**LIZ BONNIN:** Hi, I'm Liz Bonnin, and I'm digging through the BBC's amazing archives to find out all about physical geography.

Now there are a few things you need to know for this next clip.

First, that the Grand Canyon, in the American state of Arizona, is one of the great natural wonders of the world.

Second, that just a few hundred years ago, most people believed that the world was roughly 6,000 years old.

And third, that one of the men who showed that was far from accurate was a Scottish geologist called James Hutton, whose study of rocks helped to prove that our Earth is way older than that.

Got all that? Grand canyon, 6,000 years old - wrong. James Hutton, Scottish rock man - right.

Okay, armed with that information, we can join physicist, Michio Kaku and his pal, Dr Dave Thayer, looking at how the Grand Canyon was carved out of rock by the Colorado River over many millions of years.

**MICHIO KAKU:** The Grand Canyon in Arizona. 270 miles of Colorado River flow across two states, carving out a chasm one mile deep. It's created a landscape on an epic scale.

**DR DAVE THAYER:** Let's have a seat here.

**MICHIO KAKU:** Now Dave, the Colorado River's a small little thing. How can the Colorado River gouge out such a huge canyon?

**DR DAVE THAYER:** The river is digging the canyon deeper at the rate of one foot every thousand years.

**MICHIO KAKU:** Mm-hm.

**DR DAVE THAYER:** And in that time all this rubble is eroding down into it from the rain.

**MICHIO KAKU:** I see…

**DR DAVE THAYER:** You can imagine how long that's taken because it's all changing to sand as it goes.

**MICHIO KAKU:** Wow. And how much rock has been carved out?

**DR DAVE THAYER:** Well there's 800 cubic miles of missing rock in the Grand Canyon.

**MICHIO KAKU:** A mile below us, the river continues to cut its path through the rock, carrying it away in its silty waters.
So we're talking about the power of water, right? I mean, water carved this cathedral out of nothing.

**DR DAVE THAYER:** Yep.

**MICHIO KAKU:** And how long has this erosion been taking place?

**DR DAVE THAYER:** Well at least 5.5 million years is what they say.

**MICHIO KAKU:** Alright.

Unimaginable eons of time were needed for water to carve out valleys. And Hutton noticed something else. The layers of rock revealed by erosion, showed a still greater scale of time.

Now Dave, when I look at a rock, it's boring. A rock is a rock is a rock. But you're telling me that each rock has a story, right?

**DR DAVE THAYER:** Well that's true, Michio. You can see all the different colours of the layers in the canyon.

**MICHIO KAKU:** Mm-hm.

**DR DAVE THAYER:** And each one has a different thing to tell.

**MICHIO KAKU:** Amazingly, long, long before the rock was eroded away, its layers had to have been formed.

**DR DAVE THAYER:** Oh, here's a nice place to see the strata.

**MICHIO KAKU:** On the side of the canyon. Yeah. I see, yeah, right here.

**DR DAVE THAYER:** This red layer right here would be a silt stone that formed at the edge of an ocean. And, you know, it took probably a thousand years to form one inch of it.

**MICHIO KAKU:** A thousand years? So you're telling me that all of human recorded history, going back to the Babylonians and the Egyptians…

**DR DAVE THAYER:** Would be just that much.

**MICHIO KAKU:** Just a few inches. Yeah.

**DR DAVE THAYER:** Isn't that staggering?

**MICHIO KAKU:** So this is like a time machine basically, right? A thousand years per inch, on average.

**DR DAVE THAYER:** On average, yeah. If you just took the whole length of just the sedimentary rocks in the canyon that have been deposited here.

**MICHIO KAKU:** Uh-huh.

**DR DAVE THAYER:** Floods and rivers and streams and the ocean coming in.

**MICHIO KAKU:** Staggers the imagination.

**DR DAVE THAYER:** It does indeed. As you walk down this trail, by the way, I wanted to tell you that every step you take, you go about 20,000 years into the past.

**MICHIO KAKU:** Is that right?

**DR DAVE THAYER:** Yeah. And we've taken quite a few steps already.

**MICHIO KAKU:** Quite a few steps.

**DR DAVE THAYER:** And there are a lot more steps to get all the way down to the river.

**MICHIO KAKU:** I see.

**LIZ BONNIN:** So those layers of rock are really a bit like the rings on a section of a tree trunk. Both giving a visible indication of how old they are.