

Researcher: 'Tsunami likely to hit here in future'

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Even though Israel is situated on the edge of a sea and not an ocean, it too could be hit by tsunamis - massive waves and flooding caused by underwater earthquakes - that have devastated parts of Asia in recent years.

So says Dr. Beverly Goodman, a geo-archaeological researcher at the University of Haifa's Charney School of Marine Sciences, who just published a study that exposed evidence of four tsunami events on the coast of Caesarea.

"There is a likely chance of tsunami waves reaching the shores of Israel," Goodman said on Sunday. "Tsunami events in the Mediterranean do occur less frequently than in the Pacific Ocean, but our findings reveal a moderate rate of recurrence."

The term tsunami was created by Japanese fishermen who returned to port to find the area surrounding their harbor devastated, although they had not been aware of any wave in the open water. Tsunamis (from the Japanese word *tsu* meaning harbor and *nami* meaning wave) are common throughout Japanese history, with nearly 200 events recorded there.

The Talmud itself mentions a tsunami between Caesarea and Yavne that occurred on December 12 in the year 115 CE after a major earthquake hit northwest Syria.

Goodman exposed the geological evidence serendipitously, as she had originally intended to help others research Caesarea's ancient port and offshore shipwrecks.

"We expected to find the remains of ships but were surprised to reveal unusual geological layers, the likes of which we had never seen in the region before. We began underwater drilling assuming that these are simply local layers related to the construction of the port. However, we discovered that they are spread along the entire area and realized that we had found something major," she explained.

Geological drilling one to three meters long and at various depths made it possible for Goodman to date the underwater layers using carbon-14 dating and optically stimulated luminescence. She found evidence of four tsunami events having occurred at Caesarea: in 1500 BCE, 100 to 200 CE, 500 to 600 CE and 1100 to 1200 CE.

In an article published in the *Journal of the Geological Society of America*, she noted that the earliest of these tsunamis resulted from the eruption of the Santorini volcano, which affected the entire Mediterranean region. The later, more local tsunami waves were apparently generated by underwater landslides caused by earthquakes.

"Local" does not necessarily imply "small," she said. "These could have been waves reaching five meters high and as far as 2 kilometers onshore. Coastal communities within this range would have undoubtedly been severely damaged from such a tsunami. While communities onshore clear the ground after such an event and return to civilization, tsunami evidence is preserved under the water," she said.

Three years ago, Dr. Amos Salamon of the Geological Survey of Israel and colleagues in Italy and the US said at the Weizmann Institute of Science in Rehovot that since before the Common Era, there have been two dozen tsunamis documented in the region and 11 on Israel's coasts. Early-warning systems are being installed in various coastal areas in Asia so residents have time to escape to the hills.

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