

Proposed comet impacts forming Lake Michigan as an explanation of the formation of the Carolina bays.

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The Carolina bays are a group of hundreds of thousands of elliptical, shallow depressions along the eastern coast of North America and in the middle of North America. Their origins have been discussed for many years as possible wind erosion events or possible splash formations due to ejecta from an asteroid or comet impact. Wind erosion is not a satisfactory explanation since the axis of the bays are not all aligned, and the axis are not aligned with the prevailing winds. Several attempts have been made to explain the bays as splash marks from an impact in the vicinity of Lake Michigan, but no one has considered the Lake itself as the crater related to the impact primarily due to it being considered much too large to be an impact event.

Burgener 2019 (1), demonstrated that Kuiper Belt object orbits are typically unstable and therefore comet impacts should be more frequent and larger than previously expected, with new 10+ km size comets in Earth Crossing Orbits every 130,000 years. While not all will impact Earth, some will, and the frequency should be high enough to find such craters at present.

It is recognized that the angle of impact of 45° has the highest probability of occurring and that low angle impacts are much less common. What is often overlooked, is that although 45° has the highest probability, it is not true that low angle impacts are rare. The probability of an impact between 40° and 50° is 17.4%, but the probability of an impact between 0 and 25° is 17.9%. The probability of an impact between 0 and 10° is 3%, which is still high enough that some such impacts will happen. The chance of such a low angle impact leaving a noticeable crater or scar is minimal on a hard rock surface such as the Moon, but in this case, Lake Michigan was covered with a layer of 2 to 3 km thick ice, and the ground under the ice was relatively soft sediments. So a very low angle of impact would leave a splash scar of shallow depth, and send most of the impacted ice and sediments far away as ejecta. The comet itself would most likely continue on into space, as comets travel at speeds well above Earth escape velocity and such a low angle of impact would lead to a skip instead of an explosion.

It is proposed that a comet in several pieces, impacted Earth at the end of the ice age, about 12,700 years ago, impacting the present location of Lake Michigan and with a portion hitting the middle of Lake Superior, and ejecting large quantities of ice and sediments south east and south west. These large pieces of ice and sediments landed along the east coast of North America and in the middle of North America at low velocity due to air resistance slowing them, and hitting at very low angles of incidence due to their original momentum being directed away from the comet splash location. As such, elliptical depressions would form, with shallow depth. As most were formed from ice, most would leave no remaining typical asteroid or comet debris in the depressions.

The remaining scar due to the comet impact / skip is a large portion of the present day Lake Michigan and a smaller depression in the middle of Lake Superior.

(1) Burgener, J., "The Influence of Dwarf Planets on the Stability of Objects in the Kuiper Belt", 50th Lunar and Planetary Science Conference, March 18-22, 2019, presentation #3163

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