Fossilized Lightning!

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Have you ever been in a thunderstorm? Have you ever sat in a garage with the door open and watched the rain and the lightning as the storm passed overhead? Have you felt the house rumble and heard the windows rattle from a particularly loud crack of thunder? While some storms can be dangerous and destructive, spawning high winds and even tornadoes, others can just be noisy and harmless. Sometimes if the conditions are right, when lightning strikes the ground something amazing can happen.

The energy released from lightning strikes can be tremendous and dangerous; lightning can reach temperatures of 2,500° C (4,532° F) (Ege, 2005). When lightning strikes flesh it can kill. If lucky enough to not be killed, the recipient can be scarred for life. Often, scars called Lichtenberg figures are left on the tissue; humans and cattle are most often reported to have Lichtenberg figures. They have a striking resemblance to tree branches or roots and can be mistaken for tatoos. Of course more common life is more likely to be struck by lightning, especially tall plant life such as trees. Reports of trees exploding due to lightning strikes are not uncommon. The energy (released as heat) contained within lightning is enough to convert the sap within the tree to steam instantaneously, causing an explosion. Thunder is the result of the rapid, superheating of air surrounding the lightning bolt causing rapid expansion of the atmosphere and sending out a shock wave (similar to a sonic boom) that we hear as thunder.

If lightning strikes in an unconsolidated sandy area like a beach or a dune, it can vitrify the surrounding sand and a fulgurite can form (Webb, 1968). A fulgurite is what we call the fused sand-grains which are melted from the energy released during a lightning strike. Fulgurite comes from the Latin word *fulgur* meaning lightning (Brown, 1954). Sand will melt instantaneously forming a fulgurite at 1,800° C (3,272° F) (Ege, 2005), well below the maximum temperature of lightning. If lightning strikes consolidated rock it can break the rock and sometimes leave a white powder, possibly the remains of a fulgurite (Viemeister, 1983). Although fulgurites aren't actually fossils, calling them "fossilized lightning" is a quick and easy way to convey what they are.

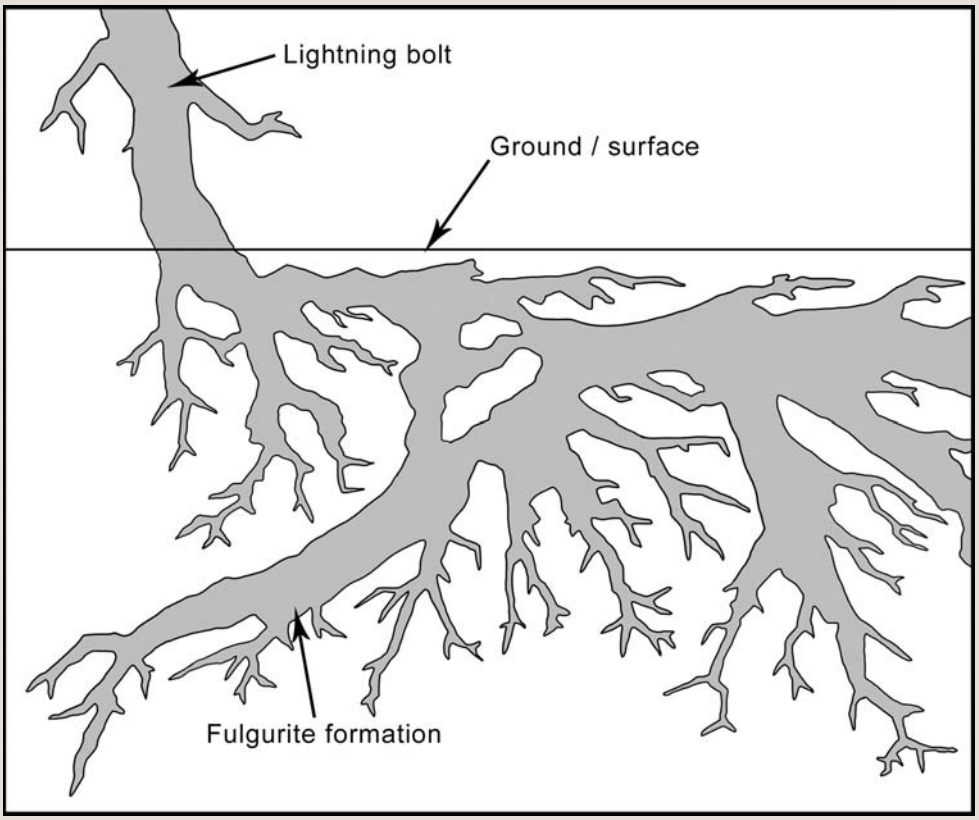

Figure 1. Graphic representation of fulgurite formation. Image by Becky Barnes.

Fulgurites are naturally occurring, nonvolcanic glass formations, such as tektites, and can come in many shapes and sizes. They can be straight or branching, hollow or solid, small or large, short or long, and all combinations in between. The shape reflects the route that the energy took through the sand after the lightning strike (fig. 1). Most often fulgurites look similar to branching tree limbs or roots. They can vary in color depending on the rock type, but are usually tan or black (Viemeister, 1983). "Inside is irregular and outside is rough sand which adheres to the fused areas" (Viemeister, 1983).

Fulgurites have been described as early as 1711 (Webb, 1968) and are found worldwide, but are considered to be rare. Although easily reproduced in the laboratory using electricity, naturally

Figure 2. Fulgurite, NDGS R92. Donated by Mr. David Jensen.

occurring fulgurites can be difficult to find and even more difficult to extract. One of the largest fulgurites ever found was in New Jersey. It broke into many pieces as it was being dug up, but when reassembled it was over 9 feet long (Viemeister, 1983). Even though fulgurites aren't exactly common, the NDGS has three in its collections. These were collected and donated by Mr. Dave Jensen (figs. 2-4).

When their distribution over a specific area is used in conjunction with other factors they can be used as paleoenvironment indicators (thunderstorms) (Sponholz et al., 1993). Using distribution patterns and relative dating techniques, one can infer the occurrence of thunderstorm activity in a certain area during a certain period of time (Sponholz et al., 1993). When used together with other paleoenvironmental indicators such as paleobotany, one can get a better understanding of past climates.

Next time a thunderstorm rolls through your area, watch out for lightning strikes. Maybe one of Thor's thunder bolts will be preserved in the ground.

References

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Figure 3. Fulgurite, NDGS R93. Donated by Mr. David Jensen.

Figure 4. Fulgurite, NDGS R94. Donated by Mr. David Jensen.