami research, including earthquake archeology. In this context, among more than 9,500 published articles in TJEM (since 1920), only three articles deal with the earthquake-related topics: two about suicide after earthquake and one about the earthquake-induced contamination of river water with toxic chemicals.

Here, I would like to announce that TJEM is willing to

Fig. 2. The tsunami-stricken streets in Ishinomaki.
A ship on the street (A) and a fire engine drifted to the hill (B). (Courtesy of Ichiyo Shibahara).

Fig. 3. The tsunami-stricken residential area in Kesennuma. (Courtesy of Shin-Ichiro Osawa).

Fig. 4. Wishing for the restoration.
Graduation ceremony was held in a small classroom of a junior high school in Kesennuma that was severely destroyed by the tsunami. Three Chinese letters in the front mean "Celebrating the Graduation!"
(Courtesy of Shin-Ichiro Osawa).

provide a platform for scientists all over the world to promote and share new findings in all areas of disaster prevention. It is our mission to provide many people living in the earthquake-prone zones with the new information in real time. In this context, as an open access journal, every article of TJEM is freely available online to all readers without any barrier to access (http://www.journal.med.tohoku.ac.jp/). The long-term goal of this new policy is to prevent human damage from natural disasters.

Lastly, as a resident in Sendai, I would like to express my gratitude to each of many teams and volunteers from every area of Japan and foreign countries for kind and warm supports. I also thank faculty members and medical staffs, including doctors, nurses, and other employees, in Tohoku University Hospital and Tohoku University School of Medicine, who have played central roles for providing urgent supports to damaged hospitals located in the tsunami-stricken areas and refugees who lost their homes.

I believe the powerful resilience of the people living in the Tohoku region (Fig. 4).

References

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