

# *The 1923 Tokyo Earthquake and Fire*

Before 1923, the gravest Japanese earthquake was the February 10, 1792 Hizen earthquake, which coincided with the eruption of Unzendake. An estimated 15,000 people were killed. The Shinano - Echigo earthquake of May 8, 1844, caused the death of about 12,000 people. In the Tokyo and Yokohama earthquake and fire of 1923, nearly 142,000 people perished.

Saturday, September 1st 1923 was hot with strong gusts of wind that followed an early morning rain. At 11:58:44 the main shocks of the earthquake arrived just as the citizens of Tokyo and Yokohama, seventeen miles south of Tokyo, were preparing to take their noon meal. Professor A. Imamura, the head of the seismological observatory at the University of Tokyo, was at his desk at the time.

*When the quake began, Professor Imamura was seated in his study and noted that the first movement was rather slight and feeble, so that he did not take it to be the forerunner of so big a shock. He began to estimate the duration of the preliminary tremors and endeavored to ascertain the direction of the principal movements. Soon the vibration became large, and after three or four seconds from the time of commencement, he felt the shock very strongly indeed. Seven or eight seconds passed and the building was shaking to an extraordinary extent, but he considered these movements not yet to be the principal portion. When he counted the twelfth second from the start, there arrived a very strong vibration which he took at once to be the beginning of the principal portion. Now, the motion instead of becoming less and less, as usual, went on to increase its intensity very quickly, and after four or five seconds he felt it to have reached the strongest [3].*

A lay person's description of the same events are provided by Otis Manchester Poole, General Manager of Dodwell & Co. who was also at his desk in his Yokohama office that morning.

*I had scarcely returned to my desk when, without warning, came the first rumbling jar of an earthquake, a*

*sickening sway, the vicious grinding of timbers and, in a few seconds, a crescendo of turmoil as the floor began to heave and the building to lurch drunkenly.... The ground could scarcely be said to shake; it heaved, tossed and leapt under one. The walls bulged as if made of cardboard and the din became awful...For perhaps half a minute the fabric of our surroundings held; then came disintegration. Slabs of plaster left the ceilings and fell about our ears, filling the air with a blinding, smothering fog of dust. Walls bulged, spread and sagged, pictures danced on their wires, flew out and crashed to splinters. ... How long it lasted, I don't know. It seemed an eternity; but the official record says four minutes...[9]*

Perhaps one official record claimed four. Others said 10 minutes of felt vibration, and up to two and a half-hours of constant motion. [6] More than 200 aftershocks followed the 7.9 M main event on Sept. 1st. On Sept. 2nd, an excess of 300 shocks was recorded, including a major event at 11:47 a.m. More than 300 additional shocks would follow from September 3-5. In all, seven prefectures were affected by the quake. These were Tokyo, Kanagawa, Shizuoka, Chiba, Saitama, Yamanashi and Ibaraki. The greatest destruction occurred at Yokohama, which at the time was the premier commercial port of Japan. The degree of shaking felt in the affected regions varied greatly because of soil structures. The epicenter of the largest quake was close to Oshima Island. This island consisted mostly of lava and scoria and experienced comparatively little shaking or ground level changes. But both the cities of Tokyo and Yokohama are located on alluvium or soft river deposits. An American geologist, T. A. Jagger, observed:

*"The geology indicates transition from hard andesites at Izu, through indurated Tertiary sediments at Misaki and Boshu, to soft quaternary beds and modern river deltas about Yokohama and Tokyo. The cities were thus on the worst ground, and suffered heavier shaking than the Izu peninsula, although farther away from the seismic*

centers.” [7]

An unusual characteristic of the Great Kanto earthquake was the dramatic upheaval and depression of the ground. The earth was lifted as high as 24 feet at Misaki, substantially changing the shape of the shoreline. This uplift lasted only about 72 hours, however, before the ground began to sink, at first by as much as two feet per day. When the settling had ceased, an offset of some 5 feet remained. The dramatic uplifting and depression of the ground resulted in thousands of landslides, the worst of which occurred in Idu province. Here the entire village of Nebukawa was buried by a massive mudflow, killing hundreds. Landslides were also observed on the Miura Peninsula, the southern part of Boso Peninsula, and the mountainous district of southwestern Sagami.

The Central Meteorological Observatory in Tokyo listed the general area of upheaval as the Boso Peninsula and the Shonan district. The epicenters of the numerous shocks that followed the main event were scattered between the southern section of the Boso Peninsula and the coast of Sagami Bay. The Observatory also noted ground upheavals of approximately nine feet near Mera, at the southern end of the Boso Peninsula and eight feet in the neighborhood of Oiso. The Imperial University in Tokyo obtained the only direct measurement of acceleration from the earthquake assessed at 10% of gravity. Maximum acceleration in the alluvial ground at Yokohama was later estimated to be 40% of gravity.

Not long after the earthquake, the Government Fishery Institute and the Hydrographical Department of the Navy undertook missions to survey the sea floor in the area of the quake at a depth of 600 to 800 fathoms. Their findings corroborated the theory that two distinct earthquakes occurred in Sagami Bay. One was centered east of Hatsushima Island and to the north of Oshima Island. The other originated to the southeast of Manazuru point. These missions also revealed new ridges 180 to 300 feet in height on the ocean floor in line with a volcanic chain that extends for hundreds of miles in a south-southeasterly direction. It appears that a collapse into a rift occurred along the line of this volcanic chain.

A tsunami followed the earthquake, but in this, at least, the citizens were somewhat fortunate. There was no large wave inside Tokyo Bay. A substantial wave — up to 39.5 feet — did strike along the north shore of Oshima Island, but comparatively little damage was done. Waves three to 20 feet in height were recorded along Izu peninsula and the Bosshu coastline.

## **Fire**

No less ferocious than the earthquake itself was the conflagration that followed the earth shaking. When the earthquake struck, coal or charcoal cooking stoves were in use throughout Tokyo and Yokohama in preparation for the noontime meal and fires sprang up everywhere within moments of the quake. Improper storage of chemicals and fuel further contributed to the holocaust. In Yokohama alone, 88 separate fires began to burn simultaneously and the city was quickly engulfed in flames that raged for two days. Although the recorded wind speed was lower in Yokohama than in Tokyo, fire-induced wind spawned numerous cyclones, which further spread the flames. In Tokyo, the wind reached speeds of 17.9 miles per hour and became the chief obstacle to containing the fire. Temperatures soared to 86 °F late into the night.

The casualties from the fires are a horrifying combination of people who were trapped in collapsed buildings and those who took refuge in areas that were later surrounded and consumed by fire. The greatest loss of life occurred at the Military Clothing Depot in Honjo Ward, where many of the refugees had gathered. Most of them carried clothing, bedrolls, and furniture rescued from their homes. These materials served as a ready fuel source, and the engulfing flames suffocated an estimated 40,000 people.

O. M. Poole, who had fled his Yokohama office after the main shock to a yacht anchored in the harbor at Yokohama, described the continuing destruction as night fell.

*In the enveloping summer night, the relentless roar of flames sounded like heavy surf, with frequent crashes of thunder. We seemed to be in the centre of a huge stage,*

*illuminated by pulsing, crimson footlights. ...we could see a thin rim of fire all around Tokyo Bay, meaning that fishing villages and small towns were all sharing the same fate; the glare above Yokosuka, where the jaws of the bay come close together, showed that the Naval arsenal was also going up. Northwards over the water there rose on the horizon a billowy, pink cloud like cumuli at sunset, so distant as to seem unchanging and motionless, yet each time one looked it had taken a different shape. This was Tokyo burning, and by the cloud's titanic proportions we knew the whole city must be in flames, as indeed most of it was. [9]*

Poole was not alone seeking refuge in the Yokohama harbor. By nightfall the harbor was full of refugees on board ships both foreign and local. The following morning, oil that had been seeping into the water caught fire and there followed a mad scramble to get the ships out to open sea before they were engulfed in flames. Many people were injured when they were caught at the end of a burning pier.

Days passed as the smoldering embers slowly cooled and the aftershocks diminished and finally stopped. In the desolate ruins left behind, it was difficult to distinguish earthquake damage from that which had burned. It is estimated that at least 80% of the total destruction in Yokohama was due to fire. [3]

### **Social Impacts**

The number of houses partially or completely destroyed totaled in excess of 694,000. Of these, some 381,000 were burned, 83,000 collapsed, and 91,000 partially collapsed. These numbers highlight the devastating effects of the fire following the earthquake.

The initial earthquake severed water mains. Potable water shortages became a tremendous problem to the survivors, and there was no possibility of fighting the fire. Also destroyed in the earthquake and fire were telephone and telegraph systems, leaving the people of Yokohama and Tokyo completely cut off

from the outside world. There was no way for them to know if the entire country was in ruins or if their own circumstances were among the best or the worst. Travel was made impossible due to the destruction of railroad tracks, damaged bridges, loss of power to electric tramways, and roads choked with rubble. All major newspaper offices were destroyed by fire. Signs were posted informing people of everything from relief efforts and where to contact relatives, to the dire consequences of looting.

On the evening of September 2nd, the Army Aviation Headquarters ordered aviators to Osaka, Yamada, and Shibata to convey news of the disaster. In the first week, more than 500 messages were also dispatched to various cities by carrier pigeon. The steamer *Korea*, which was anchored in Yokohama harbor at the time of the quake, was the first to send out messages seeking help. The first distress signal via the ship's wireless was sent to the Governor of Tokyo. This received no reply, as Tokyo was in the same predicament. A second message was sent to Osaka, where it was converted to a high-power general broadcast. This was picked-up by the American Asiatic Squadron located off the coast of South China. Immediate relief in the form of 2,500,000 yen worth of goods was sent to Yokohama. Similar help came from a number of other ships who happened to pick up the message, including an American steamer loaded with cargo intended for Hankow, which changed course and joined in the relief effort.

News of the earthquake reached the United States on the evening of September 1st, and a humanitarian relief effort was immediately launched. A sum exceeding ten million dollars was raised in just a few days. Similar efforts were mounted by a number of countries.

On Sept. 2, the government proclaimed an emergency requisition ordinance, which allowed the issue of orders for any type of goods considered necessary to the relief effort. Those who failed to comply with the requisition orders were subject to punishment. An Emergency Relief Bureau, with the Prime Minister and the Minister of the Interior acting as President and Vice-president was also established. On September 4th, the Emperor of Japan allocated 10 million yen to be spent to aid in the relief

effort.

At the same time rumors of foreigners planning some form of takeover in the aftermath of the disaster spread among a frightened population. On Sept. 5th the Prime Minister issued a warning to the public that these rumors were without basis and were contradictory to the spirit of assimilation that Japan wished to achieve. Nonetheless, the rumors led to groups of vigilantes who patrolled the streets, and there were accounts of attacks on Korean citizens. This prompted the government to open a shelter where as many as 3,075 Koreans were lodged for their own safety. By Sept. 8, the city of Tokyo was placed under martial law, and the army became instrumental in distributing food and beginning the long reconstruction process. Martial law allowed the government to disperse people, prohibit or suppress newspapers or advertisements, seize property, enter buildings, or take any action it deemed necessary to maintain order. Citizens caught in the act of looting were hanged or shot.

Electric lighting was first provided to Tokyo in the form of a searchlight and 40 other lamps that belonged to the 1st Telegraph Regiment. There was unfortunately no such relief in Yokohama, which remained in darkness for several nights. After electricity was restored in Tokyo, the lights were transferred to Yokohama where they were used until service could be restored there. Engineering corps were dispatched to begin repairs on railways, telegraphs, roads, and bridges, while medical corps worked among the thousands of injured refugees. As staggering as were the initial losses of life and property, there were more hard times to come. With a huge number of industries destroyed, unemployment was an immediate and lasting problem. The Bureau of Social Affairs [2] listed the percentage of those who lost their jobs at 45.04. In general, the early 1920s had been good times for Japan's growing economy. While most of Europe was laboring under the effects of World War I, Japan was enjoying relative economic prosperity. Prior to the earthquake, Yokohama was a booming international port. Afterwards, recovery was painfully slow, as foreign investors were very hesitant to rebuild there.

### ***About These Images***

The images presented here portray the devastation from the 1923 earthquake and fire. Paul Whiting of Australia provided electronic copies of these images to the University of California, Berkeley on a CD-ROM he had produced titled "Images of Disaster." To the best of Mr. Whiting's knowledge, all these photographs were taken by his great uncle, Edgar Sykes, who lived in Japan for many years helping to establish the Japanese wool weaving industry centered in Yokohama. The images were on 1/4-inch glass plate negatives with some damaged prints. Prints were made or scanned, cleaned, and the tonal range of the images was improved. The photographic information is based on original comments written on the back of the prints. The images were most likely sent to Mr. Sykes' brother in England who later moved to Australia.

## References

1. American Society of Civil Engineers, **Report of Special Committee on Effects of Earthquakes on Engineering Structures**, New York: 1929. [Unpublished manuscript available in microfilm]
2. Bureau of Social Affairs Home Office, Japan. **The Great Earthquake of 1923 in Japan**. [Tokyo?]:1926.
3. Busch, N.F. **Two Minutes to Noon**, Simon and Schuster, New York: 1962.
4. Cameron, C. **The 1923 Great Kanto Earthquake and Fire**. National Information Service for Earthquake Engineering (NISEE), University of California, Berkeley, 1998 (draft).
5. Freeman, J. R. **Earthquake Damage and Earthquake Insurance**. McGraw-Hill Book Company, Inc., New York and London: 1932.
6. Hadley, H. M. "How Structures Withstood the Japanese Earthquake and Fire", **Proceedings of the Twentieth Annual Convention of the American Concrete Institute**. Chicago, February 25-28, 1924.
7. Imamura, A. "A Diary of the Great Earthquake: September 1-3 Inclusive" **Bulletin of the Seismological Society of America**, March, 1924, pp 1-5.
8. Imamura, A. "Preliminary Note on the Great Earthquake of Southeastern Japan on September 1, 1923" **Bulletin of the Seismological Society of America**, June, 1924, pp 136-149.
9. Jagger, T. A. "The Yokohama-Tokyo Earthquake of September 1, 1923" **Bulletin of the Seismological Society of America**, December, 1923, pp 124-146.
10. Otani, S. "A Brief History of Japanese Seismic Design Requirements", **Concrete International**, December, 1995, pp 6-53.
11. Poole, O. M. **The Death of Old Yokohama**, George Allen and Unwin, Ltd., London: 1968.