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News

Controversy over South Korea's sunken ship

Physicists' research casts doubt on idea that North Korean torpedo downed vessel.

David Cyranoski

In May, two months after the sinking of a South Korean warship, the country released a report blaming its northern neighbour. That report soon came under fire from South Korean opposition politicians and an influential South Korean civil liberties group. Now some scientists are lending their weight to the critique.

On 26 March, the *Cheonan*, a patrol ship that monitored North Korean submarine activity, split in two and sank near the contested maritime boundary between the two countries. In a 20 May **report** the Joint Investigation Group (JIG), composed of civilian and military experts from Korea and some advisers from the United Kingdom, the United States, Sweden and Australia, concluded that North Korea had torpedoed the ship and was responsible for the deaths of 46 crew members.

The group's evidence included fragments of a torpedo found near the ship which had the same dimensions as torpedoes pictured in North Korean munitions pamphlets and had ink markings identifying it as North Korean.

The controversy started before the report was even released. An expert placed on the JIG by the opposition party — Shin Sang-chul, a former officer in the South Korean navy who had also worked at a shipbuilding company — suggested that an accidental collision with a US warship, and not North Korea, was to blame. The United States and South Korea had been carrying out military exercises in the area at the time.

On 10 June, the People's Solidarity for Participatory Democracy, a Seoul-based organisation that acts as a watchdog on government authority, sent an open letter to the United Nations Security Council in which it raised eight questions concerning the contents of the JIG's report and six problems concerning the transparency of the investigation. The letter alleged that the report's claim that a torpedo-induced water column sank the *Cheonan* contradicted earlier testimony from survivors that they did not see a water column or only felt water droplets on the face. The letter also questioned why the supposed torpedo launch was not detected, despite active sonar equipment aboard the *Cheonan*.



New research suggests North Korea may not have been responsible for the sinking of the *Cheonan*.

Xinhua/Photoshot



The Joint Investigation Group presented fragments of a torpedo found near the damaged ship.

EPA/Photoshot

Seung-Hun Lee, a Korean-born physicist at the University of Virginia in Charlottesville, says the most problematic part of the JIG's report is the linking of the adsorbed material on the propeller of the torpedo with that found on the ship. In the JIG's report, electron dispersive spectroscopy (EDS) analysis shows the samples to be nearly identical to each other and with those produced in a simulated test explosion: each has similar-sized peaks showing the presence of aluminium, oxygen, carbon and other elements. X-ray diffraction analysis likewise shows the torpedo sample to have the same signature as the ship sample. But on one point, the EDS data and X-ray data are different — the X-ray data lack any sign of aluminium or aluminium oxide.

To explain the discrepancy, the JIG's report suggests that the aluminium had supercooled into amorphous aluminium oxide, rather than a crystalline form. Amorphous

aluminium oxides do not produce an X-ray diffraction pattern.

But the supercooling of metals into amorphous forms is a delicate process, says Lee. "It's impossible that 100% of it would be amorphous," he says. Lee's own experiments show that aluminium in such conditions would primarily be crystalline.

Lousy job?

Lee posted his report online on 3 June¹. Experiments carried out independently by Panseok Yang, a technician specializing in mass spectrometry at the geological sciences department of the University of Manitoba in Winnipeg, found that the ratio of oxygen to aluminium in the rapidly cooling aluminium would be much lower than suggested by the JIG. Yang's data, which were added to Lee's online report on 28 June, suggest that the samples analyzed by the JIG could have been from old, corroded aluminium.

Lee also says that the JIG did not explain why the blue ink on the torpedo that apparently identified it as North Korean did not melt, as the temperatures following its detonation were high enough to melt the paint. "They did a lousy job in every sense," says Lee.

Lee admits that they cannot say with any certainty how the ship sank if a North Korean torpedo was not responsible, although they offer alternatives. The *Cheonan* might have been hit by a mine (probably a South Korean one, according to Jae-Jung Suh, a political scientist at Johns Hopkins University working in Washington DC), or it might have been rammed by another ship, as suggested by Shin.

The South Korean government has adamantly denied any fabrication or any major problems with its interpretation of the data.

Many others doubt that there is any alternative interpretation.

James Schoff, an expert in Asian regional security mechanisms who heads Asia-Pacific studies at the Institute for Foreign Policy Analysis in Washington DC, says, "Aside from the science, it is consistent with North Korea's behaviour in the past. It fits the goal of the conservatives [within the government], which is to try to raise awareness of a security threat."

This doesn't, however, rule out the possibility that North Korea did sink the ship but that South Korea nonetheless fabricated data to make a stronger case to the United Nations, admits Schoff. It's possible, for example, that they added the ink, he says. "It wouldn't surprise me if they added it to make it more convincing. But I have no doubts personally that the conclusion [of the JIG report] is correct."

Lee and Suh have vowed to keep raising awareness of the inconsistencies. On 9 July, they are set to speak at the Foreign Correspondents Club in Tokyo.

"South Korea should reopen an investigation, and the parliament should open an investigation into the JIG on suspicion of fabricated data," Suh told *Nature*. "They failed in their task of proving that this was done by North Korea, and so it is quite likely that they fabricated data."

CORRECTED:Our article referred to "rusted aluminium", a term used figuratively by Yang and Lee to refer to oxidized compounds of aluminium, formed by exposing the metal to moisture. However, because rust is, strictly speaking, iron oxide, we have replaced 'rusted' with 'corroded'.

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References

1. Lee, S.-H. & Yang, P. preprint at <http://arxiv.org/abs/1006.0680> (2010).

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#118

A respectable publication like Nature shouldn't be in the business of reporting on conspiracy theory and nonsense.

Please stick to science.

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Posted by: [jihobbyist dotcom](#) | 2010-07-09 11:35:48 A

#118

The foremost task in any forensic science is to establish the solid scientific evidence. No doubt the ship sinking is a tragedy with huge loss of life, but the phenomena is scientific wonder by itself. I don't see anything improper to discuss the physics part of evidence, just like Richard Feynman discussed the physics of Challenge disaster in 1986. I just wonder why such scientific inquiry did not raise general curiosity inside or outside science community.

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Posted by: [j zw](#) | 2010-07-09 01:08:49 I

#118

Science has its own way to prove what happened as far as science is concerned. Doubt and inquiry don't mean denial, but must be answered properly. Until then, the conclusion of scientific investigation is questionable. It seems to me James Schoff's comment is only political gesture. Ask Nature's editors if they will publish a scientific paper that has questionable materials and methods to draw fancy conclusion. Or ask what peer reviewers think when they found potential misconduct or critical mistake with favorable fancy conclusion. The conclusion may be sound politically to James Schoff. If it's not scientifically sound to me unless all of the above questions are cleared when drawing conclusion depends on it (either partially or totally).

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Posted by: [Andrew Roh](#) | 2010-07-09 11:52:12 I

#118:

The JIG's 20 May Report concluded that the Cheonan sank as the result of an external underwater explosion caused by high explosive torpedo made in North Korea. To support the conclusion, it used the only available scientific evidence that is based on the EDS and XRD data taken from the aluminum-containing deposits (referred to as adsorbates in the Report) scraped from the bow, stern and stack of the salvaged ship and the collected torpedo propeller. Because the data were almost identical (oxygen/aluminum X-ray intensity ratios are same and there are no XRD lines), the JIG claimed that the deposits are chemically identical (amorphous aluminum oxide) and therefore they originated from the same source, that is, the North Korean Torpedo. The JIG's claim is weak because the same intensity ratios do not necessarily mean that the deposits are the same material. The same ratios can be obtained when several aluminum- and oxygen-containing species such as aluminum hydroxide and its hydrates, and aluminum oxide and its hydrates are mixed at different ratios. To support the claim, the JIG carried out an explosion experiment to simulate the actual torpedo explosion conditions, and carried out the EDS and XRD characterization of the aluminum powder that was obtained by scraping the surface of the aluminum plate that experienced the explosion. It is not clear whether the JIG used an aluminized explosive. It is well known that for underwater applications a substantial amount (20%) of nanometric aluminum particles is added to explosives. The