

# THE 2011 TSUNAMI AND SCHOOLS IN DAMAGED AREAS

— What We Have Learned Through Regional  
Evacuation Activities from the Tsunami Disaster —



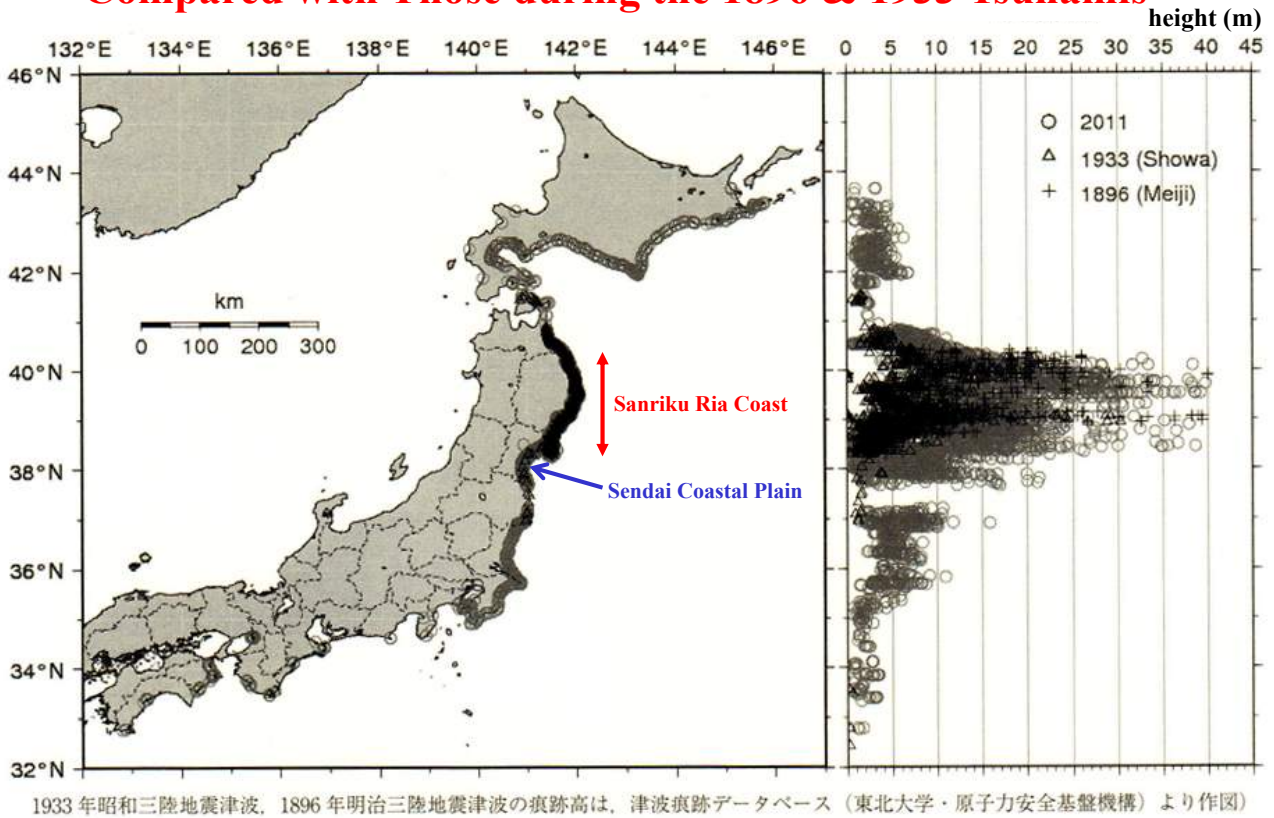
**Kazuoh SEO<sup>1)</sup> and Takashi ODA<sup>2)</sup>**  
**Support Center for Revival in Education**  
**Miyagi University of Education**

<sup>1)</sup> kazuohseo@k04.itscom.net , <sup>2)</sup> oda.tak@staff.miyakyo-u.ac.jp

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During the 2011 Tsunami Disaster  
Successful Cases v.s. Unsuccessful Cases

## Inundation Height Distribution during the 2011 Tsunami Compared with Those during the 1896 & 1933 Tsunamis



After T. Shibayama (2011.12.25)

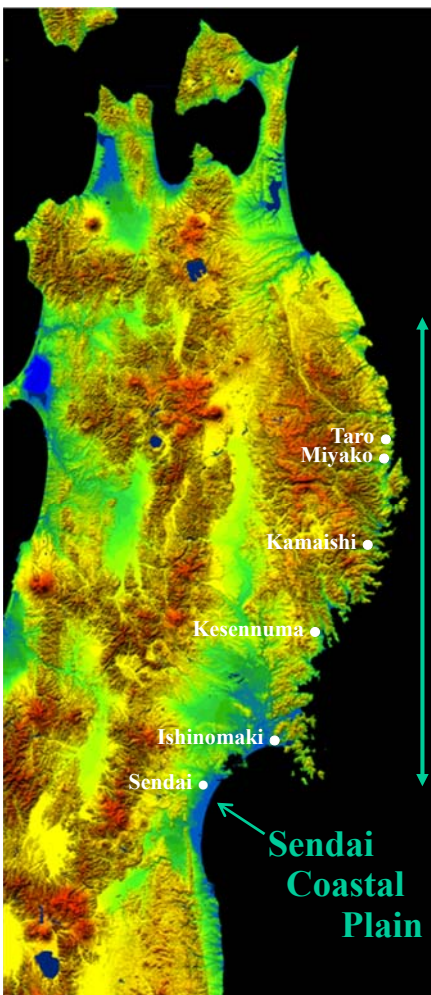
## Different Circumstances in Tsunami Disasters

### Sanriku Ria Coast

- Historic experiences in tsunamis
- Protection walls against tsunamis
- Very high inundation and runup height of tsunamis due to topographical effects of ria coasts

### Sendai Coastal Plain

- Poor experience in large tsunamis
- Pine groves against tidal waves
- Moderate inundation height of tsunami, but no space for evacuation except tall buildings



Digital Elevation Map Presented by Geospatial Information Authority of Japan, January 2008

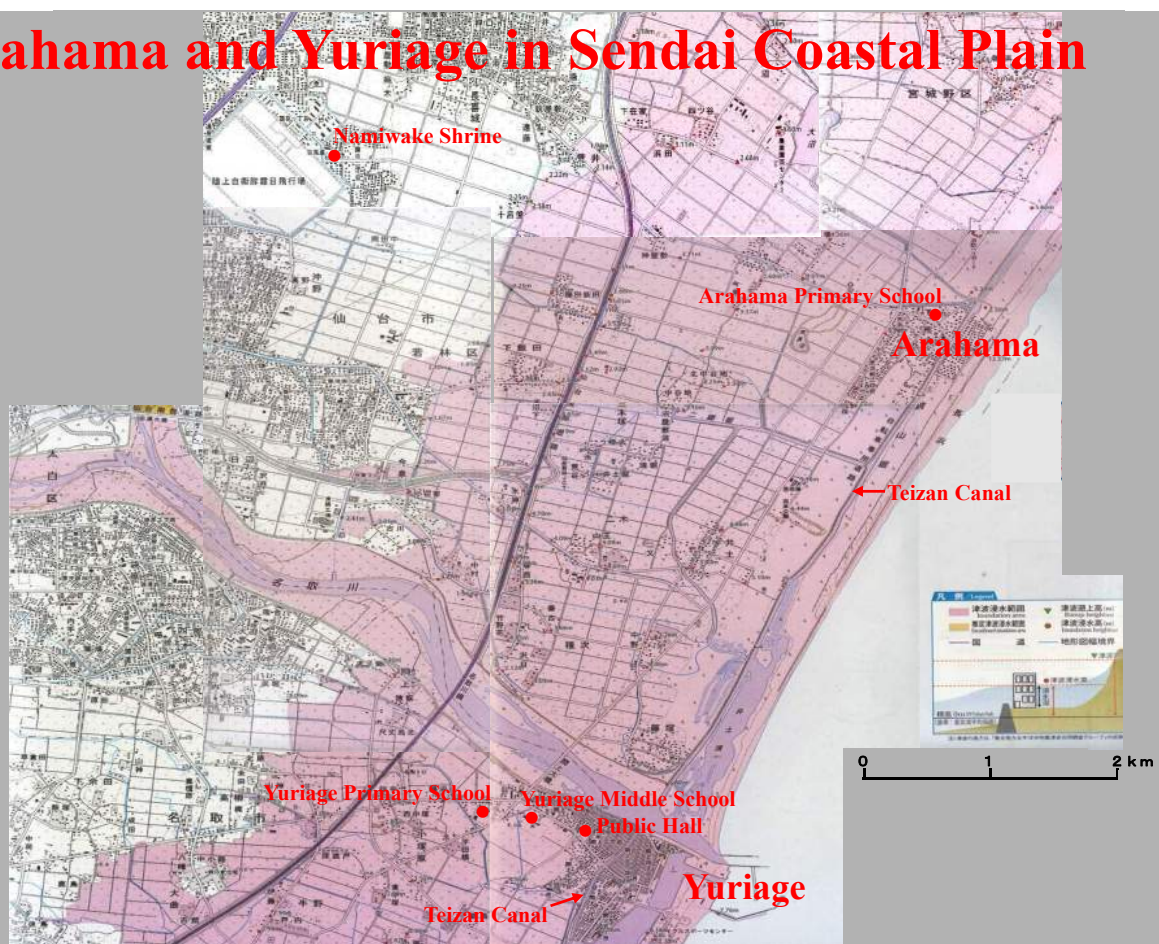


# The 2011 Tsunami Disaster in Sendai Coastal Plain



After the local newspaper “Kahoku-Shinpoh”, April 8, 2011

## Arahama and Yuriage in Sendai Coastal Plain



After Haraguchi and Iwamatsu, Inundation Map of the 2011 Tsunami, October 2011

# School Evacuation Activities Taken During the 2011 Tsunami Disaster

## A Typical Successful Case in Sendai Coastal Plain

### Arahama Primary School in Sendai City



Arahama primary school was the only tall building in Arahama district. Evacuation activity was currently made within school children, teachers and residents in this area. The schoolmaster took the leadership to manage the school building as a temporary refuge. As results, 320 people were rescued.

After an Action Report made by Sendai City Office, March 2013



# Arahama District in Sendai City



April 17, 2011



After the Photogravure by Kahoku-Shinpoh, March 5, 2012



This photo was taken by a helicopter of the Fire Department, Sendai City Office.

After an Action Report made by Sendai City Office, March 2013



# Arahama Primary School



仙台市立荒浜小学校  
一一〇年の歴史  
月日できごと

1894.10.7	創立 仙台市立荒浜小学校の設置
1904.10.1	創立十周年記念式典の開催
1910.10.1	創立二十周年記念式典の開催
1920.10.1	創立三十周年記念式典の開催
1930.10.1	創立四十周年記念式典の開催
1940.10.1	創立五十周年記念式典の開催
1950.10.1	創立六十周年記念式典の開催
1960.10.1	創立七十周年記念式典の開催
1970.10.1	創立八十周年記念式典の開催
1980.10.1	創立九十周年記念式典の開催
1990.10.1	創立百周年記念式典の開催

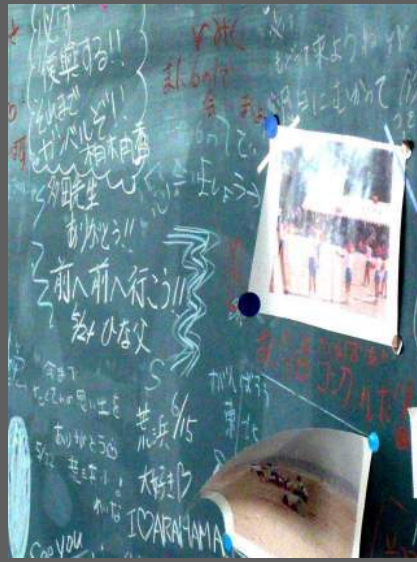


Photo : April 20, 2013

# Arahama Primary School



2nd Floor



Roof Floor



1st Floor



2nd Floor



South view



East view



1st Floor



1st Floor



# Arahama District from the School

Photo : April 20, 2013



East view



South view



North view

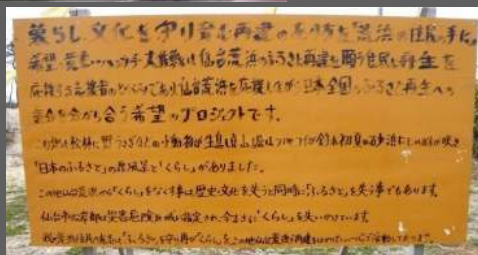


West view

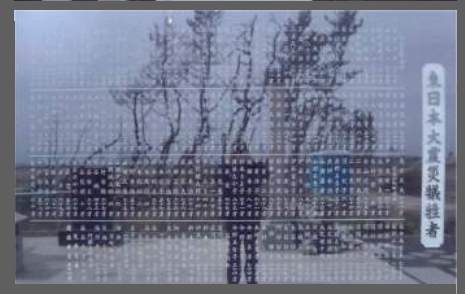


## Arahama

Photo: April 20, 2013



Monument for the Victims



The monument kept remaining  
190 names of victims

## **Simple Questions about Arahama District**

**Population : 2,709 ( 983 families) [ Data obtained in May 2010]**

**Deaths : 190 [after the description in the monument]**

**Refugees evacuated to the primary school, and then rescued;**

**320 ( Residents : 233, School children : 71, School staffs : 16 )**

**$2,709 - 320 - 190 = 2,199$  ?**

**What would happen in the majority of the residents?**

**How many residents met with the tsunami, and where did they evacuate? As the tsunami took place in daytime, not a few people might go out at that time.**

## **School Evacuation Activities**

**Taken During the 2011 Tsunami Disaster**

**A Typical Unsuccessful Case in Sendai Coastal Plain**



# Yuriage District in Natori City



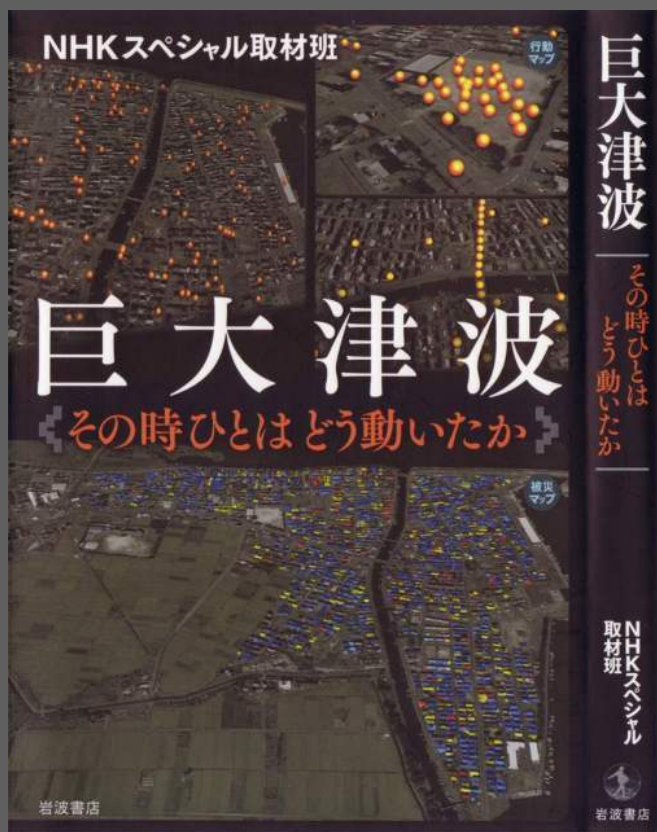
May 2007



April 17, 2011



After the Photogravure by Kahoku-Shinpo, March 5, 2012



Cover of the publication

## A Map Showing People's Behavior

Through the interviews to 542 people, they confirmed the behaviors of 2,131 people after the earthquake motion attacked the area. Especially the behaviors of 600 people were precisely traced for 70 minutes until the tsunami arrived.



The upper figure shows the damage distribution in Yuriage 2-chome area.

Blue : Houses without victims

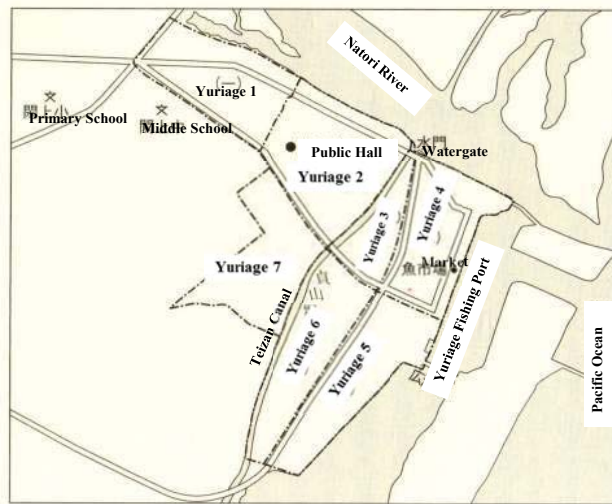
Yellow : Houses with victims

Red : Houses whole of families were lost



	Families	Population	Victims	Rate of Victims
Yuriage 1	230	655	49	7.48%
Yuriage 2	303	873	211	24.17%
Yuriage 3	119	342	45	13.16%
Yuriage 4	272	762	89	11.68%
Yuriage 5	171	531	64	12.05%
Yuriage 6	426	1072	142	13.25%
Yuriage 7	305	843	89	10.56%
<b>Total</b>	<b>1,826</b>	<b>5,078</b>	<b>689</b>	<b>13.57%</b>

Data Obtained as Families, Population: Feb. 2011, Victims : March 7, 2013



## Victims in Yuriage District

Why the rate of victims so high?

### Legend without basis

- Teizan Canal will become dry before a tsunami coming.
- Tsunamis will not cross over Teizan Canal.

Emergency radio system didn't work as it was broken because of strong shaking.

- Only way was to use car radio, but it didn't provide enough information.

Residents of Yuriage didn't care about tsunami at all.

- They were just talking with the neighbors, or they engaged in clearing broken glasses and ceramics, or put back scattered furniture after the strong motions.

Residents could not remember the existence of the monument of the 1933 tsunami disaster.

## A Photogravure by a Resident

# “その時、閉上は”

平成23年3月11日 東日本大震災  
East Japan Great Earthquake  
in YURIAGE

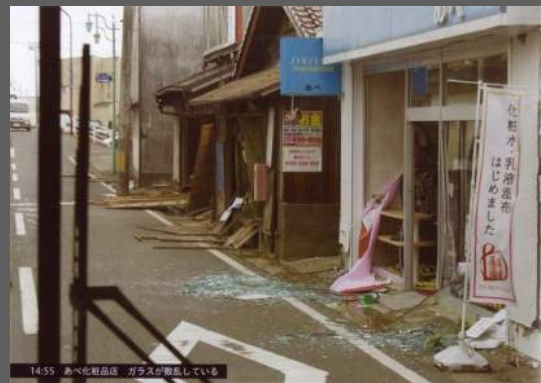
3月11日 16:00  
海から約2km離れている閉上小学校校庭



小齋誠進 写真集



Photos by Seishin KOSAI



14:55 あべ化粧品店 ガラスが破れている



15:19 名取川河口築堤 堤防の下が車が停に埋まっている

The author was just arriving Yuriage by bus when the quake took place. He took as many as photographs before the tsunami. Such photographs looked quite important because the damage due to strong motions could be understood very clearly.



# Yuriage Primary School in Natori City



March 11, 2011 16:11



Photo : July 20, 2013



March 11, 2011 16:02

About 1,000 people had successfully evacuated to the Yuriage primary school. The clock in the auditorium shows 14:49, almost the time when the earthquake motion had arrived the school.

← Photos by S. Kosai, Aug.15, 2011

# Yuriage Middle School

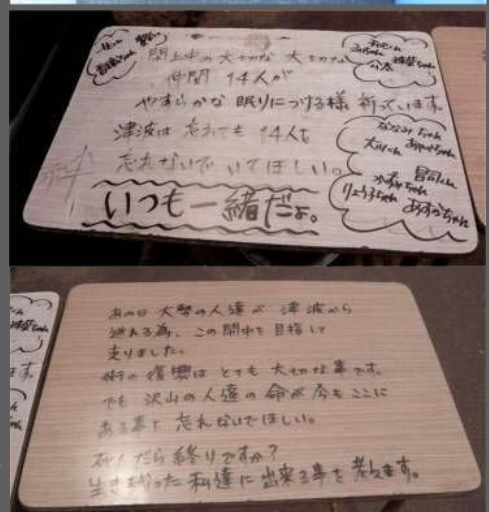


About 800 residents were evacuated and saved in the middle school.

The tsunami attacked here on the half way of the evacuation activities by the residents. Many victims appeared in this reason.



Monument for the tsunami victims



## Simple Questions about Yuriage District

Population : 5,078 ( 1,826 families) [ Data obtained in Feb. 2010]

Deaths : 689 [after Natori City Office, March 7, 2013]

Refugees evacuated to the public hall, the middle school and the primary school, then rescued;

1,840 ( Public hall : 40, Middle school : 800, Primary school : 1,000 )

$5,078 - 689 - 1,840 = 2,549$  ?

**What would happen in the majority of the residents?**

**How many residents met with the tsunami, and where did they evacuate? As the tsunami took place in daytime, not a few people might go out at that time.**

## Comparison between Arahama and Yuriage districts both in Sendai coastal plain; Before, during and after the 2011 tsunami disaster

### Evacuation Activities;

**Arahama :** Training of evacuation actions for tsunami disaster had been tried many times before the 2011 tsunami. Arahama primary school had also prepared to accept refugees in advance. Therefore there was no confusion to accept many refugees during the 2011 tsunami.

**Yuriage :** There was no preparation against tsunami disaster. As the tsunami was larger than they had estimated, they tried to change the refuge place on the half way of evacuation. Not a few refugees had to lose their lives in such condition. There was 70 minutes from the strong shaking until the tsunami arrived, but they could not utilize this valuable 70 minutes to save their lives.

### Recovery Plans;

**Arahama :** Sendai city has decided that the coastal area should be prohibited to live. Then recovery works must be made in distant inland areas. Some of residents have not agreed yet with this decision made by the local government.

**Yuriage :** Natori city has shown a recovery plan by lifting up the ground level more than the inundation height of the tsunami. An objection says, for example, that victims are still under the ground without finding.

### Subjects still remained;

In both districts, there are disagreements between residents and local governors. Before the decision making, the local governors should have made negotiation about the recovery plans. There are so many subjects unsolved up to now.



## **Additional Examples of School Evacuation Activities in Ishinomaki Plain**

### **Nobiru Primary School in Higashi-Matsushima City**



As Nobiru Primary School was located 1 km away from the nearest seashore, the school staffs could not estimate disastrous tsunami. They guided evacuated people to the gymnasium, not to the upper floors of the school building. It was merely that they have just followed the emergency guideline. Unfortunately the 5m tsunami attacked the school, and many victims of the tsunami were found in the gymnasium.

**Photo : June 1, 2013**

## Daikaido Primary School in Ishinomaki City

サイン

「SOS」。学校の屋上に避難し、サインを送って救助を求める人たち=12日午前7時40分ごろ、石巻市



A cameraman of Kahoku-Shinpoh, took this aero-photo in the next morning of the tsunami. The refugees expected to be rescued immediately, because their “SOS” signal was successfully confirmed by a newspaper plane. Unfortunately the refugees had to wait for ten days, as the cameraman couldn’t identify the exact position of this photo. The inundation height of the tsunami was about 3m in this school.

After the local newspaper “Kahoku-Shinpoh”, June 27, 2011

## Kadonowaki Primary School in Ishinomaki City



The staffs successfully guided the children uphill behind the school before the tsunami attacked the district. Soon the tsunami arrived there with 7m in inundation height. The tsunami brought the fire, but fortunately as results, there was no victims in the school building.

Photo : Aug.11, 2011



## Another Additional Examples of School Evacuation Activities in Sanriku Ria Coasts

### Togura District in Minami-Sanriku Town

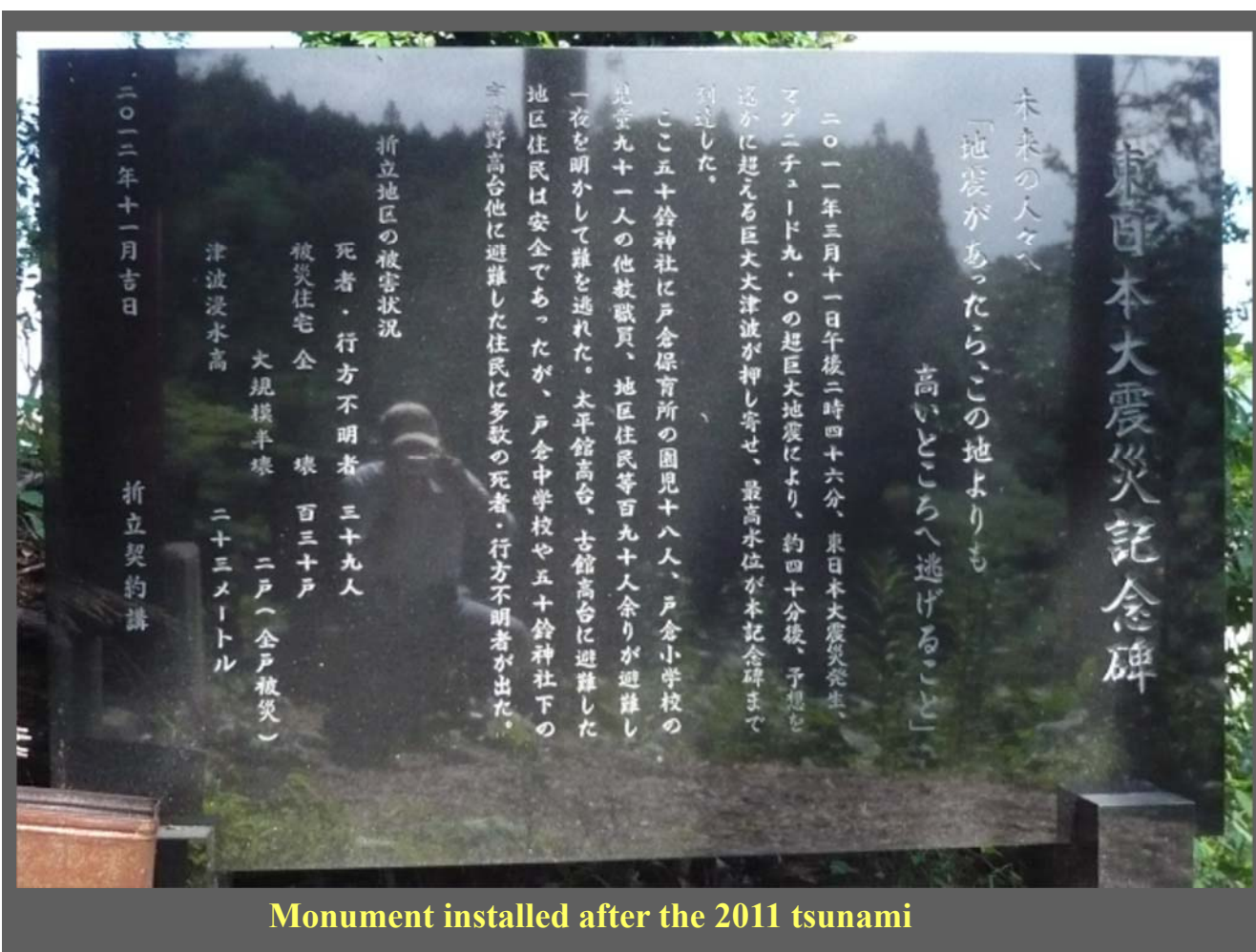


Togura Primary School was attacked by the tsunami with 20m of inundation height. But the school children immediately evacuated toward the neighboring shrine and nobody was killed.

[Photo : July 20, 2013]



A view of damaged area from Isuzu Shrine



Monument installed after the 2011 tsunami



# Togura Middle School



↓ Isuzu Shrine

An old woman kindly told me the detail what had happened here at that time.



Togura middle school attacked by the tsunami



Temporal refuges prepared in the middle school



Togura middle school on a hill attacked by the tsunami and not a few people were killed.



← inundation level of the tsunami



← for Onagawa

Central part of Ogatsu town



Ogatsu primary school already demolished



Monument of the 1933 tsunami and damaged town office



The school children evacuated through the shrine

## Ogatsu District in Ishinomaki City

According to newspapers, school children in Ogatsu district evacuated from the tsunami successfully, but almost nothing remained in the district.

← Monument of the 2011 tsunami and temporal shops

[Photo : July 20, 2013]





# Ohkawa Primary School in Ishinomaki City



Runup height of Tsunami : 9m →  
← Inundation height of Tsunami : 7m



The school was located along the Kitakami river, but 4km away from the sea. The staffs could not estimate the possibility of big tsunami, and hesitated quick evacuation. After all, the number of victims counted 84 among 119 ( school children; 74 among 108, and teaching staffs; 10 among 11 ).

Photo : June 1, 2013

## Ohkawa Primary School

Photo: June 20, 2013



The tsunami lifted the upper floor.



← The both, earthquake motion and tsunami collapsed the structure.



## **Lessons Learned from the 2011 Tsunami Disaster**

**The further improvements should be required in the early warning system against tsunami disasters, among JMA, politicians, local governors, local communities, and individuals.**

- **JMA often overestimates the magnitude of tsunamis. The 2011 tsunami was almost an exception that JMA underestimated it.**
- **People will not believe tsunami estimation made by JMA.**
- **People doesn't take action based on their own estimation that the tsunami will not be so large, and hesitates the quick evacuation.**

**School buildings played very important roles as urgent refuges in Sendai coastal plain during the 2011 tsunami. In these cases, we need as much as training how to save the evacuation time, and how to manage the refugees for a week or so without confusion.**

**In case of Sanriku ria coast, we should not stay in any school buildings. We need to evacuate immediately toward neighboring higher position. Evacuation route must be prepared and made sure in advance as well as frequent practice.**

**Thank you very much for your attention !**