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00:00:00,000 --> 00:00:05,000

In the aftermath of a tsunami disaster,

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00:00:05,000 --> 00:00:10,000

can underwater robots succeed where no humans can go?

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00:00:10,000 --> 00:00:13,000

This is a robot in highly radioactive water.

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00:00:13,000 --> 00:00:15,000

It's like three levels bad.

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00:00:15,000 --> 00:00:19,000

How did a shipwreck end up perfectly preserved

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00:00:19,000 --> 00:00:21,000

on the bottom of the Great Lakes?

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00:00:21,000 --> 00:00:23,000

She is completely intact.

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00:00:23,000 --> 00:00:25,000

It was almost as if it had been sort of gently placed

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00:00:25,000 --> 00:00:27,000

on the bottom of the lake.

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00:00:27,000 --> 00:00:32,000

And what's the dark secret buried inside a toxic Nazi submarine?

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00:00:32,000 --> 00:00:36,000

There is a ticking time bomb at the bottom of the ocean here.

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00:00:39,000 --> 00:00:44,000

The underwater realm is another dimension.

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00:00:44,000 --> 00:00:50,000

It's a physically hostile place where dreams of promise

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00:00:50,000 --> 00:00:53,000

can sink into darkness.

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00:00:54,000 --> 00:00:56,000

I'm Jeremy Wade.

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00:00:56,000 --> 00:00:59,000

I'm searching the world to bring you the most iconic

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00:00:59,000 --> 00:01:03,000

and baffling underwater mysteries known to science.

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00:01:03,000 --> 00:01:06,000

Shipwrecks can't just disappear, or can they?

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00:01:06,000 --> 00:01:10,000

It's a dangerous unexplored frontier that swallows evidence.

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00:01:10,000 --> 00:01:14,000

We know more about the face of Mars than we do our deepest oceans.

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00:01:14,000 --> 00:01:19,000

Where unknown is normal and understanding is rare.

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00:01:23,000 --> 00:01:30,000

The most extreme force in the ocean, the tsunami,

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00:01:30,000 --> 00:01:34,000

has killed hundreds of thousands of people over the centuries

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00:01:34,000 --> 00:01:37,000

and wrought destruction across the planet.

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00:01:37,000 --> 00:01:43,000

And the most powerful man-made force on Earth, nuclear energy,

26

00:01:43,000 --> 00:01:47,000

has wrought destruction across the planet.

27

00:01:47,000 --> 00:01:52,000

And the most powerful man-made force on Earth, nuclear energy,

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00:01:52,000 --> 00:01:56,000

has wrought destruction and death in equal measure.

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00:01:56,000 --> 00:02:00,000

So what happens when these two forces meet?

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00:02:00,000 --> 00:02:04,000

In Japan, this clash has led to a toxic mystery

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00:02:04,000 --> 00:02:08,000

that science is still struggling to solve.

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00:02:14,000 --> 00:02:18,000

March 11th, 2011.

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00:02:18,000 --> 00:02:21,000

Approximately 45 miles east of Japan,

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00:02:21,000 --> 00:02:23,000

deep beneath the Pacific,

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00:02:23,000 --> 00:02:29,000

a magnitude-9 megathrust earthquake rips through the ocean floor.

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00:02:33,000 --> 00:02:39,000

Japan is basically sitting right on top of the Pacific Rim, the Ring of Fire.

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00:02:39,000 --> 00:02:43,000

It's a whole series of deep underwater trenches

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00:02:43,000 --> 00:02:47,000

where one tectonic plate is moving underneath another.

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00:02:47,000 --> 00:02:52,000

The Pacific plate goes under the Japan plate

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00:02:52,000 --> 00:02:56,000

and it's snapped up, almost 100 feet in places.

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00:03:03,000 --> 00:03:05,000

The earthquake is so powerful,

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00:03:05,000 --> 00:03:09,000

it moves the main island of Japan 8 feet to the east

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00:03:09,000 --> 00:03:13,000

and shifts the Earth on its axis by over 6 inches.

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00:03:14,000 --> 00:03:18,000

There was the largest earthquake they had recorded there in many centuries.

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00:03:21,000 --> 00:03:26,000

But this natural disaster is only just beginning.

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00:03:28,000 --> 00:03:31,000

The earthquake created a huge series of waves,

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00:03:31,000 --> 00:03:34,000

tsunami waves or tidal waves,

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00:03:34,000 --> 00:03:38,000

that basically raced toward the mainland of Japan.

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00:03:39,000 --> 00:03:44,000

45 minutes later, waves over 40 feet high

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00:03:44,000 --> 00:03:51,000

and traveling in places at speeds of several hundred miles per hour hit land.

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00:03:58,000 --> 00:04:01,000

The harbor has this tsunami wall

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00:04:01,000 --> 00:04:03,000

and you just see the water rise up,

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00:04:03,000 --> 00:04:05,000

go to the top of that tsunami wall

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00:04:05,000 --> 00:04:08,000

and just pour over into the town.

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00:04:10,000 --> 00:04:13,000

Cars are flipped around like toys,

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00:04:13,000 --> 00:04:16,000

buildings are completely flooded and smashed,

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00:04:16,000 --> 00:04:20,000

people are swept away at a moment's notice.

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00:04:20,000 --> 00:04:23,000

It's just, it's a nightmare.

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00:04:28,000 --> 00:04:31,000

They were prepared for tsunamis.

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00:04:31,000 --> 00:04:34,000

They were not prepared for that tsunami.

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00:04:35,000 --> 00:04:38,000

Sitting right in the path of the oncoming tsunami

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00:04:38,000 --> 00:04:42,000

is the Fukushima Daiichi Nuclear Power Plant.

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00:04:53,000 --> 00:04:57,000

It flooded the plant much higher than they ever expected.

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00:04:57,000 --> 00:05:03,000

The plants were designed for a 18 foot high tsunami wave.

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00:05:03,000 --> 00:05:06,000

What actually hit them was 45 feet.

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00:05:06,000 --> 00:05:09,000

So it was three times higher than they ever expected.

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00:05:10,000 --> 00:05:13,000

It's an absolute disaster.

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00:05:14,000 --> 00:05:17,000

Who could anticipate something like this?

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00:05:17,000 --> 00:05:21,000

The angry ocean torrent floods the emergency generators,

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00:05:21,000 --> 00:05:24,000

cutting electricity to the cooling system

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00:05:24,000 --> 00:05:28,000

that keeps the nuclear reactor cores at a safe temperature.

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00:05:29,000 --> 00:05:32,000

And the cores overheated.

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00:05:34,000 --> 00:05:37,000

The gas built up inside, the pressure's increased

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00:05:37,000 --> 00:05:39,000

because they could not cool it.

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00:05:40,000 --> 00:05:43,000

It ignited with a spark somewhere.

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00:05:43,000 --> 00:05:46,000

And two of the buildings exploded.

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00:05:51,000 --> 00:05:55,000

All three reactor cores largely melt.

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00:05:55,000 --> 00:05:58,000

Then, like lava from a volcano,

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00:05:58,000 --> 00:06:02,000

they pour through six inches of steel at the bottom of the reactor

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00:06:02,000 --> 00:06:04,000

and down into concrete.

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00:06:05,000 --> 00:06:07,000

I report it was hell on earth sometimes,

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00:06:07,000 --> 00:06:09,000

with those operators in the control room,

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00:06:09,000 --> 00:06:11,000

in the dark wearing protective equipment,

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00:06:11,000 --> 00:06:14,000

trying to figure out what they were going to do.

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00:06:16,000 --> 00:06:20,000

Millions of gallons of sea water are urgently pumped in

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00:06:20,000 --> 00:06:24,000

to cool the core temperatures down to a safe level

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00:06:24,000 --> 00:06:28,000

and prevent the release of more radioactive gas.

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00:06:29,000 --> 00:06:32,000

The biggest concern in this situation, of course,

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00:06:32,000 --> 00:06:38,000

is the sort of exposure and release of radioactive materials

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00:06:38,000 --> 00:06:40,000

from the nuclear facility.

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00:06:40,000 --> 00:06:43,000

Leaks from the plant are not without precedent.

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00:06:43,000 --> 00:06:45,000

In previous spills,

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00:06:45,000 --> 00:06:49,000

thousands of tons of contaminated water have leaked into the ocean.

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00:06:50,000 --> 00:06:53,000

But it's the water around the destroyed reactors

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00:06:53,000 --> 00:06:56,000

that poses the most immediate problem.

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00:06:56,000 --> 00:06:59,000

There's different levels of water in the three reactors.

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00:06:59,000 --> 00:07:02,000

One of them is the water level is low,

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00:07:02,000 --> 00:07:04,000

the other one, the water, is about two feet deep,

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00:07:04,000 --> 00:07:06,000

and the other one is about nine feet deep.

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00:07:06,000 --> 00:07:08,000

So the molten core is underwater

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00:07:08,000 --> 00:07:11,000

and there's always water being injected on it to keep it cool.

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00:07:11,000 --> 00:07:15,000

Not only did water cause untold damage when it consumed the plant,

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00:07:15,000 --> 00:07:18,000

it's now stubbornly getting in the water.

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00:07:19,000 --> 00:07:21,000

It's now in the way of the cleanup,

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00:07:21,000 --> 00:07:23,000

and it's incredibly dangerous.

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00:07:24,000 --> 00:07:27,000

You have all this water around that radioactive material,

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00:07:27,000 --> 00:07:29,000

which in itself becomes radioactive.

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00:07:29,000 --> 00:07:35,000

Sending divers into the radioactive underwater areas is not an option.

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00:07:35,000 --> 00:07:37,000

The radiation levels are excessively high,

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00:07:37,000 --> 00:07:40,000

so it would be fatal to go inside.

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00:07:40,000 --> 00:07:44,000

So another solution needs to be found and fast,

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00:07:44,000 --> 00:07:46,000

because until it's contained,

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00:07:46,000 --> 00:07:51,000

there remains the risk of radioactive runoff leaking into the ocean.

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00:07:51,000 --> 00:07:55,000

How do the Japanese take care of this environmental disaster

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00:07:55,000 --> 00:07:57,000

waiting to happen?

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00:08:08,000 --> 00:08:13,000

Years after a tsunami floods the Fukushima nuclear facility,

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00:08:14,000 --> 00:08:18,000

almost a thousand tons of radioactive material lie scattered

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00:08:18,000 --> 00:08:22,000

and submerged in the bowels of the power plant.

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00:08:22,000 --> 00:08:27,000

Can new technology speed up the critical cleanup operation

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00:08:27,000 --> 00:08:32,000

to halt the spread of radioactive contamination to the ocean?

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00:08:34,000 --> 00:08:38,000

With the distance to Pacific being just 100 yards,

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00:08:38,000 --> 00:08:42,000

another earthquake could very easily cause a disaster

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00:08:42,000 --> 00:08:44,000

far greater than this one.

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00:08:44,000 --> 00:08:47,000

So the team is under a constant pressure to get the control

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00:08:47,000 --> 00:08:50,000

of the radioactive material and get it to a safe place.

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00:08:50,000 --> 00:08:52,000

They're not cleaning up.

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00:08:52,000 --> 00:08:54,000

They're figuring out how to clean up.

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00:08:54,000 --> 00:08:57,000

Technicians are struggling to solve the problem,

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00:08:57,000 --> 00:09:02,000

but so far they've been unable to even reach the reactor cause.

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00:09:03,000 --> 00:09:08,000

It requires technology beyond cleaning crews and human cleanup.

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00:09:12,000 --> 00:09:14,000

This is not a first.

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00:09:14,000 --> 00:09:18,000

In 1979, the Three Mile Island facility in Pennsylvania

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00:09:18,000 --> 00:09:22,000

suffered the worst nuclear accident in US history.

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00:09:22,000 --> 00:09:25,000

Lake Barrett was a director of the plant.

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00:09:26,000 --> 00:09:28,000

In the case of Three Mile Island,

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00:09:28,000 --> 00:09:31,000

we had several million gallons of highly radioactive water.

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00:09:31,000 --> 00:09:35,000

We had to develop specialized cleanup systems.

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00:09:36,000 --> 00:09:39,000

Faced with a molten core submerged in water,

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00:09:39,000 --> 00:09:43,000

Lake's team employed a pioneering solution for the time,

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00:09:43,000 --> 00:09:45,000

robots.

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00:09:45,000 --> 00:09:51,000

We had robots at Three Mile Island, very crude robots, 1980s robots.

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00:09:51,000 --> 00:09:54,000

We were able to develop the equipment to remove the core,

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00:09:54,000 --> 00:09:56,000

and over the next seven years of work,

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00:09:56,000 --> 00:09:58,000

and it was successfully removed.

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00:09:58,000 --> 00:10:02,000

But this operation required international assistance.

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00:10:02,000 --> 00:10:06,000

We were reaching out to the world for help.

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00:10:06,000 --> 00:10:10,000

The only one country in the world came to our aid in Japan.

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00:10:10,000 --> 00:10:13,000

So when I was asked to help them,

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00:10:13,000 --> 00:10:16,000

I felt that it was not necessary to do that.

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00:10:16,000 --> 00:10:21,000

Could the solution found in the US, robots, be the answer at Fukushima?

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00:10:21,000 --> 00:10:24,000

In theory, this sounds pretty straightforward.

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00:10:24,000 --> 00:10:28,000

Let's create some robots that can go in and photograph and clean up.

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00:10:29,000 --> 00:10:32,000

The practical reality is much more complicated.

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00:10:32,000 --> 00:10:38,000

The meltdown caused by the tsunami has created a no-man's land inside the reactors,

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00:10:38,000 --> 00:10:42,000

an uncharted lethal landscape, much of it underwater,

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00:10:42,000 --> 00:10:45,000

that the robots will need to navigate.

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00:10:45,000 --> 00:10:49,000

The robots have to be small to go inside the reactor vessel.

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00:10:50,000 --> 00:10:55,000

And it's complicated work to get these small ones to work and do what you want.

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00:10:55,000 --> 00:10:58,000

Wi-Fi and radio signals do not work in there

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00:10:58,000 --> 00:11:01,000

because of the thick reinforced concrete walls.

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00:11:03,000 --> 00:11:06,000

Finally, a robot is ready.

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00:11:06,000 --> 00:11:12,000

Known as Scorpion, it has cost tens of millions of dollars to develop and put into operation.

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00:11:13,000 --> 00:11:17,000

They had a camera come up like a tail of a scorpion over the front.

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00:11:19,000 --> 00:11:23,000

It went about 10 feet and it got caught on debris.

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00:11:25,000 --> 00:11:28,000

It couldn't get down into the molten core area.

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00:11:28,000 --> 00:11:32,000

This was a multi-million dollar mistake.

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00:11:32,000 --> 00:11:35,000

It's back to the drawing board.

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00:11:35,000 --> 00:11:39,000

Other robots follow, but with limited success.

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00:11:41,000 --> 00:11:44,000

They were supposed to work, we thought, for about eight hours.

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00:11:46,000 --> 00:11:52,000

They worked for about an hour and a half before the radiation basically fried the circuits inside.

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00:11:58,000 --> 00:12:02,000

The robots fail to get near the reactor cores.

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00:12:02,000 --> 00:12:06,000

You learn more from a failure than from a success in many ways.

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00:12:06,000 --> 00:12:11,000

Eventually, designers come up with an underwater robot called Little Sunfish.

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00:12:12,000 --> 00:12:16,000

Its task is to navigate into the heart of the flooded reactors.

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00:12:19,000 --> 00:12:25,000

The Sunfish was a small tethered submarine with cameras on it, about five inches in diameter,

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00:12:25,000 --> 00:12:30,000

that had to swim down through a little doorway underneath the reactor vessel.

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00:12:31,000 --> 00:12:36,000

Sunfish enters an underwater realm like no other.

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00:12:41,000 --> 00:12:45,000

Finally, it glimpses something through the murky water.

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00:12:46,000 --> 00:12:51,000

Almost stalactite-like formations dripping like candle wax.

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00:12:52,000 --> 00:12:57,000

You can see pieces of fuel and you can see molten debris.

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00:12:57,000 --> 00:13:02,000

This was the first time we got to see that, so everybody was very excited about the success of it.

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00:13:03,000 --> 00:13:09,000

With this breakthrough, the cleanup team can now look to build bigger muscle robots to remove the debris.

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00:13:10,000 --> 00:13:14,000

Without this technology, without robots, this would not be possible.

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00:13:15,000 --> 00:13:23,000

But developing and deploying this advanced robot fleet to clean up Fukushima is a major long-term challenge.

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00:13:24,000 --> 00:13:30,000

The cost of this is going to be large. It's going to be about \$200 billion.

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00:13:31,000 --> 00:13:36,000

And the technical cleanup of the site itself is going to be multi-decade.

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00:13:37,000 --> 00:13:43,000

Until the cleanup is complete, Fukushima will remain a potential radioactive risk to the neighbouring ocean.

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00:13:44,000 --> 00:13:49,000

And the ocean itself remains a clear and present danger to the plant.

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00:13:50,000 --> 00:13:55,000

What happens if there's enough earthquake, another tsunami, and we haven't dealt with this in time?

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00:14:00,000 --> 00:14:03,000

One thing we do know is that we underestimate the forces of nature,

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00:14:04,000 --> 00:14:09,000

whether the untamed power of the ocean or the harnessed energy of the atom, at our peril.

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00:14:15,000 --> 00:14:20,000

I've dived on numerous shipwrecks and many adjust that.

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00:14:22,000 --> 00:14:24,000

Rotted, rusting wrecks.

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00:14:25,000 --> 00:14:33,000

But on rare occasions, the depths offer up that holy grail of marine archaeology, the wreck that's perfectly preserved.

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00:14:34,000 --> 00:14:39,000

With all the evidence intact, unraveling the mystery of what happened to the ship should be easy.

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00:14:39,000 --> 00:14:41,000

Or so you'd think.

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00:14:51,000 --> 00:14:58,000

1986. Lake Huron. The second largest of the Great Lakes.

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00:15:01,000 --> 00:15:05,000

Shipwreck hunters are exploring the waters in the northwest of the lake

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00:15:06,000 --> 00:15:09,000

when they make a jaw-dropping discovery.

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00:15:12,000 --> 00:15:17,000

A schooner, more than 100 years old, frozen in time on the lake bed.

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00:15:19,000 --> 00:15:21,000

She is completely intact.

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00:15:22,000 --> 00:15:28,000

The masts are still up. The rings that hold the sails that go up the mast are still in place.

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00:15:29,000 --> 00:15:32,000

The cargo of grain is still in the hole.

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00:15:33,000 --> 00:15:36,000

This vessel is in pretty spectacular condition.

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00:15:37,000 --> 00:15:41,000

It was almost as if it had been sort of gently placed on the bottom of the lake.

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00:15:42,000 --> 00:15:45,000

What sank this perfectly preserved wreck?

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00:15:46,000 --> 00:15:52,000

A perfect, undamaged shipwreck has been found at the bottom of Lake Huron.

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00:15:53,000 --> 00:15:55,000

But what happened to her?

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00:15:56,000 --> 00:16:02,000

How is it that this great ship is pristine, in condition, resting on a lake bed?

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00:16:04,000 --> 00:16:09,000

On the ship's side, divers have been able to find the shipwreck.

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00:16:09,000 --> 00:16:11,000

The Cornelia B. Windyott.

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00:16:12,000 --> 00:16:18,000

She's a 136-foot schooner that went missing with all hands during the November storm season of 1875.

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00:16:20,000 --> 00:16:23,000

The Great Lakes take their fair share of ships.

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00:16:24,000 --> 00:16:28,000

Six thousand shipwrecks litter the beds of these huge lakes.

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00:16:29,000 --> 00:16:32,000

The Great Lakes are the first to be found in the Great Lakes.

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00:16:32,000 --> 00:16:34,000

They take their fair share of ships.

217

00:16:35,000 --> 00:16:39,000

Six thousand shipwrecks litter the beds of these huge lakes.

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00:16:40,000 --> 00:16:42,000

And over 30,000 lives have been lost.

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00:16:43,000 --> 00:16:48,000

If a vessel is in a storm, usually that storm creates havoc on the vessel.

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00:16:49,000 --> 00:16:56,000

It can rip things off the deck, tear things apart, bust masts, things like that.

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00:16:57,000 --> 00:16:59,000

None of that is seen on the Windyott.

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00:17:00,000 --> 00:17:04,000

If that ship had sunk in a storm, you'd expect it to be smashed to pieces.

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00:17:06,000 --> 00:17:10,000

As well as no signs of damage, there are no signs of any crew.

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00:17:11,000 --> 00:17:16,000

We don't know where the crew are. There are no bodies associated with it at all.

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00:17:17,000 --> 00:17:21,000

But we do know that they didn't make a standard maritime escape.

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00:17:22,000 --> 00:17:27,000

Lying in perfect condition on the lake bed is the schooner's single lifeboat.

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00:17:30,000 --> 00:17:33,000

What happened to the Windyott and her men?

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00:17:34,000 --> 00:17:36,000

One thing is certain, the ship sank.

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00:17:37,000 --> 00:17:40,000

Why or how it sank is a little bit more unclear.

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00:17:41,000 --> 00:17:46,000

In the 1870s, Lake Huron was part of a valuable grain route.

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00:17:47,000 --> 00:17:51,000

We know the vessel left Milwaukee, loaded with tons of grain.

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00:17:52,000 --> 00:17:57,000

She was heading to Buffalo, one of the great grain centers on the Eastern Great Lakes.

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00:17:58,000 --> 00:18:01,000

A November sailing carried weather risks.

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00:18:02,000 --> 00:18:06,000

But with fewer voyages being undertaken at this time of year,

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00:18:07,000 --> 00:18:10,000

it's likely there would have been a financial incentive for the crew.

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00:18:11,000 --> 00:18:18,000

The area depends on this kind of trade, and there would be nothing worse than a bunch of rotting grain,

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00:18:19,000 --> 00:18:20,000

especially at the end of the season.

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00:18:21,000 --> 00:18:24,000

It appears that the Windyott was leaving nothing to waste.

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00:18:24,000 --> 00:18:31,000

Port records show that on departure, she was overloaded with 30% more cargo than usual.

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00:18:34,000 --> 00:18:38,000

During her voyage, the Windyott would likely have encountered gale force winds

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00:18:39,000 --> 00:18:42,000

and temperatures down to minus 10 degrees or colder.

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00:18:43,000 --> 00:18:48,000

So is it possible that the freezing weather provided an unexpected escape route for the missing crew?

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00:18:49,000 --> 00:18:54,000

Because it was cold weather, perhaps the ship itself got stuck into ice,

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00:18:55,000 --> 00:18:57,000

and the crew tried to leave the ship.

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00:18:58,000 --> 00:19:00,000

Such an escape is not without precedent.

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00:19:01,000 --> 00:19:07,000

In winter, the Great Lakes are prone to freezing, and thick ice could have provided a route to shore.

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00:19:08,000 --> 00:19:13,000

But one piece of evidence suggests the Windyott crew did not simply walk off the ship.

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00:19:13,000 --> 00:19:18,000

Now the lifeboat has been left behind. Knowing that the ice is sometimes treacherous,

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00:19:19,000 --> 00:19:21,000

you would have expected to have possibly taken a lifeboat with them.

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00:19:23,000 --> 00:19:30,000

And the latest analysis of wind directions suggests that a significant lake freeze didn't happen in this period.

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00:19:32,000 --> 00:19:34,000

So getting stuck seems unlikely.

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00:19:35,000 --> 00:19:42,000

And even if that did happen, the force of ice crushing it from all sides would be evident on the

Windyott's remains.

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00:19:44,000 --> 00:19:46,000

Which are undamaged.

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00:19:48,000 --> 00:19:55,000

But could a much more recent tragedy on the high seas provide a new lead in solving this puzzling mystery?

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00:19:58,000 --> 00:20:03,000

2017, the Bering Sea in the Northern Pacific Ocean.

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00:20:04,000 --> 00:20:11,000

Seattle-based Crabboat, the destination, sails into severely cold and rough conditions.

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00:20:12,000 --> 00:20:17,000

They didn't even have time to react before the vessel capsized and sank.

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00:20:19,000 --> 00:20:21,000

Six people were killed.

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00:20:23,000 --> 00:20:28,000

A key cause of the sinking was found to be a buildup of ice on the boat.

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00:20:29,000 --> 00:20:37,000

In very cold conditions, when you have waves and you have spray, this spray will turn into ice droplets and start to cover things with ice.

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00:20:37,000 --> 00:20:42,000

It just builds up layer after layer, wave after wave comes crashing in.

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00:20:43,000 --> 00:20:46,000

Until it reaches a point where it just overtakes the vessel.

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00:20:48,000 --> 00:20:53,000

So could a buildup of spray ice have sunk the Windyott?

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00:20:53,000 --> 00:21:11,000

The 19th century schooner, the Cornelia B. Windyott, is found undamaged on the bottom of Lake Huron.

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00:21:12,000 --> 00:21:18,000

Could ice build up the phenomenon that sank an Alaskan fishing vessel be to blame?

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00:21:19,000 --> 00:21:32,000

It's this same deadly phenomenon that they were caught with sea spray icing so quickly and so perilously that they sank and didn't even have time to react.

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00:21:34,000 --> 00:21:40,000

The Windyott was a sizable vessel capable of carrying large quantities of heavy cargo.

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00:21:41,000 --> 00:21:44,000

So could ice really have taken her down?

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00:21:45,000 --> 00:21:54,000

With the weight of ice on the top of the vessel rather than at the bottom of the vessel, you have these huge issues with weight distribution.

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00:21:55,000 --> 00:22:05,000

And when the vessel goes over, there's no writing moment from the bottom of the vessel to stop that ice from pulling down. Gravity is actually working against the vessel.

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00:22:06,000 --> 00:22:11,000

And in the fresh waters of the Great Lakes, another factor would have been working against the Windyott.

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00:22:12,000 --> 00:22:23,000

Fresh water would freeze quicker than salt water. There is a possibility of having that ice buildup just from the wind.

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00:22:25,000 --> 00:22:35,000

Experts have calculated that the rate of fresh water ice buildup on the day of the Windyott sinking could have reached as much as 16 tonnes per hour.

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00:22:36,000 --> 00:22:42,000

The only kind of defences that crews have is going out and actually breaking it off by hand.

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00:22:43,000 --> 00:22:51,000

Using hammers, wedges, anything they have to kind of beat back the ice and outrun Mother Nature itself.

276

00:22:52,000 --> 00:23:01,000

And spray ice on the decks may account for another element in the Windyott mystery. The missing crew.

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00:23:02,000 --> 00:23:06,000

You're on a moving ship. The crew would have been sliding across it.

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00:23:07,000 --> 00:23:15,000

Meaning that they were actually washed off the ship. The spray which was adding ice to the ship actually got rid of them.

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00:23:18,000 --> 00:23:25,000

Whether or not the ice sent the crew sliding to their deaths, it may have played an even more surprising role.

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00:23:26,000 --> 00:23:31,000

It could be responsible for the remarkable preservation of the Windyott wreck.

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00:23:32,000 --> 00:23:37,000

So when it's covered with the ice that adds enough weight to sink it. But the ice of course is also slightly buoyant.

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00:23:38,000 --> 00:23:47,000

So that is why she ends up having a nice smooth glide to the bottom of the seabed. In fact she might have even sat there suspended in the water for a bit.

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00:23:48,000 --> 00:23:53,000

The ice just melts away and boom, you have your perfect ship at the bottom of the lake bed.

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00:23:54,000 --> 00:24:03,000

And this is how she was found over a hundred years later. But there's no way of knowing for sure that ice was what sank the ship.

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00:24:04,000 --> 00:24:18,000

The trouble is there'll be nothing for us to discover that proves the ice. Because the ice of course is mostly made up of the water which has existed around the Windyott now for hundreds of years. So it's a theory.

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00:24:19,000 --> 00:24:33,000

Further examination of the Windyott may in time offer up other answers. For now we're left with just the scene of the crime. The prime suspect has melted away.

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00:24:33,000 --> 00:24:56,000

The history of naval warfare is a record of winners and losers. But do historians ever record the wrong result? A recent underwater discovery in the Mediterranean Sea suggests just that.

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00:24:57,000 --> 00:25:03,000

Could it lead to a radical reinterpretation of the history of the ancient world?

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00:25:10,000 --> 00:25:22,000

In 2002 a fisherman trawling off the western coast of Sicily in the Mediterranean Sea is astonished to pull up not a fish but an artifact from another world.

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00:25:23,000 --> 00:25:26,000

The massive solid cast piece of bronze.

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00:25:27,000 --> 00:25:40,000

Stunned marine archaeologists recognize the mystery item as something that's never been found in the ocean before. A battering ram from an ancient warship more than two thousand years old.

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00:25:41,000 --> 00:25:57,000

The bronze battering ram at the front of these ships was the height of technology of its period. It was the Tomahawk cruise missile, the Trident ballistic missile of its period. We're talking something which could weigh in itself up to a ton.

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00:25:58,000 --> 00:26:04,000

Ancient battering rams were designed to inflict the maximum amount of damage to enemy vessels.

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00:26:05,000 --> 00:26:19,000

These rams are built with kind of three fins that angle out. These fins are meant to spring the planks of the enemy ship and tear them at the seams so that the rest of the ship kind of becomes undone almost like a zipper.

295

00:26:20,000 --> 00:26:30,000

It's the tip of a spear magnified a million times and you know you have all that weight, all that speed, all that pressure. Pretty irresistible of course.

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00:26:30,000 --> 00:26:33,000

It's like nothing else that has been found in antiquity.

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00:26:34,000 --> 00:26:45,000

The dramatic discovery prompts a major archaeological survey. What they discover is extraordinary. A site spread over an area the size of Manhattan.

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00:26:46,000 --> 00:26:56,000

And within it the remnants of one of the most important naval battles of antiquity. The battle of the Agates, also known as Agadi.

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00:26:57,000 --> 00:27:00,000

The battle of Agadi was between the Romans and the Carthaginians.

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00:27:01,000 --> 00:27:10,000

The Romans at the time are expanding their sphere of influence throughout Italy. They found that they were confronting the major local power than Carthaginians.

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00:27:12,000 --> 00:27:21,000

This battle is considered a really critical moment in military naval history because the Romans weren't really known for winning at sea.

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00:27:21,000 --> 00:27:27,000

But according to all written records from the period the Romans were victorious.

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00:27:28,000 --> 00:27:31,000

The battle of Agadi basically put the Roman Republic on the map.

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00:27:32,000 --> 00:27:41,000

This is a big pivotal moment where Rome finally goes from a regional power to kind of a Mediterranean maritime power.

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00:27:42,000 --> 00:27:50,000

The traditional interpretation of the result and importance of the battle of Agadi has been accepted for over 2,000 years.

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00:27:51,000 --> 00:27:58,000

But when they study the battle site marine archaeologists find evidence that suggests a very different story.

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00:28:00,000 --> 00:28:07,000

The battering ram, the exceptional item first recovered from the Agadi site, turns out not to be the only one.

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00:28:07,000 --> 00:28:13,000

This is a really unique site in the sense that multiple battling rams have been found.

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00:28:14,000 --> 00:28:22,000

Until now only three of these rams were known to be in existence anywhere in the world and none were found where they fell.

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00:28:23,000 --> 00:28:31,000

But as marine archaeologists comb the Agadi site they are amazed to discover more than 20 of these ancient weapons.

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00:28:32,000 --> 00:28:40,000

Battering rams would have been used by both sides in the battle of Agadi but with different features and designs.

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00:28:41,000 --> 00:28:48,000

The unique type of alloy and the quality of these rams you can pinpoint which ones are Roman.

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00:28:50,000 --> 00:28:57,000

The number of rams found on the sea floor gives an indication of the number of ships that were sunk in the battle.

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00:28:58,000 --> 00:29:08,000

But remarkably when archaeologists do the math they can confirm that only one of the rams comes from Carthage but a staggering 15 are Roman.

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00:29:10,000 --> 00:29:13,000

How these Roman rams are at the bottom of the sea.

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00:29:14,000 --> 00:29:23,000

Instead of being as history tells us the naval victory that founded an empire did the Romans in fact lose the battle of Agadi.

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00:29:28,000 --> 00:29:43,000

History has recorded a great victory for the Romans at the naval battle of Agadi.

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00:29:44,000 --> 00:29:50,000

But recent finds in the seas of Sicily suggest something very different.

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00:29:51,000 --> 00:29:58,000

When we find something that doesn't fit our expectations maybe some of our theories are incorrect.

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00:29:59,000 --> 00:30:04,000

Maybe we need to reconsider how we understand that timer or that battle.

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00:30:06,000 --> 00:30:14,000

In this period despite being a great force on land the Romans scored few victories at sea.

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00:30:15,000 --> 00:30:19,000

This is something that the Romans were not considered to be the experts at this.

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00:30:20,000 --> 00:30:23,000

And so during this battle the advantage was not on the Roman side.

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00:30:24,000 --> 00:30:30,000

The Carthaginians had an unrivaled reputation as master mariners and naval tacticians.

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00:30:31,000 --> 00:30:39,000

And in the Battle of Agadi the Roman force was less than half the size of the Carthaginian fleet of up to 700 ships.

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00:30:39,000 --> 00:30:47,000

The underdog in this fight is the Romans. They have been the losers at just about every battle with the Carthaginians up to this point.

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00:30:48,000 --> 00:30:54,000

So did the Romans in fact lose as suggested by the number of rams discovered on the sea floor.

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00:30:55,000 --> 00:31:01,000

Or could there be another reason why the remains of so many Roman ships were found at the Agadi site.

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00:31:02,000 --> 00:31:11,000

Building a warship is very expensive. Therefore you go to every measure to make it as cost effective as possible.

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00:31:12,000 --> 00:31:14,000

And the easiest way to do that is to use a captured ship.

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00:31:15,000 --> 00:31:27,000

A lot of the Roman ships that are we're finding here at this battle are actually reused ships that were captured about nine years previous at another naval battle where the Carthaginian side was actually victorious.

332

00:31:28,000 --> 00:31:35,000

Capturing ships and putting them to work in your own fleet is a tactic that's been employed by navies throughout the centuries.

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00:31:36,000 --> 00:31:42,000

The British Navy for example captured many friendships and used them afterwards as part of their own fleet.

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00:31:43,000 --> 00:31:50,000

The theory that Carthage was using captured Roman vessels at Agadi would explain why so many Roman rams have been found.

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00:31:50,000 --> 00:31:54,000

And it tallies with the historical account of a Roman victory.

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00:31:55,000 --> 00:32:01,000

But with much of the Agadi sites still to be excavated a definitive answer could be years away.

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00:32:03,000 --> 00:32:10,000

Every year that we go back every time that we actually do surveys there and find new things the questions just get exponentially bigger.

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00:32:11,000 --> 00:32:18,000

With new technology we're uncovering more and more wrecks from further and further back in time.

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00:32:18,000 --> 00:32:22,000

I wonder what re-readings of history remain to be discovered.

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00:32:32,000 --> 00:32:40,000

The dark frigid lifeless ocean depths have often been considered a good place to hide our unwanted secrets.

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00:32:40,000 --> 00:32:51,000

But a danger hidden is rarely a danger resolved such as the case with the 75 year old mystery of the toxic Nazi submarine.

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00:32:53,000 --> 00:32:59,000

February 1945 the closing months of World War Two.

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00:33:00,000 --> 00:33:10,000

With defeat in Europe looming Hitler orders one of Nazi Germany's fleet of long range U-boats to carry out a top secret underwater mission.

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00:33:12,000 --> 00:33:18,000

This is the end of the Second World War. The Germans are beginning to transport some of their secrets from the Third Reich.

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00:33:19,000 --> 00:33:27,000

The hope being that some of its leading edge cutting edge keynotch secrets can find a way to be used from a new home in Japan.

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00:33:28,000 --> 00:33:33,000

The Nazi goal is to help the Japanese change the course of the war in the Pacific.

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00:33:35,000 --> 00:33:42,000

If the sub got to Japan it would have given Japan technology that may have helped them resist the Americans.

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00:33:43,000 --> 00:33:45,000

The operation requires the utmost secrecy.

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00:33:46,000 --> 00:33:55,000

If you have something that you really want to keep well hidden a submarine was an ideal form of transportation.

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00:33:57,000 --> 00:34:05,000

What the Germans don't know is that British code breakers at their Bletchley Park HQ have cracked the Nazis enigma code.

351

00:34:06,000 --> 00:34:10,000

Hitler's top secret mission is no longer a secret.

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00:34:12,000 --> 00:34:18,000

From the Allies point of view they didn't know exactly what was on the submarine but it was absolutely critical they find it and destroy it.

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00:34:18,000 --> 00:34:28,000

They intercepted these communications which indicated to them that this had potential implications for the outcome of the war.

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00:34:29,000 --> 00:34:38,000

And the British have another key advantage. One of the German submarines engines is faulty and it's emitting a noise that can be tracked.

355

00:34:39,000 --> 00:34:44,000

And there's this cat and mouse chase up the Norwegian coast.

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00:34:44,000 --> 00:34:54,000

Like hunting down wounded prey British submarine HMS Ventura stalks you 864 through the freezing murky depths of the North Sea.

357

00:34:55,000 --> 00:35:01,000

Ventura is finally at a point where it has no choice. It's afraid that it's going to lose the 864.

358

00:35:03,000 --> 00:35:06,000

So the British sub quickly launches four torpedoes.

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00:35:07,000 --> 00:35:15,000

It's easy to sink a ship on the surface for a submarine to sink another submarine is unheard of.

360

00:35:17,000 --> 00:35:24,000

The first three torpedoes miss but the fourth finds its target.

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00:35:28,000 --> 00:35:33,000

A massive explosion rips through the midsection of the German U-boat.

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00:35:34,000 --> 00:35:41,000

This is the only time in history a submarine submerged using a torpedo has sunk another submarine.

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00:35:42,000 --> 00:35:47,000

The captain of the ship would say probably skilled but 90 percent of the rest of the world would say heck that's a lot of work.

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00:35:49,000 --> 00:35:55,000

U 864 sinks in 500 feet of water with all 73 crew on board.

365

00:35:56,000 --> 00:35:59,000

For the British Navy it's job done.

366

00:36:00,000 --> 00:36:05,000

But for the Norwegians in whose waters the wreck of the German sub lies it's a different story.

367

00:36:06,000 --> 00:36:11,000

Because of the materials that were known to be aboard it was secret military materials.

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00:36:12,000 --> 00:36:14,000

It was always a priority to try and find her.

369

00:36:16,000 --> 00:36:19,000

She's finally found after 70 years.

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00:36:20,000 --> 00:36:21,000

But there's a problem.

371

00:36:22,000 --> 00:36:27,000

There are over 1800 canisters full of liquid mercury.

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00:36:29,000 --> 00:36:32,000

The Nazi sub is toxic.

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00:36:44,000 --> 00:36:50,000

When German U-boat 864 sinks in the closing stages of World War Two she remembers the fact that the U-boat was in the water.

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00:36:51,000 --> 00:36:57,000

And remains hidden in the darkest depths of Norway's North Sea for over 70 years.

375

00:37:00,000 --> 00:37:04,000

It's not until 2003 that the wreck is discovered.

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00:37:06,000 --> 00:37:11,000

A Norwegian Navy minesweeper using unmanned underwater vehicles discovered the submarine on the seabed.

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00:37:12,000 --> 00:37:16,000

And it found the submarine was in two major portions with a spread of debris around it.

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00:37:16,000 --> 00:37:21,000

Is the sunken Nazi U-boat finally ready to give up her wartime secrets?

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00:37:22,000 --> 00:37:29,000

The difficulties of doing recoveries on a military site the obvious one is well this is a German submarine at war.

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00:37:30,000 --> 00:37:32,000

How many torpedoes are still left in the vessel?

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00:37:33,000 --> 00:37:38,000

U-864 is thought to contain over 20 high explosive torpedoes.

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00:37:40,000 --> 00:37:43,000

But there's something even more dangerous waiting on the underwater wreck.

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00:37:44,000 --> 00:37:51,000

By 2003 Norway is in possession of the original 1945 manifest for the Nazi sub's final voyage.

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00:37:52,000 --> 00:37:55,000

And it reveals a particularly sinister cargo.

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00:37:57,000 --> 00:37:58,000

Mercury.

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00:38:00,000 --> 00:38:05,000

1857 canisters which equates to over 65 tons.

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00:38:06,000 --> 00:38:10,000

Enough poisonous liquid metal to cause an environmental catastrophe.

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00:38:10,000 --> 00:38:15,000

And once in the food chain a serious danger to human life.

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00:38:16,000 --> 00:38:20,000

Mercury is a neurotoxin. It's bad for the brain for your neural system.

390

00:38:21,000 --> 00:38:25,000

It can cause dizziness, loss of function in your muscles.

391

00:38:26,000 --> 00:38:29,000

You can't walk, you can't talk, slurs your speech.

392

00:38:31,000 --> 00:38:37,000

Before they can even think about recovering this lethal liquid, scientists face a more immediate challenge.

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00:38:38,000 --> 00:38:45,000

A major problem with the project is that the submarine is lying on the bottom of a shelf.

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00:38:46,000 --> 00:38:49,000

So it's sloping off into the deep Atlantic.

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00:38:50,000 --> 00:38:53,000

Part of the submarine could actually slide to a deeper depth.

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00:38:54,000 --> 00:39:02,000

If the U-boat slips it could release all the toxic mercury into the sea potentially poisoning an entire ecosystem.

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00:39:03,000 --> 00:39:08,000

And it's not stable. At any time it can kind of fall apart. Something has to be done.

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00:39:10,000 --> 00:39:14,000

So the key thing to start with is to actually stabilize the submarine.

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00:39:15,000 --> 00:39:18,000

So a platform, a shelf, is being built underneath the submarine.

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00:39:19,000 --> 00:39:22,000

The operation is further complicated by the depth of the wreck.

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00:39:24,000 --> 00:39:28,000

At over 500 feet down it's too deep to send divers.

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00:39:29,000 --> 00:39:35,000

So a brand new remote system is designed to stabilize the sub using gravel ballast.

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00:39:37,000 --> 00:39:43,000

It's not like you can just take a big ship load of gravel and just dump it off the side of the ship.

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00:39:44,000 --> 00:39:48,000

It has to strategically be placed using technology.

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00:39:49,000 --> 00:39:57,000

An ROV basically is almost sort of like a garden hose in that it's spraying small gravel or very coarse sand.

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00:39:58,000 --> 00:39:59,000

It's stabilizing the wreck.

407

00:40:00,000 --> 00:40:03,000

The stabilization of U-864 is successful.

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00:40:04,000 --> 00:40:08,000

But despite this there are indications that the mercury may be spreading.

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00:40:09,000 --> 00:40:15,000

We are detecting leaks of this mercury right now. How much has already leaked out? How much is safely contained?

410

00:40:16,000 --> 00:40:19,000

The recovery process itself might actually spread the mercury around.

411

00:40:20,000 --> 00:40:22,000

You might disrupt the canisters, you might break them.

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00:40:23,000 --> 00:40:27,000

So it's a catch-22. If you do you could be damned. If you don't you could be damned.

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00:40:28,000 --> 00:40:32,000

But the salvage team think something even more deadly may be on board.

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00:40:33,000 --> 00:40:39,000

So the speculation at the time was that the U-864 could have been carrying enriched uranium.

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00:40:40,000 --> 00:40:44,000

Enriched uranium is the vital element in nuclear bombs.

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00:40:45,000 --> 00:40:50,000

Thankfully testing around U-864 does not show traces of uranium.

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00:40:51,000 --> 00:40:54,000

But it's another threat that must be considered by the salvage team.

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00:40:55,000 --> 00:41:04,000

With the toxic danger of the wreck thought to be too great to attempt to raise it to the surface, other options are being considered.

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00:41:05,000 --> 00:41:10,000

Another way the Norwegians are looking at is to cover it in a sarcophagus.

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00:41:11,000 --> 00:41:14,000

I want to say a post-Chernobyl approach.

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00:41:15,000 --> 00:41:18,000

Encapsulate it in a giant concrete cap.

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00:41:18,000 --> 00:41:26,000

One plan proposes that the toxic submarine be given an underwater burial beneath 40 feet of concrete and gravel.

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00:41:27,000 --> 00:41:30,000

But locals are concerned that the mercury will still pose a threat.

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00:41:31,000 --> 00:41:39,000

So the solution to a toxic problem created by Allied action at the end of World War II remains elusive.

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00:41:40,000 --> 00:41:45,000

The mystery for us here is we still don't know exactly what we're dealing with within the submarine.

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00:41:45,000 --> 00:41:47,000

And once we do know what to do with it.

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00:41:50,000 --> 00:41:58,000

There have been rumours over the years that in addition to its toxic cargo, U-864 may have been carrying Nazi gold.

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00:41:59,000 --> 00:42:02,000

Or even the last will and testament of Adolf Hitler.

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00:42:03,000 --> 00:42:10,000

But until we find a way of accessing the wreck safely, all of this will remain a tantalising mystery.

