

**MAY 31, 1985
A DEADLY
TORNADO
OUTBREAK**

The devastating tornado outbreak of May 31, 1985 was responsible for 88 deaths, and over \$200 million in damage. What caused these deadly storms? What can we learn from the experience?

DONALD WITTEN is a public information officer for the National Weather Service in Washington, D.C.

By Donald E. Witten

The tornado outbreak that struck Ohio and swept through western Pennsylvania, central New York, and Ontario, Canada, on May 31, 1985, proved to be the worst tornado event in the written weather history of Pennsylvania.

Some 88 people were killed—12 in Ohio, 64 in Pennsylvania, and another 12 in Canada. The tornadoes included some of the most violent and widespread twisters on record nationally. They spun along 21 well-defined tracks in Ohio and Pennsylvania and another eight tracks in Canada as well as a number in New York. Total damage amounted to over \$200 million.

Pennsylvania's previous worst tornado event occurred in 1944 when three powerful twisters with winds

PRELIMINARY TORNADO STATISTICS— MAY 31, 1985, OUTBREAK

Number	Tornado Name	F-Scale	Length km	Width m	Time		Deaths
					TD	EDT	
1	Rush Cove	2	4	e30	3:00PM		0
BARRIE FAMILY							
2	Hopeville	3	17	e150	4:10		0
3	Corbetton	3	35	200	4:17		0
4	Borden	2	18	e150	4:50		0
5	Essa	1	0.5	30	4:57		0
6	Barrie	4	10	250	5:00		8
GRAND VALLEY FAMILY							
7	Grand Valley	4	102	250	4:15		4
8	Wagner Lake	1	5	e100	5:40		0
9	Reaboro	1	8	e100	6:05		0
ALMA FAMILY							
10	Alma	3	33	e150	4:15		0
11	Ida	2	9	e150	6:15		0
12	Rice Lake	3	14	e200	6:20		0
13	Minto	1	1	13	6:35		0
ALBION FAMILY							
14	Albion OH-PA	4	23	400	4:59		12
15	Corry PA-NY	4	45	e300	5:25		0
16	Busti NY	3	21	e200	6:25		0
17	Dorset OH-PA	2	16	150	5:28		0
SAEGERTOWN FAMILY							
18	Linesville PA	2	6	200	5:10		1
19	Saegertown PA	3	37	600	5:25		2
20	Centerville PA	3	27	800	6:12		2
21	Thompson Run PA	1	8	200	6:30		0
ATLANTIC FAMILY							
22	Mesopotamia OH	3	24	300	5:05		0
23	Kinsman OH	2	5	e150	5:20		0
24	Atlantic PA	4	90	600	5:20		14
25	Tionesta PA	4	48	700	6:35		7
26	Lamont PA	2	55	400	6:50		1
KANE FAMILY							
27	Tidioute PA	3	21	800	7:25		0
28	Kane PA	4	42	900	8:00		4
MOSHANNON FAMILY							
29	Moshannon State Forest	4	105	1000	7:35		0
30	Watson PA	3	34	600	9:15		5
31	Hollenback Twp. PA	1	16	400	10:45		0
WHEATLAND FAMILY							
32	Wheatland OH-PA	5	66	450	6:40		24*
33	Big Bend PA	2	10	130	7:54		0
34	Emlenton PA	0	8	30	7:56		0
BEAVER FALLS FAMILY							
35	Middleton OH	2	24	40	7:35		0
36	Beaver Falls PA	3	63	300	8:10		9
37	Penn Run PA	0	10	25	9:53		0
UTICA FAMILY							
38	Utica OH	3	45	80	7:15		1
39	Cooperdale OH	1	18	70	7:20		0
40	London OH	1	0.2	e10	7:06		0
41	West Union OH	1	0.2	e10	9:06		0

Notes: e indicates estimated; * indicates 16 in Ohio and 8 in PA. Fatalities by tornado and by state are preliminary: Pennsylvania: 65, Ohio: 17, Ontario: 12 Total: 94

from 207 to 260 miles an hour swept from Cleveland, Ohio, southeastward through the suburbs of Pittsburgh, Pennsylvania, killing 43 people.

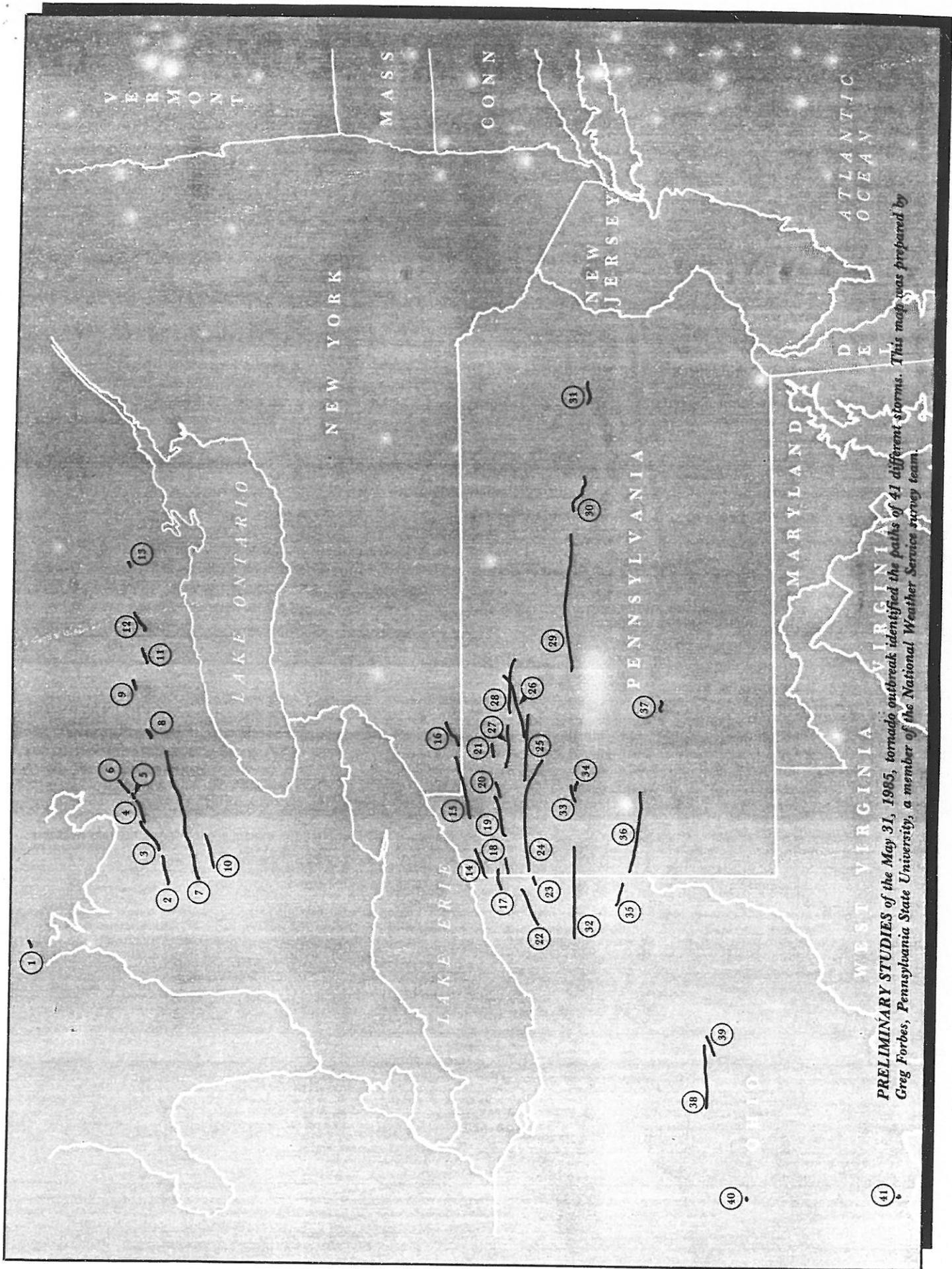
The last major tornado event in Ohio occurred on April 3-4, 1974, when 12 twisters tore through the western part of the state claiming 37 lives, injuring 2,000 people and causing damage estimated at \$100 million. Hardest hit was Xenia, Ohio, with tornadic winds ranging from 261 to 318 miles an hour. These tornadoes were part of a massive outbreak of 147 twisters produced by a large storm system that swept across the eastern third of the United States.

Storm Severity

Preliminary findings from the NOAA disaster survey team revealed that one of the 21 tornadoes generated internal winds reaching 300 miles an hour, an F-5 classification on the Fujita-Pearson Tornado Scale. Eight other twisters in the outbreak were classified as F-4's with internal winds indicated at speeds up to 250 miles an hour. More than half of the Ohio and Pennsylvania tornadoes churned up paths ranging from a quarter of a mile to over two miles wide and as long as 50 miles. All of them moved forward at speeds ranging from 35 to 60 miles an hour. In contrast, the average tornado has a path one-eighth of a mile wide and two miles long, and moves forward at 35 miles an hour.

The most violent of the tornadoes touched down at Ravena Arsenal, Ohio—about 30 miles west of Youngstown—and continued on the ground through Newton Falls and Niles, Ohio, and then across the Pennsylvania state line through Wheatland and almost to Mercer, Pennsylvania. Total path of this tornado was 41 miles. At touchdown, this tornado was classified as an F-4, but it intensified to an F-5 as it reached Niles.

At least one individual in Newton Falls, Ohio, was recognized by the survey team for saving lives there. He is Police Captain Clayton Reakes who was trained as a tornado spotter by the National Weather Service. Reakes warned over 100 bingo players in a building to take cover if they heard the town's siren. He then climbed to the

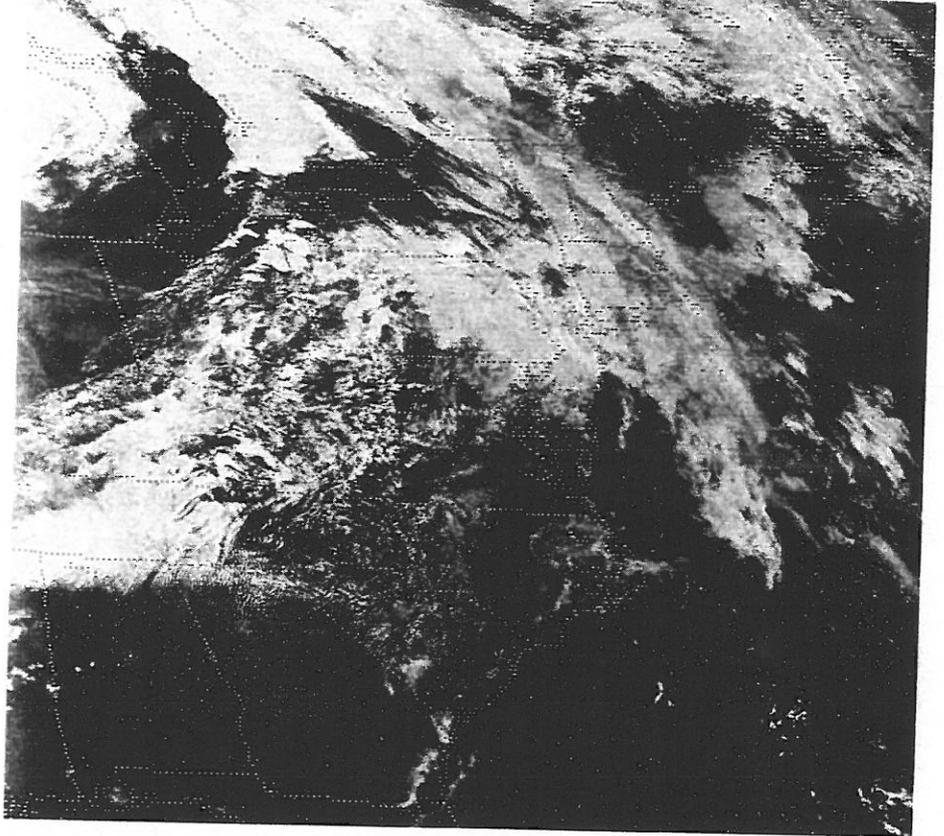


PRELIMINARY STUDIES of the May 31, 1985, tornado outbreak identified the paths of 41 different storms. This map was prepared by Greg Forbes, Pennsylvania State University, a member of the National Weather Service survey team.

ANATOMY OF

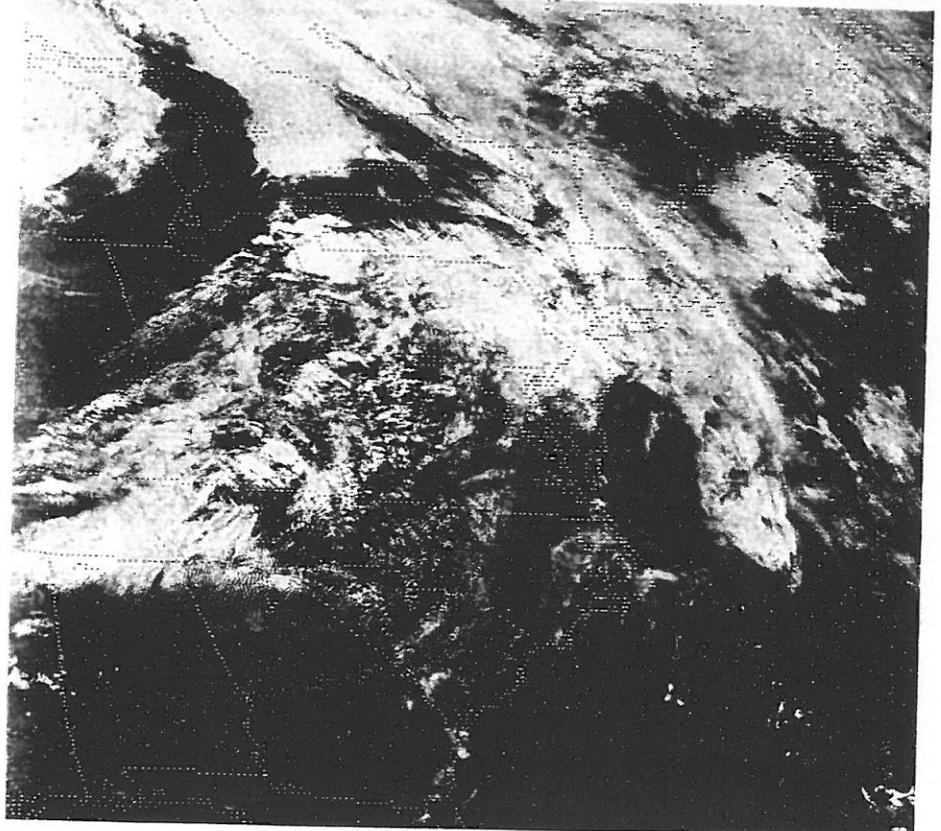
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TWO AND A HALF HOURS in the life of a deadly storm system are shown in this series of photographic images from GOES weather satellites. The storm, on May 31, 1985, struck Ohio, western Pennsylvania, central New York, and a large part of the province of Ontario in Canada. This photo shows the storm at 4:30 p.m. on that day, spawning clouds approaching Albion, Ohio, and nearby areas in Pennsylvania. It would shortly cause the most severe tornado outbreak in the history of Pennsylvania, killing 64 persons in that state. The most destructive "family" of tornadoes occurred at Wheatland, spanning the Ohio-Pennsylvania line, and hitting Big Bend and Emlentown, Pennsylvania; 24 persons, 16 in Ohio and 8 in Pennsylvania, were killed in that outbreak.



A HALF HOUR LATER, at 5 p.m., a twister has just hit Albion, Ohio, and others in the same group will strike Corry, which straddles the Pennsylvania-New York line, and Busti, New York, taking a toll of 12 lives, all in Albion. Another deadly family of storms known as the Atlantic family will strike Mesopotamia, Ohio, in five minutes, then work its way across Kinsman, and the towns of Atlantic, Tionesta, and Lamont in Pennsylvania, killing a total of 22 persons, all in Pennsylvania.

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Preliminary Statistics

Longest tornado: Moshannon State Forest, 105 km

Longest tornado family: Moshannon Family, 231 km (155 on ground)

First tornado touchdown: Rush Cove, Ontario 3:00 PM

Last tornado liftoff: Hollenback Township PA 11:00 PM

Strongest tornado: Wheatland OH-PA, F5

Widest tornado: Moshannon State Forest, up to 3.5 km

Number of maxi tornadoes (F4,F5): 9

Number of moderate tornadoes (F2,F3): 21

Number of mini tornadoes (F0,F1): 11

Number of tornado families: 11

Number of tornadic thunderstorms: 15

Number of killer tornadoes: 14

Number of killer thunderstorms: 10

Total path lengths of 41 tornadoes: 1124 km

Duration of outbreak: 8 hours

Items of Scientific Interest

Tornadoes moved down hillsides into river valleys and back up subsequent slopes with only minor disruption of circulation in most cases.

In a few places there was evidence that stretching or compression of the tornado column as it moved over varying terrain produced spin-up or spin-down, respectively.

Many tornadoes were accompanied by mesocyclones which produced intermittent minor damage (tree limbs) over a path of up to 6 km surrounding the tornado. This type of damage usually continued to accompany the thunderstorm even after tornadoes had dissipated. Power outages due to fallen limbs were reported in association with these storms across the entire Commonwealth of PA.

In some of the damage tracks there was evidence that tornado-like vortices were forming under the mesocyclone on the south or north flanks of the main tornado and spiralling around and toward the tornado. These "inflow vortices" resulted in a widening of the "tornado" path to several kilometers in several tornadoes. The Moshannon State Forest tornado was the best example.

The Hollenback Township tornado had the inflow vortices, but did not have the main tornado, so was characterized by a complicated pattern of inflow swaths.

Several of the tornadoes made interesting turns; sometimes leftward and sometimes rightward.

Large hail also accompanied most of the tornadic storms, with confirmed occurrences of up to 6 cm.

Some of the thunderstorms also produced vivid lightning displays, and caused some fires.

The statistics cited in this article were prepared by Greg Forbes based upon aerial and ground surveys, interviews, and newspaper accounts.

Aerial and ground surveys in the United States were performed by:

Dr. Greg Forbes, associate professor, Penn State University

The National Weather Service

Mr. Duane Stiegler, University of Chicago

Aerial and ground surveys in Ontario were performed by:

Ontario Weather Centre, Atmospheric Environment Service

Mr. Brian Smith, University of Chicago

roof of the city's Municipal Building where he watched for possible tornadoes. Using a walkie talkie unit, the policeman ordered sounding of the town's siren when the advancing twister was spotted. Newton Falls suffered no fatalities from the storm.

Niles, Ohio, was not so fortunate when the powerful tornado passed through that city—nine people died. Fire Chief Charles L. Semple said that his city could have had a much higher death toll. He cited the fact that a new, but empty, nursing home for 100 people was totally destroyed in the area where the city's nine fatalities occurred.

Chief Semple said that if the city's roller rink had been destroyed an hour later than it was, it would have been filled with more than 300 youngsters. One tornado passed within 1,000 feet of Waddell Park where 300 people were attending five baseball games and an adult softball game. The youngsters scattered for cover when they became aware of the approaching tornado.

Family Outbreak

According to Fred Ostby, director of NOAA's National Severe Storms Forecast Center in Kansas City, Missouri, "The tornado outbreak was an explosive development of what is known as a family outbreak of tornadoes."

The original culprit was a low pressure system over the Lower Great Lakes area, which simultaneously drew hot, moist air northward from the Gulf of Mexico and cold dry air southward from Canada. As the cold front, or leading edge of the Canadian air, swept through the midwestern states and into the Gulf air, it set off an explosive development of violent thunderstorms and tornadoes. The storm was enhanced by a strong, upper level jet stream, which helped draw the Gulf air to high altitudes. There, it condensed to release latent energy as fuel for the tornadoes. □

*Damage photo by Jim Campbell,
NWS survey team.*

AN EYEWITNESS ACCOUNT

“The tornado was right on top of me . . .”

Mrs. Juel Sponaugle of Newton Falls, Ohio, was literally picked up and redeposited by the powerful tornado that swept through Newton Falls on May 31, 1985. She had been in her car when the tornado arrived but she knew that it was one of the least safe places to be during a twister. She made all of the right moves and survived the event. Here is her first person story:

“I heard the tornado alert as I pulled up to the stop sign on Route 534 where it turns into Broad Street. I knew instantly what it was and ducked down in the car to look out to the west where the storms always come from. I was looking right at the Church of God on Charleston Road. The tornado was already on the ground coming straight at me, and I saw parts of the church steeple coming off.

“I knew enough to jump out of the car and get away from it so that it would not blow on top of me. I visualized the car being blown over a nearby dam. I was looking for a low spot or a hole or anything I could get into, but there was nothing but flat cement. I ran toward the parking lot of the Ashland gas station with hopes of wrapping my arms around the concrete abutment of a sign.

“But it was too late. The tornado was right on top of me the moment I stepped out of the car. The next thing I remember I was on the ground. The lady five cars behind me later said she saw the tornado suck me straight up in the air and throw me across the Ashland parking lot next to the sign pole. I grabbed the pole base and tried to get my body in under the sign.

“Everything was beating me. Gravel and rocks felt like bullets hitting me. The big tree at Donna Sower’s Beauty Shop came down on top of me but the sign pole blocked its fall and the tree didn’t get me. Then, the roof of the gas station came down on me and the tree. I didn’t know what all was on top of me then.

“... like I was crepe paper.”

“The winds would suck me up and then slap me back down just like I was crepe paper. The whole time it sounded like a thousand freight trains inside my head. I didn’t even hear the tree fall on top of me.

“Although it seemed like hours, I suppose the whole thing lasted only a matter of seconds. Then I realized that I was choking because I had been pelted with so much mud and gravel and glass. It was all in my mouth, my eyes, in my ears and down my shirt.

“I tried to let go of the pole to reach into my mouth and clean it out, but I felt like I was frozen there. It was like I had hung on so tight that I couldn’t get my hands to work. I finally got loose and cleaned out my mouth and eyes, which were burning and stinging me.

As soon as I got my eyes cleared out, I was able to look out over the dam and that’s the first time I saw the tornado funnel. It was sucking up Alan’s Drug Store at the side of the dam. I could hear people screaming and crying. I had never seen a funnel before that.

“When I stood up, my left pants leg was ripped and my knee was cut, but not real deep. My leg was turning blue and was already half again normal size. Hot wires were dancing all around and I was afraid to move at first. When they stopped, I walked across the parking lot toward my car.

“The car that had been directly behind me at the stop sign was blown into a pavillion near the dam, and I could hear people in it screaming. It was really smashed up. A van that had been in line behind me was sitting on top of the gas station pumps.

“My car looked like it had been pelted with everything. The tires had two to three inch holes in them. The passenger’s side was all smashed in and all of the glass was busted out. I looked in at my purse, which was still on the car seat. It was cut to shreds from the flying glass. Wood and rocks and everything imaginable were inside the car where I had been sitting just moments before.”

—Don Witten

(Writer’s Note: This article is based on an interview of Mrs. Sponaugle taped by National Weather Service meteorologist, Jim Campbell, who was part of a NOAA disaster survey team that visited Newton Falls after the May 31 tornadoes.)