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‘Extraordinary’ Discovery

Elements of Virginia Asteroid Impact Found at Paint Hill Farm

BY ANA RISANO || Staff Writer ana@thepilot.com

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Front: Geologist Bob Ganis stands in the pipeline trench and studies the expected horizontal geology layer with a mysterious channel cutting through it. Photo contributed. Back: Paint Hill Farm consists of more than 300 acres of pristine longleaf pine forest ANA RISANO / The Pilot

The chance of being in the right place at the right time has led to a significant geological finding at Paint Hill Farm, a few miles outside of downtown Southern Pines.

Layers of ash, tsunami deposits and ejected rock from what was likely an asteroid impact in the Chesapeake Bay area in Virginia 35 million years ago were found preserved in an ancient channel.

To the untrained eye, it looks like multi-colored rock layers shaped by weather and time. But retired geologist Bob Ganis saw a story to tell, with each layer a chapter in an unwritten book

“The rocks at Paint Hill in Moore County are scientifically quite important and are a unique bit of geology,” Ganis said. “There is a geologic story told here, not told in a similar fashion, as far as we know, anywhere else in the country.”

The layers hold sequential details from the impact, which happened roughly 240 miles away. It’s the only known example of such layers in a setting far away from what’s considered America’s largest bolide impact. A bolide is an extraterrestrial object, like a meteor or asteroid.

“The layer of geology here chronicles the horrendous and varied consequences from impact in the succeeding minutes, seconds and hours upon the distant land — far beyond the marine target crater,” Ganis said.

When the bolide hit Earth’s surface, it created a series of catastrophes — killing life for hundreds of miles around. First was a fiery incineration. Then ash coated everything. Later, a swirling tsunami ripped through.

“To give some sense of the energy (the impact) created,” Ganis said, “if you took all the nuclear bombs and all the military arsenals everywhere in the world and you piled them up in one spot, and then you multiply that times hundreds and set them all off at once? That’s the kind of energy we’re talking about.”

The initial crater impact was 24 miles wide and 6,000 feet deep. It spread to 40 miles wide as the land around it crumbled away. The bolide was estimated between 2 and 3 miles wide, moving at an estimated 44,000 miles per hour, according to a research paper by the US Geological Survey.

“The blast zone inferno traveled at thousands of miles per hour. And it was an instantaneous kill zone for many hundreds of miles,” Ganis said.

At that time, America’s eastern shoreline was much further inland — at least half of North Carolina and much of Virginia were under the Atlantic Ocean. Scientists classify the time period as the Eocene, between 56 and 35.9 million years ago. Mammals not dissimilar to creatures today roamed the land.

But until this discovery, evidence beyond the crater was believed to have eroded away into the ocean. Yet, Paint Hill had the right conditions to preserve layers from the event.

“This is really an amazing bit of luck,” Ganis said. “And the whole project from the beginning to the end was a series of coincidences. Lucky things happening that fell into place.”

Deposits of the impact were found by accident in 2016. Ganis, who had previously been on the property because of a report about aquatic fossils, was invited to see a trench dug for a gas pipeline. The trench was open for one day, and he spent roughly one hour looking at what was then confusing geology.

He shared a picture of the trench and identified two distinctions — a horizontal Eocene layer and what appeared to be a channel, full of multi-colored debris, cutting through it.

“I did not expect to see that channel deposit,” Ganis said. “This was a mystery.”

Assembling the Team

Intrigued, Ganis started collecting fossils to date the findings. The Eocene lasted 20 million years, so he wanted to narrow it down. Among the fossils were small, fragile molds of shark teeth.

Ganis worked with a local family involved with the Sandhills Natural History Society: Nancy Rolland and her daughters, Emily and Hannah. They spent hours on the ground, carefully identifying and removing the fossils.



Clockwise from top left: Hannah Rolland, Bob Ganis and Steven Hageman at Appalachian State University looking at an enlarged surface of a bryozoan finding; Hannah and Emily Rolland find fossils at Paint Hill; Nancy Rolland finds a piece of petrified wood in the tsunami layer; Rich Whittecar examines the finding of ancient soils in the tsunami layer; David Cicimurri, Ralph Willoughby and Bob Ganis discuss fossils at the South Carolina State Museum; and Bob Ganis and Ralph Willoughby conduct measurements on a logging road at Paint Hill Farm.

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Once overwhelmed by their collection, Ganis reached out to retired vertebrate paleontologist David Cicimurri, who works at the South Carolina State Museum.

Ganis said Cicimurri was excited to see the fossils, having worked with similar ones in a collection from Alabama. The fossils narrowed down the 20-million-year Eocene period to about 3.5 million years.

Then, Ganis reached out to Steven Hageman, an invertebrate paleontology expert from Appalachian State University. Among the fossils at Paint Hill were findings of domal bryozoans — aquatic invertebrates.

Another piece fell into place when Ganis met Ralph Willoughby, who has worked extensively in the Eocene as a paleontologist and stratigrapher, at a conference.

Ganis said Willoughby worked by the book, visiting the property and measuring various aspects of the geology. Together, they identified what was believed to be plinthite, an ancient soil also known as paleosol with a distinct red-to-orange pattern.

“No one had reported Eocene paleosols in this part of the Southeast before,” Ganis said. “Everything’s new.”

So, plinthite expert Rich Whittecar, professor emeritus from Old Dominion University in Virginia joined the group. His main role was to confirm the plinthite finding.

With the team of researchers assembled, Ganis knew they had to dig another ditch to examine the layers. Until then, the work was based off of a picture of Ganis looking at the layers. The new trench was about four feet deep and 10 feet across.

Whittecar noted it had rained the day before the team gathered to look at the geology layers, so they splashed around in boots and scratched their beards while talking through what could have created such unique geology.

“This collaborative thinking really is so important because everybody brings their own interests to the field,” Whittecar said. “So it was a case of sitting and looking for the most part, and getting in and poking and taking some samples, and sitting and thinking some more.”

Extraordinary Claims, Evidence

Several theories were discussed before the scientists landed on an idea: a tsunami.

“Extraordinary claims require extraordinary evidence,” Ganis said. “So, proposing that the channel deposits were caused by a tsunami needed extraordinary evidence — something that had not been reported in this area.”

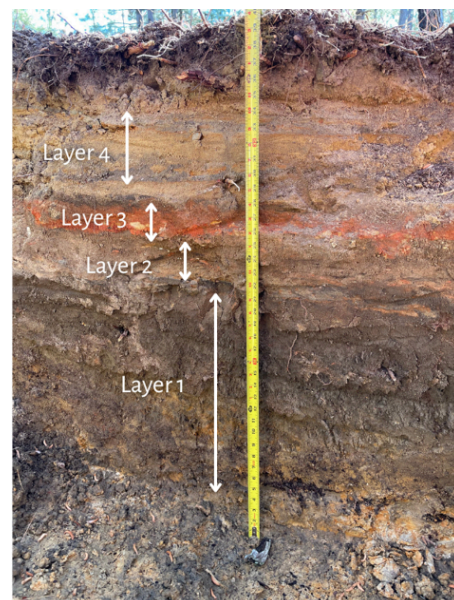
That’s when the Chesapeake Bay impact was considered. It had been reported to generate a tsunami “the likes of which the world perhaps had never seen before. Thousands of feet high.”

That tsunami, generated almost 240 miles away, would have traveled at hundreds of miles an hour, tearing up the coastal plain. And it aligned with the dating of the shark teeth fossils.

To further check the theory, the scientists reviewed the four distinct layers in the channel and how each could correspond with the Chesapeake Bay impact.

The bottom layer, or first layer, was full of charcoal and a sandy matrix. That was determined to be burned material from the impact. It also featured natural glass and an abundance of weathered rock fragments. When the impact occurred, it melted and exploded the rock around where it hit. That melted rock then cooled in the atmosphere and fell to earth as hard droplets called tektites.

“Clearly something had burned up here. Burned up big time. We’re talking about major scale incineration,” Ganis said.



The four chapters in the Paint Hill book of geology: the bottom, dark layer features burned material and ejecta, the next layer is a bed of ash, the third layer features the results of the tsunami and the top layer has backfill sediments.

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The second layer featured a thick bed of ash, similar to what happens after a volcanic eruption. But there are no volcanoes in North Carolina. The ash fall happened after everything was incinerated by the super-heated bolide impact.

The third layer from the bottom features the paleosols, where the tsunami ripped up the land.

“When you’re looking at this, nothing is living here,” Ganis said. “If you’re not burned up and dead, you’re suffocated from ash. And if you’re still alive, you’re going to die in the mud. There’s nothing that’s going to survive this.”

The last layer, closest to the earth’s surface, mostly consists of gravel and sand. Ganis said that is from the retreating tsunami waters. That wave went past Paint Hill, but eventually stopped, and all of the water retreated to the low points, pulling sediment with it.

“Now, it’s preserved. We’ve made a tomb for our deposits.”

But, Ganis said the final piece of evidence to confirm the extraordinary claim was finding high levels of iridium — a rare metal that occurs in miniscule amounts on earth and in higher levels in extraterrestrial objects.

The finding aligned with research by a father-son duo, Luis and Walter Alvarez, who found high concentrations of iridium in a clay earth layer around 65 million years old — around the time the dinosaurs went extinct. The Alvarazes had hypothesized the iridium distribution happened after a giant asteroid strike.

“There is absolutely no way that you’re going to enrich the sediments of Paint Hill in iridium if their origin wasn’t from an asteroid impact,” Ganis said.

The team of scientists worked on and off on this research for a decade, with most of the ground work before 2020. The findings are pending publication in the Southeastern Geology journal.

“Those layers out there are the book of geology,” Ganis said. “Those are the pages of our story. And that book is mostly gone everywhere.”

Paint Hill Farm Future

More than 300 acres comprising Paint Hill Farm has been sold recently by owner Alison Ives to The Nature Conservancy, further protecting the pristine longleaf pine forests her family has maintained for decades. The property is expected in coming months to be added to the neighboring Weymouth Woods Sandhills Nature Preserve.

In November, the state earmarked \$3.25 million from the North Carolina Land and Water Fund to buy the property, with nonprofit The Nature Conservancy serving as middle man. The federal government's contribution will allow the state to redirect about \$1.6 million of that money to other projects.

The property remains private property monitored by The Nature Conservancy and managed for its conservation value until sold to the state parks. Weymouth Woods Parks Superintendent Billy Hartness said it will take some time to prepare the property for visitors after the sale.

That includes looking through the grants it received to follow any stipulations about usage. The plan is to maintain the land for low-impact recreation like hiking and birdwatching. He anticipates reviewing existing trails and working to better them for visitors.

"What we're looking at when we're talking about developing trails is long-term sustainability because people love the park and as our population grows in this area, our visitation is just steadily climbing," Hartness said.

"That's more and more people on the trails, and the more people you have using them, the more damage they do. It's not horrible and people don't even notice it if your eyes aren't trained for it. The thing we worry about the most is erosion."

In 2024, Weymouth Woods had more than 152,000 visitors. The park has experienced a steep increase in visitation since 2018, when it had about 65,000 users.

The park spans over 900 acres today. Once Paint Hill Farm transfers to the state parks system, it will be over 1,200 acres of preserved forest in Southern Pines. The two homes on Paint Hill will become ranger houses.

Regarding important geology finds on the property, Hartness said the park plans to host educational programs about the discovery as well as monitor the park to ensure curious visitors do not damage any ongoing research. He noted a majority of the discovery is below ground.



At Paint Hill Farm, Saving a Key Piece of Southern Pines

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