This is Scientific American's 60-second Science, I'm Julia Rosen.

We all know the story: 66 million years ago, a giant asteroid crashed into Earth, killing off three quarters of all species, including most of the dinosaurs.

Researchers suspect that the impact caused the extinction by kicking up a cloud of dust and tiny droplets called aerosols that plunged the planet into something like a nuclear winter.

"These components in the atmosphere drove global cooling and darkness that would have stopped photosynthesis from occurring, ultimately shutting down the food chain."

Shelby Lyons, a recent Ph.D. graduate from Penn State University.

But scientists have also found lots of soot in the geologic layers deposited immediately after the asteroid impact.

And the soot may have been part of the killing mechanism too—depending on where it came from.

Some of the soot probably came from wildfires that erupted around the planet following the impact.

But most of these particles would have lingered in the lower atmosphere for only a few weeks and wouldn't have had much of an effect on global climate.

But scientists hypothesize that soot may also have come from the very rocks that the asteroid pulverized when it struck.

If those rocks contained significant amounts of organic matter—such as the remains of marine organisms—it would have burned up on impact, sending soot shooting up into the stratosphere.

In that case, soot would have spread around the globe in a matter of hours and stayed there for years. And it would have radically altered Earth's climate.

So Lyons and her team set out to identify the source of the soot.

They looked at chemicals known as polycyclic aromatic hydrocarbons, or PAHs, which are another by-product of combustion.

“You can find PAHs in meat or veggies that you grill. You can find them from the exhaust of a car.

You can also find them in smoke and debris from the wildfires today out west.”

PAHs are made up of fused rings of carbon atoms—think of chicken wire.

To determine the origin of the soot, the researchers looked at the structure and chemistry of the PAHs buried along with it.

Specifically, the researchers looked for groups of atoms that stick off the rings like spikes.

PAHs generated from burning wood don’t have many spikes, but PAHs from burning fossil carbon—like what would have been in the target rocks—have more.

Lyons and her team found that most of the PAHs deposited after the impact were spiky, which suggests that soot from the rocks hit by the asteroid played a major role in the mass extinction.

“There was more dust and more sulfate aerosols than soot, but soot is a stronger blocker of sunlight than either of those two. So a small amount of soot can drive large reductions in sunlight.”

The findings are in the Proceedings of the National Academy of Sciences.

The results suggest that the devastation of this very sooty asteroid impact may be due in part to a fluke of geography: the space rock smashed into the Gulf of Mexico, where the sediments were rich in organic matter.

They still are: the region produces large amounts of oil today.

“Where it had occurred was likely one of the reasons that it led to a major mass extinction. It was kind of the perfect storm, or the perfect asteroid impact, I guess you could call it.”

Thanks for listening for Scientific American's 60-second Science. I'm Julia Rosen.

这里是科学美国人——60 秒科学系列，我是朱莉娅·罗森。

我们都知道这个故事:6600 万年前，一颗巨大的小行星撞向地球，消灭了四分之三的物种，大多数的恐龙也包括在内。

研究人员怀疑，撞击是由一团被称为气溶胶的尘埃和小水滴组成的云引起的，这些云使地球突然进入了类似核冬天的状态。

“大气中的这些成分推动了全球变冷和进入黑暗，这会阻止光合作用的发生，最终关闭食物链。”

谢尔比里昂斯，最近获得了博士学位，毕业于宾夕法尼亚州立大学。

但科学家们也在小行星撞击后立刻沉积的地质层中发现了大量煤烟。

煤烟也可能是杀戮机制的一部分——这取决于它的来源。

一些烟灰可能来自撞击后在地球周围爆发的野火。

但这些粒子中的大多数只会在低层大气中停留几周，不会对全球气候产生太大影响。

但科学家们假设，烟灰也可能来自小行星撞击时粉碎的岩石。

如果这些岩石中含有大量的有机物，比如海洋生物的残骸，那么它们就会在撞击中燃烧殆尽，并将烟灰喷到平流层中。

在这种情况下，烟灰会在几小时内扩散到全球各地，并在那里停留数年。它将从根本上改变地球的气候。

因此，里昂斯和她的团队着手确定烟灰的来源。

他们研究了被称为多环芳烃的化学物质，这是燃烧的另一种副产品。

“你可以在烤肉或蔬菜中发现多环芳烃。你可以在汽车的排气管里找到它们。

你也可以在西部野火的烟雾和碎片中找到它们。”

多环芳烃是由碳原子的熔合环组成的——想想铁丝网。

为了确定烟灰的来源，研究人员观察了与烟灰一起掩埋的多环芳烃的结构和化学成分。

具体来说，研究人员寻找的是像钉子一样从环上粘下来的原子群。

燃烧木材产生的多环芳烃没有很多峰值，但燃烧化石碳产生的多环芳烃——比如目标岩石中的多环芳烃——有更多峰值。

里昂斯和她的团队发现，撞击后沉积的大多数多环芳烃呈尖状，这表明小行星撞击岩石产生的烟尘在大规模灭绝中扮演了重要角色。

“灰尘和硫酸盐气溶胶比煤烟多，但煤烟比这两种都更能阻挡阳光。所以，少量的煤烟就能大幅减少日照。”

这项研究结果发表在《美国国家科学院院刊》上。

研究结果表明，这次烟尘弥漫的小行星撞击造成的破坏可能部分是由于地理上的侥幸:太空岩石撞进了墨西哥湾，那里的沉积物中富含有机物。

现在仍然如此:该地区现在生产大量石油。

“它发生的地方可能是导致大规模物种灭绝的原因之一。这是一场完美的风暴，我想你可以称之为完美的小行星撞击。”

谢谢大家收听科学美国人——60 秒科学。我是朱莉娅·罗森。