



Antarctica's Doomsday Glacier

Why in News

Researchers from **Sweden's University of Gothenburg** have been able to obtain data from underneath Thwaites Glacier, also known as the '**Doomsday Glacier**'.

- They find that the **supply of warm water to the glacier is larger than previously thought**, triggering concerns of faster melting and accelerating ice flow.

Key Points

▪ **Doomsday Glacier:**

- Called the **Thwaites Glacier**, it is **120 km wide at its broadest**, fast-moving, and melting fast over the years.
- Because of its **size (1.9 lakh square km)**, it contains **enough water to raise the world sea level** by more than half a metre.
 - Studies have found the **amount of ice flowing** out of it has **nearly doubled over the past 30 years**.
- Today, Thwaites's melting **already contributes 4% to global sea level rise** each year.
- It is estimated that it would collapse into the sea **in 200-900 years**.
- Thwaites is **important for Antarctica as it slows the ice behind it** from freely flowing **into the ocean**.
- Because of the risk it faces, and poses, Thwaites is often called the **Doomsday Glacier** (Doomsday meaning warning or threat, something that can cause destruction).

▪ **Previous Studies:**

- **Hole in the Glacier: A 2019 study** had discovered a **fast-growing cavity in the glacier**, sized roughly **two-thirds the area of Manhattan**.
 - The **size of a cavity** under a glacier **plays an important role in melting**. As more heat and water get under the glacier, it melts faster.
- **Detection of Warm Water at Grounding Line:**
 - **About:** In 2020, **researchers from New York University (NYU) detected warm water** at a vital point below the glacier. In the NYU study, scientists dug a 600-m-deep and 35-cm-wide access hole, and deployed **an ocean-sensing device called Icefin** to measure the waters moving below the glacier's surface.
 - **Findings:**
 - The **NYU study** reported water at just two degrees above freezing point at Thwaites's **"grounding zone" or "grounding line"**.
 - **The grounding line** is the place below a glacier at which the ice transitions between resting fully on bedrock and floating on the ocean as an ice shelf. The location of the line is **a pointer to the rate of retreat of a glacier**.
 - When **glaciers melt** and lose weight, **they float off the land** where they

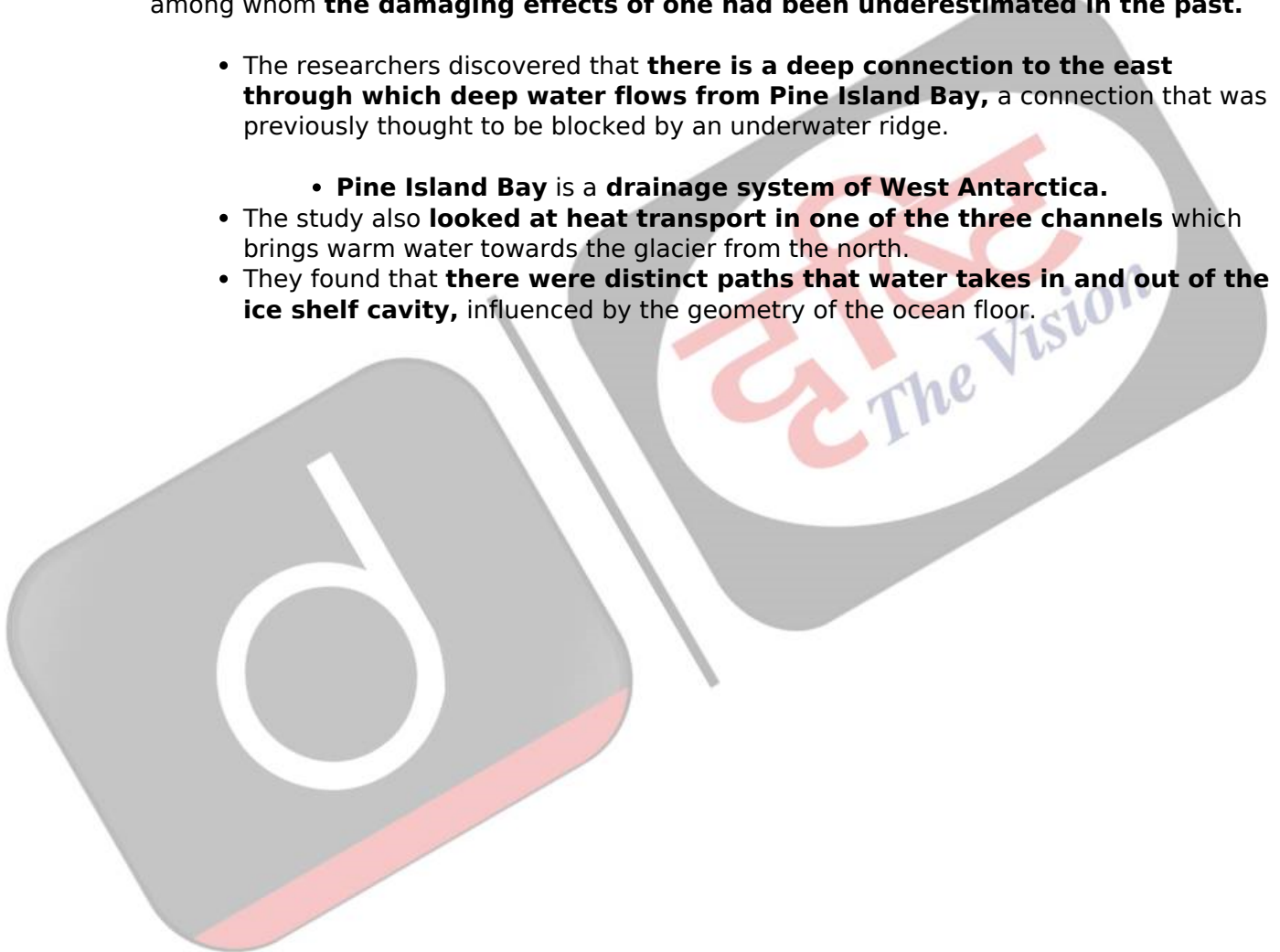
used to be situated. When this happens, **the grounding line retreats**. That **exposes more of a glacier's underside to seawater**, increasing the likelihood it will melt faster.

- This results in the glacier speeding up, stretching out, and thinning, causing the grounding line to retreat ever further.

▪ **Findings from Sweden's Gothenburg Study (New Study):**

- **About:** Sweden's Gothenburg study **used an uncrewed submarine** to go under the Thwaites glacier front to make observations.
 - The submersible called **"Ran"** measured among other things the **strength, temperature, salinity and oxygen content of the ocean currents** that go under the glacier.
 - Using the results, the researchers **have been able to map the ocean currents** that flow below Thwaites's floating part.
- **Findings:** The researchers have been able to identify **three inflows of warm water**, among whom **the damaging effects of one had been underestimated in the past**.
 - The researchers discovered that **there is a deep connection to the east through which deep water flows from Pine Island Bay**, a connection that was previously thought to be blocked by an underwater ridge.
 - **Pine Island Bay is a drainage system of West Antarctica.**
 - The study also **looked at heat transport in one of the three channels** which brings warm water towards the glacier from the north.
 - They found that **there were distinct paths that water takes in and out of the ice shelf cavity**, influenced by the geometry of the ocean floor.

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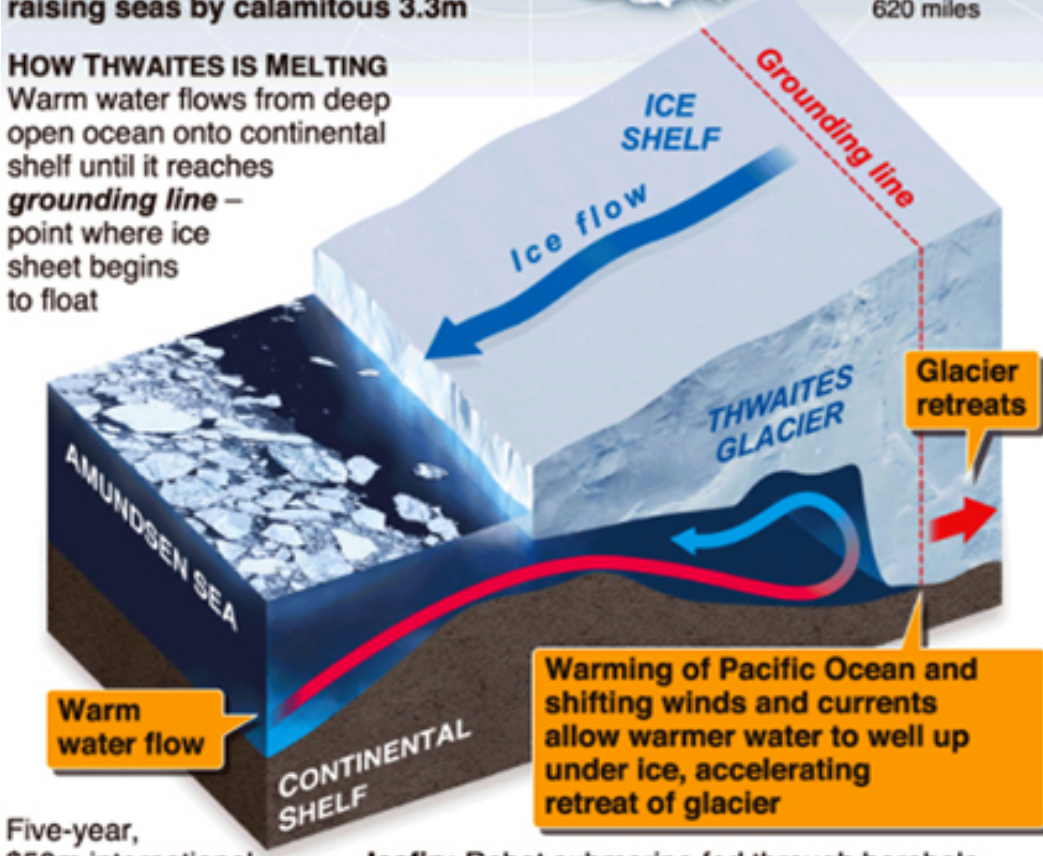
Antarctica's doomsday glacier explored

THWAITES GLACIER
192,000km²

Ice loss has nearly doubled over last 30 years

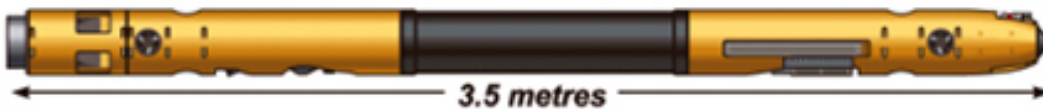
Collapse of glacier would increase sea levels by around 65cm and could trigger wider collapse of West Antarctic Ice Sheet, raising seas by calamitous 3.3m

HOW THWAITES IS MELTING
Warm water flows from deep open ocean onto continental shelf until it reaches **grounding line** – point where ice sheet begins to float



Five-year, \$50m international effort underway to understand why glacier is changing so rapidly

Icefin: Robot submarine fed through borehole drilled through glacier. It carries high definition cameras, sonar, and instruments for monitoring water flow, salinity, oxygen and temperature



Thwaites Glacier is similar in size to Great Britain

1,000km
620 miles

Way Forward

- The study shows that warm water is approaching the pinning points of the glacier from all sides, impacting these locations where the ice is connected to the seabed and where the ice sheet finds

stability. This has the potential to make things worse for Thwaites, whose ice shelf is already retreating.

- For the first time, data is being collected that is necessary to model the dynamics of Thwaites glacier. This data will help better calculate ice melting in the future.
- With the help of new technology, models can be improved and the great uncertainty that now prevails around global sea level variations can be reduced.

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