Alaska Earthquake and tsunami waves

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The tsunami waves which battered the Alaskan coastline Good Friday evening were caused by the sudden tilting of a section of the earth's crust larger than the state of Florida, a Scripps Institution of Oceanography scientist, recently returned from the disaster area, has found.

Dr. William G. Van Dorn, Associate Research Oceanographer and a specialist in wave mechanics, flew to Alaska three days after the March 27 earthquake to attempt to reconstruct the events which took place during and immediately following the earth tremors. He spent nearly two weeks interviewing eyewitnesses, studying aerial photographs, and flying to as many of the rugged and uninhabited islands as he could reach.

His purpose was to reconstruct the source of the tsunami, or wave action, which swept its devastating power as far south as California.

Dr. Van Dorn found that a huge block of material, at least 400 miles long, 150 miles wide, and encompassing 60,000 square miles, tilted on an axis running northeast-southwest and nearly parallel to the Alaska Peninsula. The tilted land mass lies mostly under about 100 fathoms of water off the west coast of the state.

The southeast edge of the land mass, running from the city of Valdez through Cordova and Middleton Island, was forced up as much as five and a half feet in some areas. At the sane time, the northwest edge, 200 miles to the west and extending from the Kenai Peninsula to Kodiak Island sunk by a like amount. The entire island of Kodiak settled five feet below its previous level.

The tilting of this huge block produced a giant seiche, an effect similar to that of kicking water in one end of a massive bathtub, Dr. Van Dorn said. A great torrent of water surged from the south edge to the north edge of the land mass. Almost immediately, most of the wave action was then reflected with great force back to the south and on down the coast of Canada and the United States.

The surge of water to the north was seen by residents in Valdez, Cordova, and Middleton Island who observed great sudden recessions in the water level, and by residents at Hope, Seldovia, and Kodiak Island who observed early increases in the water level.

Dr. Van Dorn said very little of the wave action continued north into Shelikof strait and Cook Inlet due to the presence of a shallow ridge which connects the Kenai Peninsula with Kodiak Island at a depth of about 50 fathoms. Anchorage, located on the northern end of Cook Inlet, was protected from major wave action.

In addition, apparently very little wave action moved to the west since no abnormal disturbances were observed on the tide gages at Adak and Attu in the Aleutian Islands.

The major damage to the port towns located throughout Prince William Sound was caused by the gigantic seicheing action in the long narrow fiords. The towns of Seward, Valdez, Cordova, and Whittier were literally drowned, Dr. Van Dorn said.

In spite of the slumping of the deltas on which the towns are built, the damage would have been minor had it not been for the avalanche of water that traveled the length of the fiords. Dr. Van Dorn said Seward, located on a fiord about 30 miles long, 2 miles wide, and about 100 fathoms deep, was struck first by a cross seiche, causing minor damage, and then by a longitudinal seiche which pushed the fishing fleet up into the town.

Several eyewitnesses in Seward watched as an oil tanker in the harbor appeared to drop from sight below the water level but then reappeared two minutes later as the mass of water surged back across the fiord.

"The cross seiche was misleading rather than a warning," Dr. Van Dorn said. "Everyone thought the waves were over but then, 30 minutes later, the longitudinal seiche, coming the length of the fiord, swept in and wrecked the town. This pattern was repeated in nearly every fiord and bay in the Prince William Sound area."

A miner who fought a running battle against the waves in Hobo Bay in the interior of the sound was able to describe vividly the seiches that hit his camp. He said he and his partner ran to higher ground when they felt the earthquake, even though their cabin was located five feet above the highest tide level. They returned to the cabin after a small wave washed ashore but 45 minutes later they were up to their armpits in water and barely able to make dry land.

Dr. Van Dorn said the miner told him the same seicheing action took place three times forcing him and his partner to remain on the mountain all night. They were airlifted to safety by helicopter the next day.

Dr. Van Dorn said very little flooding was found on Montague Island located in the middle of the sound, indicating that it was on the axis with the major wave action on either side.

Dr. Van Dorn was able to check the uninhabited outlying islands in a small single engine plane, fitted with wheels, and flown by an Alaskan bush pilot.

"The only place the pilot could land was on the narrow beaches and even then he wasn't sure that the sand was solid enough to support the wheels of the plane," Dr. Van Dorn said. "He would make one pass touching the wheels down and wobbling the wings to test the firmness, and then circle back and land if he thought it was solid."

Aerial photographs were taken by the Air Force the day after the earthquake. The day was clear and the Air Force photographed every mile of the stricken area, giving a complete picture of what had taken place. Dr. Van Dorn said thousands of landslide scars were vividly pictured by the spilling of black earth throughout the miles of snow covered mountains. He said brilliant blue and green cracks and fissures were seen in the glaciers.

Dr. Van Dorn said his findings will probably be amended by further investigations which may take a year to complete.

"This is the first time that a large scale tsunami has been generated in an area where there were many people living and also where there exists a fairly detailed geodetic control," he said. "New land elevation surveys and many eyewitness accounts of the wave history will make it possible to put together the most complete picture ever obtained of the tsunami generation process."

Dr. Van Dorn said the United States Coast and Geodetic Survey ship, Surveyor, is now working in Prince William Sound making geodetic surveys. He said seismologists and structure experts from Japan, Hawaii, and other areas are combing the Alaskan countryside in an effort to find out what happened.