

FOREWARD

This picture was produced under the auspices of GHR, by Japanese scientists, cameramen, directors and editorial staffs working under the supervision of 1st Lt., Daniel A. McGovern, AC and Mr. Dan B. Dyer of the United States Strategic Bombing Survey, Motion Picture Project.

This production is a photographic summary of the scientific investigations conducted by Japanese scientists in Hiroshima and Nagasaki and presents their factual findings in a manner designed to facilitate the study of various phases of atomic research including physical damage, radiation, heat, blast, and flash burns as well as the medical, biological and botanical aspects of the problem.

Daniel A. McGovern

DANIEL A. MCGOVERN
1st Lt., Air Corps
Officer In Charge
Of Production

**EFFECT OF THE ATOMIC BOMB
ON HIROSHIMA AND NAGASAKI**

COMMENTARY

AND

TITLES

I N D E X

HIROSHIMA

1. DAMAGE IN GENERAL ON HIROSHIMA
2. THE PHYSICAL SCIENCE REPORT ON HIROSHIMA
 - a. RADIOACTIVITY
 - b. SHADOW
 - c. HEAT
3. BIOLOGICAL STUDIES AT HIROSHIMA
4. EFFECTS ON THE HUMAN BODY IN HIROSHIMA

NAGASAKI

1. DAMAGE IN GENERAL ON NAGASAKI
2. THE PHYSICAL SCIENCE REPORT ON NAGASAKI
 - a. SHADOW
 - b. HEAT
 - c. ELAST
 - d. RADIOACTIVITY
3. EFFECTS ON THE HUMAN BODY IN NAGASAKI
4. BIOLOGICAL STUDIES AT NAGASAKI
5. EPILOGUE

TOP TITLES

Title 1

EFFECTS
OF
THE ATOMIC BOMB
ON HIROSHIMA AND NAGASAKI

Title 2

FORWARD

COMPLETED UNDER THE AUSPICES
OF GENERAL HEADQUARTERS

BY

UNITED STATES STRATEGIC BOMBING SURVEY
(MOTION PICTURE PROJECT)

WITH THE ASSISTANCE OF

G-2 NAVAL TECHNICAL MISSION TO JAPAN
AND
THE SURGEON GENERAL'S OFFICE

Title 3

PRODUCTION SUPERVISION
UNDER THE DIRECTION OF

1ST LT. DANIEL A. MC GOVERN, AC

MR DAN B. DYER
UNITED STATES STRATEGIC
BOMBING SURVEY

TITLE 4

A Cinematographic Record made by
the Nippon Eiga Sha of studies made
by the Special Commission of the
Natural Research Council of Japan

Title 5

Photography and Recording
by
the Nippon Eiga Sha Staff

Title 6

PRODUCTION STAFF

Producer - Akira Iwasaki
Associated - Ryuchi Kano
Producers - Hideji Aihara

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Physics phase Chozo Obata
Biological phase Dairokuro Okyama
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Narrator Yoshiro Shimanouchi

Title 7

PHOTOGRAPHY

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HIROSHIMA (1)

DAMAGE IN GENERAL ON HIROSHIMA

Title 8

HIROSHIMA

Photographed
Sept. 21 to Oct 10
1945

Title 9

1945

Title 10

AUGUST 6TH

Superimposed
Title 1

HIROSHIMA STATION

Superimposed
Title 2

HIROSHIMA
PREFECTURE OFFICE

Superimposed
Title 3

DAMAGED STRUCTURES (APPROXIMATE)

NUMBER BEFORE THE
BOMBARDMENT.....75,000

COMPLETELY RUINED.....55,000
HALF RUINED.....2,200
COMPLETELY DESTROYED.....6,700
HALF DESTROYED.....3,700

TOTAL 67,600

Superimposed
Title 4

CASUALTIES (APPROXIMATE)

POPULATION BEFORE
THE BOMBARDMENT.....350,000

KILLED.....66,000
MISSING.....10,000
SERIOUSLY WOUNDED.....18,000
WOUNDED.....44,000
SLIGHTLY WOUNDED.....60,000

TOTAL 194,000

Title 11

These effects on the surface
were inspected several times
by scientists from various
universities and research
institutes a few days after
the bombing.

Title 12

Later, several study parties
devoted to the various bran-
ches of science were organ-
ized by the Japan council for
Scientific Research and dis-
patched to Hiroshima and Nag-
asaki.

Title 13

Staffs of the Nippon Eiga Sha
accompanied each of these study
parties to record their obser-
vations in pictures.

HIROSHIMA (2)

THE PHYSICAL SCIENCE REPORT ON

HIROSHIMA

(a)

RADIOACTIVITY

Title 1

THE PHYSICAL SCIENCE REPORT ON
HIROSHIMA

Title 2

RADIOACTIVITY

SCIENTIFIC SUPERVISION
Institute of Physical and Chemical Research
Dr. Yoshio Nishina and Staff

Title 3

Was the bomb dropped on Hiroshima atomic?
The surest way to determine this was to
measure wheather or not the material
elements found in the city contains
radioactivity.

This was the first step taken in devastated
Hiroshima. Soil was collected from all parts
of the city and studied. It then became known
that the bomb was atomic. As to the effects
of radioactivity, studies are still continuing.

HIROSHIMA (2)

THE PHYSICAL SCIENCE REPORT ON
HIROSHIMA

(b)

S H A D O W

Title

SHADOW

SCIENTIFIC SUPERVISION

Dr. Yoshio Mishina
Mr. Kazuhara Kikura
Mr. Eizo Tajima

Institute of Physical and Chemical Research

HIROSHIMA (2)

THE PHYSICAL SCIENCE REPORT ON

HIROSHIMA

(c)

H E A T

HEAT

Title

SCIENTIFIC SUPERVISION

Dr. Takeo Watanabe
Professor, Tokyo Imperial University

HIROSHIMA (3)

BIOLOGICAL STUDIES AT HIROSHIMA

Title 1

BIOLOGICAL STUDIES AT HIROSHIMA

SCIENTIFIC SUPERVISION

By Mr. Hiromi Kanayama
Institute of Physical and Chemical Research
Sept. 25 --- Oct. 2, 1945

Title 2

It has become known from studies that when plants are exposed to a large dose of penetrating rays (neutrons, gamma rays and X-rays) --- There is a decrease in the percentage of germination and a notable retardation in their growth. Various anomalies are also caused in the external morphology of plants grown from rape seeds. Cell divisions behave abnormally.

HIROSHIMA (4)

EFFECTS ON THE HUMAN BODY IN HIROSHIMA

Title 1 EFFECTS OF THE HUMAN BODY
DATE: Oct. 1 -- 20, 1945

Title 2 BURNS

Title 3 INJURIES

Title 4 RADIATION SICKNESS

Title 5 PATHOLOGY

Superimposed BONE - MARROW
Title 1

Superimposed SPLEEN
Title 2

Superimposed LYMPHNODES
Title 3

Superimposed SKIN
Title 4

Superimposed TESTICLES
Title 5

Superimposed OVARY
Title 6

Superimposed INTESTINE
Title

Superimposed
Title 8

LUNG

Superimposed
Title 9

LIVER

Superimposed
Title 10

KIDNEY

Superimposed
Title 11

ADRENAL GLAND

Superimposed
Title 12

HYPOTHYROIDISM

Superimposed
Title 13

THYROID GLAND

Title 6

PRINCIPAL HOSPITALS AND
FIRST-AID STATIONS
DATE: OCT. 1 -- 20, 1945

Title 7

SHORTAGE OF MEDICINES
CLOTHING, FOOD AND HOUSING

NAGASAKI (1)

DAMAGE IN GENERAL ON NAGASAKI

Title 1

N A G A S A K I

Photographed
Sept. 21 to Nov. 26, 1945
and
Dec. 21 to Jan. 25, 1946

Title 2

AUGUST 9th

NAGASAKI (2)

THE PHYSICAL SCIENCE REPORT ON NAGASAKI

(a)

S H A D O W

Title 1

THE PHYSICAL SCIENCE REPORT ON NAGASAKI

Title 2

SHADOW

SCIENTIFIC SUPERVISION

Dr. Yoshio	Nishina
Mr. Masaharu	Kimura
Mr. Hizo	Tajima

Institute of Physical and chemical research

NAGASAKI (2)

THE PHYSICAL SCIENCE REPORT ON NAGASAKI

(b)

H E A T

Title 1

HEAT

SCIENTIFIC SUPERVISION

Dr. Takes Uetanabe

Professor, Tokyo Imperial University

NAGASAKI (2)

THE PHYSICAL SCIENCE REPORT ON NAGASAKI

(c)

B L A S T

NAGASAKI (2)

THE PHYSICAL SCIENCE REPORT ON NAGASAKI

(d)

R A D I O A C T I V I T Y

RADIOACTIVITY

Title 1

SCIENTIFIC SUPERVISION

Dr. Yoshio Nishina
and Staff

Institute of Physical and Chemical Research

Dr. Kenichi Shinohara
Professor, Kushu Imperial University

Title 2

The damage done by the Atomic Bomb was obviously great. It was obvious to anybody. Naturally even more interest was felt from the viewpoints of scientists. The calculation of the radioactivity at Nagasaki was started by Dr. Kenichi Shinohara.

NAGASAKI (3)

EFFECTS ON THE HUMAN BODY IN NAGASAKI

Title 1

EFFECTS ON THE HUMAN BODY

DATE: SEPT. 24 - 25, 1945

NAGASAKI (4)

BIOLOGICAL STUDIES AT NAGASAKI

Title 1

BIOLOGICAL STUDIES AT NAGASAKI

SCIENTIFIC SUPERVISION

Mr. Hiroshi Nakayama

INSTITUTE OF PHYSICAL AND CHEMICAL RESEARCH

OCT. 12 - 17, 1945

Title 2

A few examples will now be shown as to how the effects of heat rays or penetrating rays vary in relation to the distance from the center of explosion.

Title 3

We have seen the disastrous effects of the atomic bomb on plant life. These were entirely caused at the moment of explosion by heat, blast, or penetrating rays.

One of the great worries of the public at first was whether or not the radiation of radioactive substances which were either induced in the soil by neutrons emitted from the bomb or produced as a smoke by the bomb explosion and later brought down to the ground, would have ill effects on living things.

Results of studies made by physicists show that radiation still remaining in the soil is so weak to cause worry. Here is a good example which makes this fact clear.

EPILOGUE

DAMAGE IN GENERAL ON HIROSHIMA
(ENGINEERING AND CONSTRUCTION ASPECTS)

(H I R O S H I M A)

- (1) From the beginning of 1945, the whole of Japan was within the bombing range of the United States Strategic Air Force based in the Mariannas. As the days and weeks went by, the bombings became increasingly intensified. Not only the coastal waters, but the inland regions and the hind side of Japan came under the wings of the Superfortresses.
- (2) Hiroshima, a city of 350,000 facing the inland sea, was the largest city in the Chugoku district in Western Honshu, the main island of Japan. Here was located the army headquarters for the Chugoku district. Since the time of the Sino-Japanese War of 1894-95, when the Imperial General Headquarters was temporarily established, Hiroshima was an important military base. The port of Ujina, Hiroshima's outport, served as a supply and transport base throughout the war, while the neighboring towns of Kure was one of the principal naval bases of Japan.
- (3) It was the 6th of August. The air-raid alarm which had been on from the night before throughout the Chugoku district was lifted for the time being. It was an unusually calm and clear morning. A few minutes after eight o'clock, two Superfortresses in formation appeared over the city. Then a bomb came hurtling down from one of the giant bombers.
- (4) There was a blinding flash, then a deafening explosion. In

an instant, Hiroshima was a scene of unprecedented chaos.

(5) Hiroshima was instantly transfigured. There was nothing left but ruins, nothing standing to hinder a full view of the city.

(6) Every type of transportation was completely wiped out. All institutions and organizations, public and private, were destroyed. Their functions came to a complete standstill. For several days little information was available.

(7) Over the radio from the United States came the announcement that the deadly weapon was the atomic bomb, the first ever used in the world.

(8) As the situation quieted down, it became clear how fearful the bomb was--fearful beyond ordinary human imagination. The first casualty report gave the dead as 30,000 and the injured as 86,000. Later, it became known that the casualties were actually much larger.

Ninety per cent of the 75,000 buildings and dwellings in the city were completely destroyed by blast and fire.

The total casualties were approximately 194,000. Accurate figures are unknown and difficult to obtain because of the confusion which gripped the city for several days and because several unaccounted army units were stationed there at the time.

(9) The scope and extent of the devastation testify more eloquently than anything to the enormous destruction power of the

new bomb.

The direction in which the trees fell offered one clue in locating the center of destruction. Hereafter we shall call the center of detonation the epicenter.

As seen from here, the epicenter was South or on the other side of the torii gateway to the Gakoku Shrine.

(10) We considered the damage area to be within 15 kilometers from this point.

This, for instance, is Itsukushima, 15 kilometers from the epicenter, or at the outside limit of the afflicted area.

Damage here was confined to broken windows.

(11) This is Yano Station, about 10 kilometers from the epicenter. Here, too, the only damages were broken windows.

(12) Within the radius of 8 kilometers, shattered windows were more widespread. At some places, tilted roofs were also damaged.

(13) Generally speaking, at points about 5 kilometers from the epicenter, sides of objects which faced the blast showed more extensive damage. Damage was greater as we approached the epicenter. Roof-tiles were shattered or blown off and here and there Japanese dwellings leaned over to one side.

(14) This is Hiroshima Meteorological Observatory, situated on a hill at the Eba, about 4 kilometers from the epicenter. Here we found evidence of the powerful atomic blast, especially in the seismograph Room. Noticed pieces of glass lodged into the wooden

cabinet.

(15) As we drew nearer to the epicenter, we saw buildings, their walls blown out and their roofs blown down.

Ordinary wooden Japanese houses are supported with pillars four inches square. Upon these pillars rest wooden trusses and over them are laid the roof-tiles. These houses were destroyed without a single exception. At some places fires broke out, causing more carnage.

(16) Within a radius of 2 kilometers, practically all buildings were burned.

Of the 75,000 buildings and dwellings destroyed, 80 per cent were lost by fires which started between a few minutes to an hour after the atomic explosion.

Except for their walls, concrete buildings were completely burned out. Steel frames and structures which would not burn were bent, twisted or otherwise fell in a mangled heap.

(17) This is the Japanese Red Cross Hospital 1,500 meters South of the epicenter. Here, all the surrounding wooden buildings were burned, but the main building of concrete was saved. The damaged windows indicated the power of the blast.

(18) A building of reinforced concrete one kilometer from the epicenter -- a watch dealer's store.

This is the Hiroshima Gas Company about 800 meters from the epicenter. Two-thirds of it's East side was destroyed. Upon examination of these reinforced concrete buildings, we found that in many cases faulty construction also contributed to the extent of the destruction.

(18a) This is a section of ancient Hiroshima castle one kilometer North of the epicenter, where the Imperial General Headquarters was once located. This represents the state of damage caused by the blast on wooded Japanese structures.

(19) As we drew closer to the epicenter, we found that because the blast came from overhead, such perpendicular objects as the torii gateway (which is not a strong structure in itself) remained erect on the ground.

The concrete Chamber of Commerce building near the epicenter. The damage parapets indicated that the blast came from overhead.

This is the Commercial and Industrial Exhibits building built of brick, 300 meters from the epicenter.

(20) Two bridges close to the epicenter attracted the special attention of our survey party.

The Aioi bridge 300 meters from the epicenter. The entire walk on the North side, which is further removed from the epicenter, slipped out of place by 60 to 120 centimeters. In the case of this bridge, it is believed that this was caused by the reflection of the blast from the surface of the water below. The pavement on the West side also slipped out of place.

(21) The Motoyasu bridge 100 meters from the epicenter. The interesting point about this bridge is that the copestones of the lanterns on both sides have jumped out of place in opposite directions. This indicates at a glance that the epicenter lies on a line which runs through the middle of the bridge.

RADIOACTIVITY

- HIROSHIMA -

Iron rust - this was the color of bombed Hiroshima.

Bones and sulphur were collected as we as we toured through the ruins of the devastated city.

Sulphur was removed from porcelain insulators on electric poles. These materials proved most useful in studying the characteristics of radioactivity.

Measurements were made with the Lauritsen Electroscope which is sensitive to both Beta-rays and Gamma-rays.

(Fig. Bone Curve)

When bones are bombarded by slow neutrons, the phosphorous in them becomes RADIOACTIVE PHOSPHOROUS P-32 which emits Beta-rays with a half-value period of 14 days. This curve was reduced to the value of August 6th, the day of the bombing. The ordinate indicates the intensity of Beta-rays, while the abscissa, the distance from the epicenter.

When bombarded by fast neutrons, sulphur emits protons and, like bones, produces RADIOACTIVE PHOSPHOROUS P-32.

The intensity of the Beta-ray is indicated on the graph. In this way we found the distribution of neutrons.

(PICTURE)

To determine the degree of the intensity with which the neutrons were distributed in the earth in the area of the epicenter, measurements were begun in the middle of August, proceeding to the North and South from the torii gateway of the Gokoku Shrine. Measurements to the East and West were begun in September.

This graph shows the intensity measurements. At the Gokoku Shrine in August it was 4.2 times the natural leak. About 1.5 kilometers from the Shrine, the intensity in the first part of September was 3.9.

For the sake of convenience, calculations were made on the basis of the value of the natural leak in Tokyo.

The intensity at the center was about four times the natural leaks. And so the physicists announced to the public that at no place in the devastated area did there exist such powerful radioactivity as would peril a human life.

(PICTURE)

In October, measurements were continued with the NEHER ELECTROMETER which is sensitive only to Gamma-rays. Hence, measurements with this instrument were entirely different from those made with the LAURITSEN ELECTROSCOPE. The strongest point of intensity was determined with measurements made with the NEHER ELECTROMETER. That point was 150 meters South of the torii gateway of the Gokoku Shrine and on the South side of the Shima Hospital. The epicenter was determined according to the intensity of radioactivity.

The value was 74.6-J. J indicates the intensity at which one ion pair is made in a single second in one cubic centimeter of air under normal temperature and pressure.

(T. RADIOACTIVITY IN AREAS CLOSE TO THE EPICENTER)

While taking measurements our interest was drawn to the effect of the meteorological condition at the time of the bombing. This was studied at the Observatory 4 kilometers from the epicenter.

The day was clear. A slight breeze came from the Southwest. However, the pressure-tube Anemometer stopped recording. The average

time was about 8:15 A.M. The recordings of the sunshine recorder were also interrupted at approximately the same time and showed that clouds had appeared, indicating the time of the detonation.

Thirty minutes after 8:15 A.M. ashes rained in torrents Northwest of the city in such places as Fukushima-cho, Koi and Takasu. Clothes of the refugees were stained black by the ashes.

(FIG. MAP)

This area was measured with the LAURITSEN ELECTROSCOPE in September.

Although the greatest volume of ashes fell in the vicinity of Koi Station, the intensity of radioactivity was much stronger at Takasu, 1,400 meters West of Koi.

(FIG. INTENSITY DISTR.)

Upon measuring the intensity distribution along a line running East and West through the epicenter. It was found that the point of highest intensity was at the entrance to the Ueno Garden. The intensity was 3.6 times as much as the natural leak.

The intensity was found to be still stronger in the hills behind the Fukuzoji Temple, slightly North of the Ueno Garden along the North-South line. In other words, the amount of ashes did not necessarily correspond with the intensity of radioactivity.

In their search for radioactivity in ashes, our physicists collected in eave troughs and water tanks.

Measured with the LAURITSEN ELECTROSCOPE. Some of these ashes contained radioactivity as strong as 70 times the natural leak.

(FIG. LOG CURVE)

As a result of chemical analysis, it was found that the ashes were a fission product of uranium. What are called ashes con-

tained fractions of strontium and barium, the mass number of strontium being 89 with a half-value period of 51 days and that of barium 140 with a half-value period of 12 days. The ashes were found to be fission products.

(FIGURE)

Further measurements were made in October and January with the Neher Electrometer. The area of strongest intensity was the hill to the rear of Takasu, the value being 22-J.

However, close study of the intensity distribution revealed that activity was weak at the summit of hills and other elevated places, and strong in the canyons. This is because fission products were washed down into the canyon by rain which fell several times since the bombing. The distribution was thus quite different from that at the time of the bombing.

We also found radioactivity in areas as far away as Kure and Hiro, 26 kilometers from the epicenter. It is believed that fission products whirled up high into the sky and drifted with the wind to these different places.

The discovery was also made that radioactivity in the earth did not descend below the value of 7-J, however far we went. In Tokyo or Nagasaki, the natural leak was around 5-J.

To find the answer, measurements were extended to Otake, 28 kilometers to the west. The value here was 10.3J, in other words wherever we went the value did not descend below 7-J.

S H A D O W - HIROSHIMA

In this burned out area, objects could be found which were burned in a distinctly different manner from those which were burned by fire.

For instance, concrete was discolored to a light reddish tint.

Granite was scaled off.

The surface of wooded materials were scorched black.

A characteristic of these burns was that shadows were left by obstacles.

What, we ask, can be conceived from the relative positions of the shadow and the obstacle?

For instance, what can we conceive from the shadows of the bridge? By the shadow of this walking man? Or by the shadow of such immobile objects as the railing of the bridge?

This report of ours, however, was confined to one problem namely to determine the direction from which the radiation heat came by a study of the relative positions of obstacles and their shadows.

For instance, we studied the direction of radiation by this shadow. We selected obstacles which had shadows on both sides, compared them and computed for an average. Lines were then elongated.

By such means measurements were able to determine the direction at which the bomb detonated.

This look-out post is located on top of the Credit Association building near the Hiroshima Station. The shadows found here were one of the means of determining the epicenter as well as the angle of the point of detonation.

Direction and angles were also measured by means of the shadow on the window frame of this tower atop the Chugoku Electric Supply building. The epicenter is 727 meters North of this point. Measurement of the angle showed that the point of detonation was about 580 meters above the ground.

Shadows caused by intense heat were found on the roof of the Chamber of Commerce building, 200 meters from the epicenter.

The direction of the epicenter was also measured by the shadow of the handle of this gas tank. The epicenter is about 2,300 meters to the North West.

In the compound of the Gokoku Shrine there were many granites with shadows which were suitable for making measurements, both of direction and angle.

From this shadow the epicenter was 350 meters; the point of detonation about 550 meters above the ground.

From the data thus gathered a chart was drawn to determine the epicenter.

Lines elongated from various points did not necessarily coincide at the center. However, a point within an observational error of 15 meters was determined as the epicenter. This was about 25 meters Southeast of the Shima Hospital. The point of detonation was determined as 750 meters plus-minus 20 meters above the ground.

H E A T - HIROSHIMA

Because of the phenomena found, the area of the epicenter may be called the "fused zone." One such phenomena is the granite. And one reason why it has scaled off so beautifully is that granite is a poor conductor of heat. By magnifying the granite's surface, it can be noticed that it has not only scaled off, but the mica has melted.

This is natural granite.

The melting point of Mica is 900 degrees centigrade. Hence, in the case of this granite the heat applied was over 900 degrees.

This is the Gokoku Shrine, 350 meters from the epicenter, pebbles molten like glass were also found at the shrine.

This wall was 50 meters from the epicenter. On the surface of the andesite on the wall, it appears as if some molten substance has adhered, but magnified it actually proves to be the effect of heat on the andesite itself. The molten condition is similar to that of the pebbles we saw.

The entire surface of this tile, found at the epicenter, has been fused. The heat which fused this tile was about 1,300 degrees.

This is the surface of an entirely unaffected tile showing the structure under a prism. Some of the substance shown here was fused like molten glass when sudden heat was applied.

Fused tiles found at the epicenter however were all not originally the same, as the tiles were made by different manufactures in different localities using not all together the same materials.

The manner in which the tiles fused differed the more removed they were from the epicenter, because of the difference in the angle of

H E A T - HIROSHIMA

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The manner in which the tiles fused differed the more removed they were from the epicenter, because of the difference in the angle of

radiation and declining degree of the heat.

Let us now compare the tiles found at different distances from the epicenter.

1. This was found at the epicenter
2. This one was picked up 300 meters away.
3. This one was found 550 meters from the epicenter.

The furthest limit at which tile fused was at 550 meters.

Granites however scaled off even at this distance.

By magnifying the scaled granites, we found that the mica had melted in some portions and carbonized in others. In some instances the two phenomena were found together in the same granite.

By our survey, we found that the furthest limit at which granites scaled off extended to a point about 900 meters from the epicenter, or much farther than the limit of fused tiles.

BIOLOGICAL STUDIES AT HIROSHIMA

We shall begin our tour from the outer rim of the city and proceed toward the epicenter in order to see the effects of the atomic bomb on plant life at various distances from the epicenter.

Rice fields removed by some 6 kilometers from the epicenter were burned out. In those located 8 kilometers away, half of the leaves of the rice plants were said to have been burned, but toward the end of September when we visited Hiroshima these plants had already recovered and the fields were turning mellow gold.

At points 2 and 3 kilometers from the epicenter there are two hills -- Hijiyama and Putabayama.

Here the leaves of trees facing the blast were burned out by heat rays, but at the time we inspected the area new leaves were beginning to sprout and considerable recovery was noted.

Upon close observation, signs were still in evidence of the harm plants had suffered. Leaves which were exposed to the radiation of heat rays were burned from yellow to a reddish brown. Parts of which were shaded by other leaves were unharmed.

Burns on the dai-dai or bitter orange. This is 3 kilometers from the epicenter.

The Hiroshima Higher School 3 kilometers from the epicenter, South, was spared from the fire, but the Hiragi mokusei, a specie of olives growing in the campus, were burned. The leaves in the shade, however, were unaffected. You can even see the shadows of the ash-
toothed edges printed on the leaves, below.

The urban district 2 kilometers from the epicenter was completely demolished, but even in this area signs of new life were

observed.

We then proceeded to the Gokoku Shrine, located close to the epicenter. The compound of this shrine was untouched by the fires which raged in the city, but due to powerful heat rays, all plant life completely disappeared from the surface. Life which survived in the sub-surface, however, was already beginning to grow again.

Fukuro-gusa, or pigeon grass

Mahishiba, or crab grass

Kayatsuri-gusa, a kind of sedge

No abnormal signs were observed in any of these plants.

The atomic bomb emitted powerful penetration rays, such as gamma rays and neutrons. It is here that we discovered the effects of these rays on plant life.

(TITLE 2)

This is the ordinary castor bean plant which we found at a point about 2 kilometers from the epicenter. Those we found in the compound of the Gokoku Shrine had leaves with white or yellowish green variegations, and were sometimes also deformed. These leaves are unequally lobed.

These show poor development of a part of the leaf. The chlorophyll is lacking and white patches are seen.

These are unequally lobed and shriveled.

These abnormal plants were seen in an area about one kilometer from the epicenter, but as this area was in the urban section, almost all plants were burned by fire. Hence, the area was not suitable for study as regards the effects of penetrating rays.

Because our study began rather late, sufficient results could not be obtained, but observation of such animal life as we collected

EFFECTS ON THE HUMAN BODY IN HIROSHIMA
(MEDICAL STUDIES -- HIROSHIMA)

BURNS ON THE ENTIRE BODY (Red Cross Hospital)

It was mid-summer when the atomic bomb hit the heart of Hiroshima and the people were thinly clad. Many parts of their body were exposed. In fact, quite a large number were semi-nude. First-aid stations reported that 80 to 90 per cent of the cases handled by them immediately after the bombing were burns. Burns resulting directly from the atomic bomb were caused on the parts that faced the rays. There were no burns on the opposite side.

TWO SOLDIERS WITH BURNS (Military Hospital)

These two soldiers were among the 2,000 others who were at the Chiyoda School, 1,800 meters South of the epicenter. The one at the right was wearing long trousers; the one at the left a short sleeve blouse and knickers. Burns in these cases were only on the right as the ray came from the above right-front direction. The toes of the fellow in knickers escaped burns because he had protection offered by the slippers he was wearing at the time.

MILITARY HOSPITAL NO. 2

This soldier was in his barracks about 900 meters Northwest of the epicenter. His posture at the time was somewhat like this and the ray came from the left rear. He was wearing his uniform and his hand was bandaged in white as shown in the picture. The comparatively heavy uniform was charred but the bandage hand was unaffected.

WOMAN WITH BURN SHOWING PATTERN OF DRESS (still)

Color of clothes made quite a difference, and degree of the burns varied according to the color of dress burned on the skin.

A SOLDIER (Military Hospital)

The difference in the speed of heat at blast is shown here. This soldier was 1,800 meters South of the epicenter. When he saw the flash of light he immediately fell flat on the ground. Then his cap was blown off by the blast. The cap mark around his head indicates that he was burned by the ray before the blast blew his cap off.

PIGMENTATION (Communications Hospital)

Some of the scars shown pigmentation in deep purple. On the head, however, de-pigmentation is seen.

DISTURBANCE OF FUNCTION

Disturbance of function is also caused as a result of burns.

SKIN GRAFT (Military Hospital)

Four or five days after the burn, skin was grafted from the right thigh. This is the condition a week later.

PERICHONDritis OF EAR (Red Cross Hospital)

A case of perichondritis of the ear as a result of burns.

DEFECT OF AURICLES

The bombing occurred when this fellow was in the Military Hospital 500 meters from the epicenter. Although he survived miraculously, he suffers from severe depilation.

CERATITIS

A slight case of ceratitis caused by burns. This fellow was exposed to the ray about two kilometers from the epicenter, the ray coming from his left-front.

COMPOUND FRACTURE

This girl was at the Toyo Steel Mills 1,500 meters West of the epicenter. Her left leg in the region of the knee was pinned under the debris when the building in which she was working collapsed.

RED CROSS HOSPITAL NO. 2

This Red Cross nurse was injured when the Red Cross Hospital dormitory was destroyed. A falling pillar caused a compound fracture in the right leg.

LACERATION FROM GLASS FRAGMENTS (Red Cross Hospital)

Another Red Cross nurse, working on the second floor of the hospital, suffered from lacerations caused by flying glass. Other nurses suffered from facial injuries.

ANEURYSMA (Military Hospital)

This fellow was standing three meters from a window of a building one kilometer North of the epicenter, bare from his waist up. From about the 10th day aneurysma of the right radius artery appeared.

COMMUNICATIONS HOSPITAL

This woman was one kilometer East of the epicenter. Although she was not burned, she received lacerations in the region of her left eye and ear. On September 6th the eyeball had to be removed on account of abscess of vitreous. On September 15th her leucocytes were 2,500; on the 20th, 3,500. The prognosis was poor.

FUKUYA DEPARTMENT STORE

At the Fukuya Department Store there was a sign: "Don't Touch! Infected with Contagious Disease." This corresponded to the report that cases of diarrhea accompanying high fever and bloody stool resembled dysentery.

AUTOPSY ROOM, COMMUNICATIONS HOSPITAL

On the second day after the bombing, this shack, on the premises of the Communications Hospital, was built as a ward for infection diseases -- because a violent outbreak of diarrhea and vomiting created suspicion of an epidemic.

GLOOMY WARDS

At the end of two weeks, which was the critical period, burns and cuts, which appeared to be curing suddenly worsened. Hemorrhage developed which could not be stopped. Many died and the number of deaths kept mounting from day to day.

(Still Picture- SHOWING PURPURA

Purpura appeared on the upper half of the body in a majority of cases and as it spread to all parts of the body the condition of the victim became worse.

DEPILATION (Military Hospital)

Depilation was also a characteristic symptom of the critical period. This soldier was in the barracks one kilometer Northwest of the epicenter. He suffered no burns, but around the 28th of September more than 7 weeks after the bombing, depilation developed, spots appeared accompanied by a fever of 39.5 degrees and diarrhea.

MILITARY HOSPITAL NO. 5

THIS SOLDIER WAS ABOUT 800 meters North of the epicenter. Leucocytes were 5,000. The main symptom is depilation.

DEPILATED CHILDREN (Red Cross Hospital)

A brother and a sister who were upstairs in their house two kilometers Southwest of the epicenter. It was reported, that after about a week, they began to develop symptoms of depilation, anorexia, gingival bleeding and fever.

MOTHER AND DAUGHTER

Mother and daughter, shown here were both inside their house, two kilometers Southwest of the epicenter. The daughter was injured when an icebox fell on top of her. The mother had no visible injuries and was nursing her daughter outside of the city when, a month later

she herself became seriously ill.

ANEMIC FACIES (Military Hospital NO. 7)

This woman was pinned under her house 600 meters East of the epicenter. Excoriations are observed around her ears and other places. On October the 3rd Leucocytes were 1,500; symptoms - apathic facies. Her entire family died, leaving her the sole survivor.

RED CROSS HOSPITAL NO. 7

At army headquarters less than one kilometer North of the epicenter, this fellow suffered a sprain in his loins when the barracks collapsed. A case of oedematous apathic facies with symptoms of anemia.

STILL PICTURE OF FEMUR

The bone-marrow of the upper half of the femur is red, while the bone-marrow in the lower half is fatty.

BONES 10a. 26, 21, 12

The Myelocytes are practically disappearing, leaving only plasmacytes, erythroblasts, macroblasts and megacaryocytes would re-appear.

STILL PICTURE OF SPLEEN

The spleen is generally atrophied. So also are the lymph-follicles. When burns accompanied, the fibrinoid degeneration of lymph-follicles is sometimes seen.

STILL PICTURE OF SKIN

The skin shows depitation and ulcer. The ulcer is fringed in dark purple, the center part reaching the corium with the epidermis exfoliating.

SKIN 4

On the scalp, hair roots and sweat glands are atrophied, causing depilation.

TESTICLES

The spermatogenesis in the testicles have declined and there are practically no spermatozoons left. Only cylindrical sertolli cells are left.

OVARY

In ovaries the atrophy of primordial and graaf's follicles are observed.

STILL PICTURE OF DIGESTION TUBE (STOMACH)

On the surface of the mucous membrane of the digestion tube, necrotic pseudo-membraneous inflammation is seen.

STILL PICTURE OF LUNG (Lung 23)

In the lung, bleeding and edema were often observed. Secondary infection by bacteria develops, making various abscesses large and small.

The liver shows muddy swelling when microscopically seen. while the liver cells are atrophic when viewed microscopically. When burns are combined, serious exudation in the Disse's space is observed.

STILL PICTURE OF KIDNEY

In the kidney, nephrosis, a muddy swelling, and sometimes seen with tubulus atrophied here and there.

ADRENAL GLAND

The adrenal gland was atrophied in the critical period. Histologically examined, the cortex becomes thin and atrophic.

HYPOPHYSIS

In the hypophysis the colloid, vacuolic degeneration of the basophilic cells, is observed.

THYROID GLAND 11B

In the critical period, follicles varied in size, the epithel being flat

HIROSHIMA BRANCH HOSPITAL OF RED CROSS

The Hiroshima Hospital of the Japanese Red Cross, 1,500 meters from the epicenter, was the best hospital in the city. It was completely demolished, save for the three-storied reinforced concrete building. All the installations and equipment were destroyed. Few wards and instruments were found in usable condition. One hundred fourteen of the in-patients were injured. Among the hospital staff and nurses under training 36 were killed, and nearly 300 injured, leaving only 36 physicians and 120 students in any condition to handle the patients. Though short-handed they did amazing work amidst the confusion which followed the bombing - such as fighting the fire, and taking care of 400 cases within the hospital itself, as well as caring for who rushed here from the outside.

HIROSHIMA COMMUNICATIONS HOSPITAL

The Communications Hospital, 1,500 meters Northeast of the epicenter, also overflowed with patients. Medical supplies amounting to one hundred thousand yen(yen 100,000) were completely exhausted on the 4th day. Out of 12 doctors and pharmacy staff, 3 were killed and 5 injured, including the director. Only 7 of them, including the injured, were able to work immediately after the disaster at defending the hospital from the spreading flames and treating the injured.

TEMPORARY AUTOPSY ROOM

The shack which was built immediately as an isolation ward, because of fear of possible epidemics, is now used as a temporary autopsy room.

OSHIBA PUBLIC SCHOOL

The Oshiba Public School, two and a half kilometers North of the epicenter, was used as a first-aid station. The entire neigh-

borhood was encircled by fire and everybody was forced to abandon the place temporarily, leaving behind the seriously wounded who could not be moved. As soon as the fire was brought under control, the residents returned to resume their duties. Among the first of them were two physicians, three dentists, two pharmacists and one mid-wife whose services were badly needed.

KOI NATIONAL SCHOOL

The Koi Public School, two and a half kilometers West of the epicenter. Victims came here were in a horrible condition. When they arrived many collapsed and died. Doctors and school teachers worked hand in hand to administer treatments, and even to cook meals.

This great post was erected in memory of the hundreds who died and were cremated.

KUATSU PUBLIC SCHOOL

The Kusatsu Public School 5 kilometers from the epicenter, Southwest. The building was only slightly damaged. Patients were removed from first-aid stations into the Western section of the city and concentrated here.

LECTURE HALL

Day in and day out, Professor Araki of the Kyoto Prefectural Medical College was engaged in autopsy work in this dimly lit warehouse.

NINOSHIMA QUARANTINE STATION

The army quarantine station at Ninoshima on Hiroshima Bay, 11 kilometers from the epicenter. A field hospital was immediately established here and patients who were brought here by boat received first-aid treatment and were given lysol baths. Two thousand patients were brought here on the atomic bomb day alone. Eighty members of the

army medical corps worked without a wink of sleep for three consecutive days and nights under the supervision of army surgeons. The hospital attached to the quarantine station containing 1,000 beds treated from 3,000 to 9,000 patients daily.

The tomb-post bears the words, "Tomb of a thousand persons." However, during the first seven days, this quarantine station alone handled more than 1,300 bodies of the dead.

GLOOMY LIFE TEMPORARY HOSPITALS (Fukuromachi Public)
(School, etc.)

To make up for the deficiencies, boiled sea water was distilled as a substitute for saline solutions. Even decoctions from persimmon leaves were made where vitamin B was needed. Lack of medical supplies and food generally weakened the physical condition of the inmates.

SHATTERED WINDOWS OF HOSPITAL

One hospital director told us, "People will be discharged from here, but they have no place to go. Our hospital is no longer a hospital, it's becoming a regular slum."

DAMAGE IN GENERAL ON NAGASAKI
(ENGINEERING AND CONSTRUCTION ASPECTS)

(N A G A S A K I)

(1) T. (Nagasaki)

(2) The second tragedy visited Nagasaki, a historic port city in the Northwest of the island of Kyushu.

(3) The port of Nagasaki is a deep inlet connected with the East China sea. Surrounded by house-covered hills, Nagasaki is, or rather used to be, one of the most picturesque port cities of Japan.

It's population at the time of the disaster was 270,000. An old seaport, Nagasaki was also active industrial city with shipbuilding yards, steel mills, ordnance factories, and electrical manufacturing plants. With Sasebo Naval Base and the Omura Air Field nearby, Nagasaki constituted an important military zone.

Nagasaki, if you will recall your history, was the gateway to Japan in medieval times. Through it flowed into Japan the world's civilizations before Japan secluded herself from the outside world for nearly three centuries. Evidence of these old contacts with the outside world were the many temples, whose architecture was fashioned after that of old China, and the Roman Catholic churches. Nagasaki is the holy land of Japanese who embrace the Roman Catholic faith; 22,000 of them lived in Nagasaki.

(4) Came the deluge three days after the tragedy visited Hiroshima. The date -- the 9th of August 1945.

(5) The day was calm, bright and windless. A hot Summer/sun shone upon the city. Since early morning an air-raid alarm was on

in the Nagasaki-Sasebo area. Then it was lifted. But two hours and a half the alert warning continued to prevail. Then, exactly at 11 o'clock, two Superfortresses appeared over the city from the Northeasterly direction, flying at a high altitude. The first plane dropped three objects attached to - parachutes- At 11:02 o'clock, the second plane dropped an object, it's decent taking about 40 seconds. Then came a blinding flash, followed by an explosion, and a blaze. The destruction was the greatest ever wrought by man.

(6) The bomb missed the center of the city and detonated above a canyon to the North.

Let us now view the general scene of devastation from the top of one of the hills to the East of the city.

On the other side of the hills at the left of the harbor lies the city. These hills on both sides of the city were the breaks which intercepted the atomic blast and prevented the destruction from extending to the harbor section and the heart of the city.

At the right of this narrow pass lies the area of total devastation. All buildings, save those of stout reinforced concrete, were demolished.

The whole of the neighborhood once teemed with wooden houses and small factories. Now it's flattened out and denuded of everything. Only pebbles and broken tile remain.

The epicenter was slightly to the North of the center of this district.

We shall go to the top of the hill on the other side, the Western side, to survey the destroyed area.

We'll first view the neighborhood of the epicenter and then the urban center.

(7) According to the deductions by the group of Physicists, the point of detonation was about 490 meters above the ground and above the street block number 170, Matsuyama-cho. ✓

The epicenter is between 30 to 40 meters across the road to the right of the telephone pole in the center of the picture. This pole was there before the bombing and was damaged very little, except the second cross piece which was bent. This indicates that sudden pressure came practically from overhead.

The camera will now be turned 360 degrees to view the immediate neighborhood of the epicenter.

The epicenter is midway between where we are standing and the elevation in the background.

Trees immediately below the point of detonation were not blown down. Though burned they remained standing erect.

(8) Houses within 500 meters of the epicenter were principally of Japanese construction and were completely destroyed by the blast and by fires which were instantly started. Concrete buildings in the same area were partially destroyed, but all caught fire. Most of the human beings and animals were instantly killed.

This is a view toward the West.

We are now looking Southward.

And this is a view toward the East.

This elevation used to be a residential section. We called it the Hill of death. It was densely crowded with small wooden houses which were completely destroyed. Only broken tiles and battered pieces of concrete walls remain.

This section swarmed with tiny work shops. Only parts of wrecked machine tools were left in the wake of the devastation.

Contrary to expectations, many of the steel poles for trolley wires were not blown in this area. Some were bent in the direction of the East. But as we proceeded further away from the epicenter we found them bent or blown flat on the ground.

The body of this tramcar, made of wood, was completely destroyed by the blast from overhead, but did not catch fire. The same was the case with this one.

This one was blown off the rail and completely burned. All passengers were killed instantly.

These rails were twisted when this railway bridge was struck by the blast which came from the right side above. The girder on one side was thrown out of place by more than a meter.

The penitentiary - 300 meters from the epicenter. The wooden buildings and reinforced concrete walls were destroyed; and over 140 persons, including the inmates, the prison staff and their families were instantly killed. The powerful heat melted the surface of the tiles.

The Shiroyama Primary School 500 meters from the epicenter. The roadway trees below the school were broken at their base. All parts of this reinforced concrete building which faced the blast was completely demolished. The interior was burned out. The entire building was cracked on the side facing the blast. Parts of the ceiling on the top floor were blown down or up.

(9) All wooden construction within a radius of 1,000 meters from the epicenter were completely demolished and burned, and most of the human beings and animals were killed instantly.

Most of the steel poles from trolley wires were bent. Some were

broken or blown down.

Grass and underbrush on the hills in the area caught fire and burned, while the trees broke or fell down in the direction of the blast.

The Chinzei Middle School 550 meters from the epicenter. The top floor of this four-storied reinforced concrete building was smashed, while the entire interior of the building was burned.

The Keiho Middle School. This school building is typical of the large wooden construction. It was completely wrecked, but did not catch fire.

The Nagasaki Steel and Arms Works of the Mitsubishi Heavy Industries Company stretching from North to South for one thousand meters. The greatest part of this plant was crushed in the direction of the blast and its steel frames were greatly twisted. Some 2,500 workers were in the plant at the time of the bombing, including student workers. Two hundred of them were instantly killed, while some 480 were seriously injured.

Urakami Station, North of the Mitsubishi Steel Works, was built of wood and was completely burned down. Practically everyone here was instantly killed. A signboard facing the epicenter was not burned, but a part of the black lettering was scorched by the heat.

Tanno Shrine. The first stone torii archway was not knocked down, but half of the next one was blown down, while the other half remained standing in a precarious position. Extremely powerful pressure was applied for a mere fraction of a moment. This stone lantern has been forced out of its original position at the base.

Here are the colleges of Medicine, the Medical Junior College, the School of Pharmacy, and the hospitals attached to these instit-

utions. One of the smoke stacks leaned in the direction of the blast. Another smoke stack in the campus was knocked down.

Most of the hospital buildings, being of reinforced concrete, escaped collapse, but the interior of many of them were burned.

Because most of the hospital patients had been moved to other places, casualties were limited to 198 killed and 235 injured. But most of the students, the faculty, and employed personnel of the 3 schools, numbering about 730, died on the day of the bombing or the day after.

The Uragami Roman Catholic Cathedral, the largest in Nagasaki, 550 meters from the epicenter. Built of brick, this church could not resist the blast, it also was burned completely. Two Fathers, and a dozen or more parishioners attending confession, were buried under the debris and killed. 90 per cent of the 14,000 Roman Catholics, who had formed a settlement around the cathedral, lost their lives.

The Yamazato Public School 750 meters from the epicenter. This concrete school building was comparatively near the epicenter but was not seriously damaged. It demonstrates the fact that the extent of destruction also varied according to the design and construction of buildings.

The engineering school, a large wooden building collapsed, but did not catch fire.

(10) In the area between 1,000 and 1,500 meters of the epicenter, practically all wooden structures were destroyed by the blast and fires which followed.

The Morimachi Plant of the Mitsubishi Ordnance Factory. The greater part of this light steel frame structure was destroyed, while arched concrete ceilings supported by many pillars collapsed for the most part.

This gas tank at Ohashi-machi, was hit by the blast from left side above. It contained such a small quantity of gas that the did not ignite and explode.

The Ohashi Plant of the Mitsubishi Ordnance Factory. The greater part of this plant, which was at right angles to the blast, was destroyed. The various units constituting the plant were mostly built of reinforced concrete, but were mangled and twisted in a mighty heap. Incidentally, the aerial torpedoes used at Pearl Harbor, which marked the first shots of the Pacific War, were manufactured in this very plant. Of the 7,500 regular and student workers who were in this plant on the day of the bombing, 6,200 were killed, injured or missing.

Steel poles for transmission wires on a hill 1,300 meters from the epicenter were completely bent in the direction of the blast. The underbrush on the nearby hills caught fire and started a mountain fire.

Wooden buildings in an area extending two kilometers from East to West and three kilometers from North to South were completely destroyed by blast and fire.

All wooden buildings in an area of 4.7 square kilometers - - 2 kilometers from East to West and 3 kilometers from North to South, were also completely destroyed by blast and fire. All wooden buildings in an area of 20 square kilometers, 4 kilometers from East to West and 7 kilometers from North to South, were completely destroyed by fire alone. In short, approximately 11,500 houses were lost.

The broadcasting station, 2,400 meters from the epicenter, burned, but there was no damage to the antennae.

Most of the wooden buildings of the Nagasaki railway station were burned.

The Nagasaki Church, built of brick, was burned by fire.

The Prefectural Government Office. Parts nearer the epicenter caught fire instantly, but parts farther away caught fire from 10 to 20 minutes later. The brick building of the prefectural office burned down about an hour and a half later, after the flames had spread to other wooden buildings nearby and started a general conflagration in the entire neighborhood.

Some of the buildings in areas which escaped complete destruction by blast and fire were damaged. Areas which suffered partial destruction extended as far as 15 kilometers from the epicenter.

A casual glance at these houses makes it seem as if they damage. But most of the roof tiles were destroyed.

Even from a distance considerably removed from the epicenter, the extent of the damage varied according to the position of the building and the topography of the land. Houses standing on the projecting part of this hill suffered more severely than others in the same neighborhood.

Wooden fences with little resistance were also smashed.

Let us examine a typical wooden house. The window frame has been blown off. The roof tiles are also partly blown off. The ceiling has been wrecked. Sliding windows have been shattered.

SHADOWS - NAGASAKI

Where was the epicenter? Before we began our studies, the newspaper reported that the bomb dropped on Nagasaki was much more powerful than the bomb dropped on Hiroshima. Now what were the phenomena caused by radiation originating from such a powerful bomb? What kind of shadows were produced?

One of the replies was the discoloration of concrete.

The Medical College Hospital. From the windows facing the North-West the direction of the epicenter was measured.

The angle was measured from the pent-roof. Shadows such as this were not found in Hiroshima.

The Shiroyama Primary School.

No matter what building we went to, shadows shadows for purposes of measurements were found in abundance.

The Yamasato Primary School.

The epicenter was 700 meters from here.

The epitaph at the Urakami Cathedral. This shadow on the base stone was of great value in measuring the epicenter from the Northeast.

By drawing elongated lines from these various points, it was determined that the epicenter was South of the penitentiary at a point slightly East of the cross-road at Matsuyama-cho. The observational error in this case was about 30 meters in radius.

Now, as to the point of detonation. Measurements were made from four points.

1. One point was made from the Shiroyama Primary School.
2. Another was the Medical College Hospital.
3. Still another was the Mitsubishi Ordnance Plant.

4. And the fourth point was the Mitsubishi Steel and Arms works.

The altitude of the point of detonation averaged 490 meters,
plus-minus 25 meters. In toher words, it was lower by 80 meters
than the point of detonation at Hiroshima.

H E A T - NAGASAKI

Roof-tiles found in the zone of the epicenter indicated that radiation heat was received directly from above.

The fused surface of the roof-tiles showed several characteristics which could not be found in Hiroshima. For instance as shown here the glassy matter on the fused surface flowed downward.

The scratch on this tile must of been caused when some object was blown against it, by the blast. Countless pieces of stone fragments are seen stuck on the surface.

A comparison of the tiles found at Nagasaki and Hiroshima shows that those in Nagasaki were fused to a far greater extent.

This tile is from Hiroshima.

As the distance between the detonation point and the epicenter was much closer at Nagasaki than at Hiroshima, it would be more proper, in comparing the heat, to select objects in both cities which were found at the same distance from the point of detonation.

Tiles picked up at the epicenter at Hiroshima and 300 meters from the epicenter at Nagasaki were found, upon comparison, to show similar characteristics. It is obvious from this comparison that the effects of heat were greater in Nagasaki.

Examination of tiles made of concrete showed that whereas lead paint remained on the surface which was not exposed to the heat there was no trace of it on the surface exposed to the heat. The fused surface was magnified.

Asbestos slates have been scaled off.

Let us magnify the edges of the scaled and unscaled portions.

The scaling was not caused by blast, but by the effects of heat.

This concrete road leading to the penitentiary is about 200 meters from the epicenter.

The entire surface of the road has been beautifully fused - a phenomenon which could not be seen in Hiroshima. The same was the case with those concrete blocks.

The surface of the wayside stones were also fused.

This is the fused portion of the andesite magnified.

This is a sandstone, it's fused portion magnified.

Another example of a fused andesite.

Scaling of this kind was found on some of the stones in the embankment of the Shimokawa River which flows South of the epicenter. stones on both sides show the effects of the heat.

Tiles found about 100 meters downstream and 300 meters from the epicenter.

This one was picked up 600 meters from the epicenter at the Urakami Cathedral. Let us magnify it and see how it is fused. It very closely resembles the tiles found at the epicenter in Hiroshima.

This is a tilt from Hiroshima.

This image, made from a specimen of andesite, is scaled in one part by heat and fused in another.

The pillars at the front entrance to the Cathedral are made of granite. The mica in the granite melted in the manner shown here.

We found evidence of scaling and melting of mica on the granite torii gateway to the Sanno Shrine, as far as 850 meters from the epicenter.

Only slight effects of the heat were observed on this tile in the 850 meter area.

This tile was picked up near the Urakami Station about 1,000 meters from the epicenter. This was about the limit of the effect of heat on tiles.

We then proceeded further away from the epicenter in search of granite and other rocks. Sealing on andesite such as this was found at the cemetery behind the cathedral 1,200 meters from the epicenter.

The blackish spots on the peridotite shown here are ordinary light yellowish brown, but the heat changed them to a dark reddish color.

The granite torii gateway to the Fuchi Shrine, 1,750 meters from the epicenter shows only slight traces of sealing. This was about the furthest limit of sealing.

B L A S T - NAGASAKI

It is impossible to know what kind of power was brought into play at the epicenter. Trees standing here were split in two, suggesting that the pressure came from above. But this does not indicate the power of the pressure.

This is a wall of the penitentiary 350 meters from the epicenter. Three-fourths inch bars inside the concrete were torn by the tension. The power that tore these bars is only a small expression of the enormous power of the blast.

The brick structure of the Urakami Cathedral, 600 meters from the epicenter, did not simply collapse by itself. Before it collapsed, the entire corner-stone slipped out of position by 8 centimeters.

At the Mitsubishi Steel and Arms Works, 800 to 1,500 meters from the epicenter, all structures which took the blast on their side completely fell over.

However, the factory which stood lengthwise to the blast still stands on the ground. Only the iron sheets which were put up around the building were blown off, and the frames were unaffected. The difference between the two buildings is roughly the extent to which the structure could withstand the blast until the iron sheets had been torn off.

A simple example indicating the power of the blast was found in this wall at the Yamasato Primary School 700 meters from the epicenter. 152 centimeters in height, 822 centimeters in length, and 12 centimeters in thickness, this concrete wall jumped over two trees and moved out of place as shown here. It instantly moved 5 meters to the rear 400 centimeters at the left end, 610 centimeters at the center and 565 centimeters at the right end.

In a cemetery in the hills to the rear of the Urakami Cathedral, several tombstones were knocked down. Among them there was just one left standing on it's foundation. This indicates that the blast had approached it's maximum limit of effectiveness. This graph shows the measurements of the size of the tombstones and the extent to which they moved out of position.

This water-tank on the roof of the Mitsubishi Ordnance Plant, 1,300 meters from the epicenter, is situated some 30 meters above the ground.

It was bent by the blast, and the welded portions were cracked as seen here.

Moreover, the side which was not connected with the building by means of pipes moved as much as 40 centimeters. The second tank in the rear was also pushed back together. In this instance, there was not much difference in the power of the blast either with respect to the altitude or the ground. What, however, were the effects at the higher altitude?

As the epicenter at Nagasaki is surrounded by hills, an examination of them should provide an answer as to the effects of the blast at higher altitudes.

The summit of this mountain, Inasa is 280 meters high; the distance from the epicenter 2,350 meters.

Shacks on the summit collapsed in the manner shown here.

Except this single shack, built after the bombing, all buildings on the summit were blown down. In other words, the blast was no less at this altitude than on the level below.

In this vicinity, the only objects spared from the effects of the blast were limited to houses which were protected by hills.

The question now arises: To what distance did the effects of the blast extend? We conducted our survey in three directions.

At tegami, 6 kilometers Southeast, the ceilings were blown up and the walls were cracked.

At Futami, 9.5 kilometers, ceilings were also blown up and paper sliding doors broken.

At Tene, 15 Kilometers, paper and glass sliding doors were blown off and broken.

At Isonichi-machi, a few window panes were broken in each house. However, evidence showed that the blast was diverted by the mountains to a great extent in this area than in others.

It could be seen from the air that immediately after the earth was hit by sudden heat of tremendous intensity, it was struck by an all-powerful blast which blew past these seemingly unaffected houses and, after affecting everything it touched on it's way, it finally wound up in the sea.

RADIOACTIVITY - NAGASAKI

(FIG.) This curve represents the results of measurements made on September 10th. Radioactivity of bones collected at certain distances were examined with the Lauritsen Electroscope on a sample of 10 grams each.

(CURVE) Activity found in the bones obtained at the epicenter was 4.2 times the natural leak and was 3 times weaker than that found in Hiroshima.

(CURVE) Intensity of radiations coming from the ground was approximately the same as Hiroshima, but that at Hiroshima was slightly weaker. The value at the epicenter was 4.3 times the natural leak, while the limit of radioactivity was found to be at about 800 meters from the center.

Measurements of radiations from the ground were also made with the Neher Electroeter in December 1945 and January 1946. From the results we were able to see the general thread of distribution.

(FIG.) Calculations were made in this manner to determine the epicenter. The determination was made also with the Neher Electrometer, after a rough determination had already been made by Dr. Shinohara and others.

(FIG.) Dr. Shinohara located the epicenter at "A" which was taken as the starting point of the Neher Electrometer measurements. The intensity at this point was 39.6-J and measurements were successively made at points alphabetically indicated.

By these measurements the epicenter was fixed at a point M, the intensity being 44.8-J. The center determined from the shadow on scorched surfaces lies at point "N."

What, then, were the effects of neutrons extended into the ground?

(PIC.) To solve this question, a square hole 2x2 meters was dug at the epicenter. Measurements of the radioactive intensities were made at various depths up to one meter, but no more, as subterranean water prevented measurements beyond that depth. Results showed that intensity dropped sharply to a depth of 30 centimeters and then eased off.

(PIC.) In the Nishiyama district, about 3 kilometers from the epicenter, rain and ashes fell at the time of the detonation. Measurements were made in the same manner here as in the corresponding district of Takasu in Hiroshima.

(MAP) This is the results of measurements made with a Lauritsen electroscopes. Radiation as strong as 260 times the natural leak, was found here, thus indicating that ashes with far stronger radiation fell here than at Takasu in Hiroshima where the radiation was only 5 times the natural leak.

Radioactivity at Nishiyama decreased with time.

Curve "A" was obtained by successive measurements at different times. The half-value period was 44 days.

Curve "B" indicates radioactivity in the ground at the epicenter.

Radiation, at the epicenter, was caused by direct bombardment by neutrons; at Nishiyama by fission products. This may explain the difference in readings, but the question is yet to be clarified.

Radioactivity of the earth was measured with samples taken from a roof, shown in Curve "C" and from an sheet iron, shown in Curve "D".

Although a definite explanation of the difference is difficult, a probable explanation is that the earth taken from the roof was washed by rain and lost it's original composition.

(MAP) We know that the radioactivity at Nishiyama was due to the fission products of the atomic bomb which were brought down to the ground by

rain. It is an interesting question how far such radioactive dust extended over the Shimabara Peninsula.

To answer this question the intensities of radiation emitted by the ground were measured all over the peninsula with the Neher Electrometer.

To the Northwest, at Tokitsu the value was - 4.8-J

To the South, at Mogimachi, the value was - 4.9-J

Since all these values were about the same as the natural leak of our Neher Electrometer, we concluded that radioactive dust did not fall either to the North or to the South of the epicenter.

Because the Westwind prevailed in this district at the time of the detonation, we extended our observation toward the East and found that radioactivity extended all over the Shimabara Peninsula.

Starting from Nishiyama, we proceeded toward the East to Unzen, then as far as Shimabara, and then we encircled the entire peninsula.

From the results we saw that the strongest radioactive point was at Nishiyama; that on proceeding Eastward the intensity gradually decreased at first and then increased again, showing a second maximum of 55.4-J at Yaguni, 9 kilometers from the epicenter. The intensity then decreased again as we went Eastward until we came to Shimabara, 47 kilometers from the epicenter, where we found the third maximum of 16.4-J.

From these results, we concluded that the radioactive dust of the atomic bomb was blown high up in to the air and then drifted with the then prevailing Westwind towards the East. Some of the dust on the ground along the way. From our measurements, we surmise that the dust crossed the Ariake Sea and that radioactivity can probably be found even in the Kumamoto area.

EFFECTS ON THE HUMAN BODY IN NAGASAKI
(MEDICAL PHASE -- NAGASAKI)

Effects on the human body observed here in Nagasaki were similar to those observed in Hiroshima.

First-aid work was carried on in the large buildings which escaped destruction and at the hospitals in the neighboring towns and villages.

This is the condition we found at the Shinkosen Public School where treatments were continued over the longest period. More than 3,000 patients were treated here.

Later, patients were asked where they were at the time of the atomic explosion and whatever else they remembered. Blood corpuscle tests were also made, and medical observations and studies were carried on simultaneously with the treatments.

Many patients were brought for treatment, both outdoors and from houses which escaped destruction.

This is a burn case.

This is an example of burns on the hands and face.

And here is a case of laceration caused by flying glass fragments

The serious cases and homeless patients were accommodated in schoolrooms which used as wards.

Burns on the right thigh.

Burns on the feet.

A girl 10 years old who was 400 meters from the epicenter. She shows symptoms of anemia. Leucocyte count 1,600. Four fingers of her left hand are about to fall off on account of severe burns. Like her sister, she is losing her hair as a result of radiation.

This woman also shows anemia, and depilation caused by radiation.

This 15 year old girl has lost practically all her hair.

This little girl of 4 was 500 meters from the epicenter. For about 14 days she was as lively as she could be, but gradually she lost vitality and got edema.

A case of hemorrhage, caused by a fracture of the bone and anaemia.

This boy of 11 was 2,000 meters from the epicenter. Leucocyte 5,900. Depilation, extreme anaemia and asthenia.

This young man of 18 suffers from burns and anaemia and shows serious symptoms.

This boy of 6 lost his resistance power and developed coma. He died three days after this photograph was taken.

BIOLOGICAL STUDIES AT NAGASAKI

The city of Nagasaki is narrow and extends from North to South. The hills flanking both sides of the city are, for the most part, farmland. Because the epicenter was not in the center of the city, but in the outskirts to the North where buildings were comparatively few, the effects of the fire was insignificant, affording a convenient opportunity to study the effects of penetrating rays.

According to an American announcement, the bomb used in Nagasaki was more powerful than the one used on Hiroshima. The first impression we received at Nagasaki is that near the epicenter almost every variety of vegetation showed abnormalities.

In Hiroshima, abnormal plants were found in an area which was within 1 kilometer or so from the epicenter. In Nagasaki however, the range was greater, extending to one and a half kilometers.

We shall now see a few examples of abnormal plants.

At the foot of the hills at Shiroyama-machi, about one kilometer from the epicenter, we found a field of tare. When the atomic bomb hit Nagasaki, the entire surface of the tare field was burned out. In all the leaves which have sprouted since then, greenish yellow patterns appeared.

The Morning Glory. The shape of the leaves has changed and there is a diminished amount of chlorophyll.

The Sun Flower. In this group of sun flowers, the leaves were shriveled and showed peculiar white patches caused by penetrating rays.

The Castor Bean Plant. Like those seen in Hiroshima, the shape has changed and the leaves are shriveled.

Edisu-gusa or low senna. As in Hiroshima the leaves show white patches.

Murasaki Katabami or violet wood sorrel. White dots and shriveled leaves.

Masaki, a plant of the stuff tree family. These patches are often found under normal conditions, but these are believed to have been caused by penetrating rays. Note the white patches between the stem and the leaf.

Kakidoshi, of the mint family. Another example of white patches. They are often found under natural conditions too.

Sweet Potato. It's leaves with patches.

The Hedge. There are leaves with white lines and those which have entirely turned white.

Parts where active cell division is taking are generally most easily affected by penetrating rays. By this illustration we can see the position of the tip of the subterranean stem which was exposed to penetrating radiation

(TITLE 4)

First with regard to trees.

In the epicenter area, trees were completely burned by powerful heat. As the blast came directly from overhead, the trees did not fall but remained standing erect.

In the hills behind the Medical College, some 500 meters from the epicenter, trees which lost their leaves were beginning to sprout new ones, but only on the side not face the epicenter.

In this vicinity we discovered the agiri tree, sultan's parasol, whose side facing the epicenter was completely burned.

The epicenter is around there.

On the banks of the stream below the Uragami Cathedral, 600 meters East of the epicenter, we found the higan-haba, a plant of the amaryllis family. The stems we saw were exceedingly short, average only 6 centimeters. But as we proceeded up stream and farther away from the epicenter, we found the stems increasingly longer. At point "B" 1 kilometer from the epicenter, the stems averaged 21 centimeters. At point "C" 500 meters further beyond, we found the stems having the normal length of 46 centimeters on the average.

Rice Fields, closest to the epicenter were immediately below the cathedral. The rice plants were completely burned -- only stubble was left.

About 100 meters further, rice plants grew only sparsely, but somehow managed to grow and bear grain.

Another 800 meters even further beyond, or 1 kilometer from the epicenter, the growth appeared to be quite normal, but even this area was completely burned when the atomic bomb fell. If you comb the stalks, burnt leaves would be found among them.

Near the prison which was close to the epicenter,

This Sweet Potato Field is completely burned; if you dig into the ground you can find sweet potatoes still alive, but their sizes remain the same as at the time of the atomic bombing.

The entire hill behind the cathedral, 700 meters from the epicenter, is covered with sweet potato fields.

Feebly-looking stems were beginning to shoot out in this vicinity. If you dig, you would find that stems which existed at the time of the atomic explosion were burned completely and that new stems were seen growing out of the potatoes themselves. There were also many deformed leaves and stems found here.

To add a few remarks. In the sweet potato fields in the rear of the cathedral, various studies were possible as to the effects of penetrating radiation of sweet potatoes.

Due to the fact that there are slopes of varying degrees facing the detonation center, the amount of radiation received by plants varied greatly. We found, accordingly, various kinds of potatoes from those which do not even have buds, to those which grow normally.

The farther removed the sweet potato fields are from the epicenter, the better is their state of recovery.

In the hills behind the Medical College, about 1 kilometer from the epicenter, the sweet potatoes stem was dried up by the heat, but those hidden in the ground were alive and new stems had sprouted from them. The crop was comparatively good.

(TITLE 5)

Mr. Furuno, chief of the agricultural section of the Nagasaki Prefectural Government at the time, lost his wife and daughter when his house, located 300 meters from the epicenter, was wiped out by the explosion. Determined to stay where his house had stood, he planted buckwheat in his yard on August 13th, only 4 days after the disaster. The buckwheat is growing without showing the least sign of abnormality. Since then, Furuno has planted zakagi, a kind of onion, and this, too, is growing normally.

Experimental gardens were started in various places in Nagasaki by the faculty of Agriculture of the Kyushu Imperial University in order to study the effect of radioactivity, produced by the bomb, on the growth of rape seed, Japanese white radish, barley, buckwheat, broad beans and other plants. Everyone of them is growing well, as if no atomic bomb had ever fallen in the vicinity.

EPILOGUE

T. DESTRUCTION IS NO MORE

The cities of Hiroshima and Nagasaki, for a moment tragic scenes of devastation, have begun to recover with the passage of time. Slowly, but surely, efforts toward construction are being made.

In-sufficient though the studies of the scientists may have been, they have given hope and light to these cities and their citizens.

The day may come when atomic energy, used for the first time in the world for strategic military purposes, will be utilized toward the ends of peace and the happiness of all mankind. So is it desired, so is it hoped, and so is it believed.

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