

Script for the “Grand Time Game”

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Cast:

Time Voyagers:

Precambrian
Paleozoic
Mesozoic
Cenozoic

Geologists:

Arizona
Georgia

Precambrian: This is _(your name)_____, coming to you from the Precambrian, 4.6 billion years back in time. Our time-craft can’t land, because Earth is still molten. The lava stays hot because asteroids keep hitting the planet. Just dodged another one! I’ll check in again when there’s something living to report on.

Now it’s 3.8 billion years ago. Even moving at 1000 years a minute, it’s over a year since my first report. In that time the planet cooled to rock, and it rained a long time, making oceans. Now the ocean bottom looks like the floor of my shower when I haven’t scrubbed it for a while. Germs everywhere. Well, that’s life. Wait a minute. That’s life! Bacteria - that’s all that’s going to be alive for a long, long time.

Now I’m reporting from 1.8 billion years ago. We’ve been time voyagers for more than five years! I have a report now from our Arizona geologist, _____.

Arizona: The metamorphic rocks in the bottom of the Grand Canyon tell a story from this time. They were forming deep underground under great heat and pressure. Metamorphic rocks like these form whenever two moving continents collide.

Instructor: [shows and explains Precambrian rocks at bottom of #01 Grand Canyon picture]

Precambrian: Now I’m checking in at 1 billion years ago. Nearly seven years riding the time-craft, and only now are there living things big enough to see. I recognize seaweed, sponges and jellyfish. Now the Georgia geologist is calling in.

Georgia: Continents have collided here. Heat and pressure deep underground make metamorphic rocks. At 1 billion years old, these are the oldest rocks in Georgia, found near Cartersville, about 50 miles north of Atlanta.

Precambrian: My work with the Precambrian is almost over. Nobody told me I would have to cover 88% of Earth history. There is still nothing at all alive on the land, and not much to see in the oceans, either. That will begin to change right after this review.

Instructor: [asks students to give answers for each matching item from 4.6 to 1.0 billion years]

Paleozoic: This is _____, reporting from the beginning of the Paleozoic Era. Now there is only one year left until we time-voyagers will be back to civilization. Some people call this moment the Cambrian explosion. You can see the explosion on page 312 of your text.

Instructor: [Shows overhead corresponding to textbook page; points out and discusses trilobite]

Paleozoic: OK, so nothing blew up. But in a few million years - just a few days on our time voyage – the ocean became full of many different kinds of life. Not only that, but the new animals have hard skeletons, so there will be many more fossils left behind.

Was there anything going down in Arizona?

Arizona: Everything was going down in Arizona. Very slowly – maybe an inch or two every century. But over time it was enough to put what had been dry land down below sea level.

Instructor: [shows and explains model including the foam board representing Precambrian rocks. Lowers model platform, to make room for the first layer].

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Arizona: Rivers carried sand to the ocean and put in the first layer of sand at the bottom of the Grand Canyon. It contains a few trilobite (TRY-lo-bite) fossils.

Instructor: [shows the first layer, places in model].

Arizona: As the bottom continued to go down, a thick layer of mud settled out. It has trilobites and other fossils.

Instructor: [lowers platform, adds two layers for shale – points out Tapeats Sandstone and Bright Angel Shale, first on #01 overhead then on #02 Bright Angel Creek overhead].

Arizona: Climbing up through the Grand Canyon’s rock layers, you notice that the trilobites change gradually. Fossil experts can tell early, middle, and late Cambrian trilobites apart, just like a car expert could tell a 1980 Toyota Camry from a 1990 or 2000 model.

Paleozoic: So what happened in the Cambrian Period in Georgia?

Georgia: The rock layers in northwest Georgia start out like the Grand Canyon’s – sandstone, then mud. Then we find limestone that formed in a tropical sea.

Paleozoic: In that tropical sea, continuing into the Ordovician (or-doh-VISH-un) period, new life forms appeared that you can see in your text. Now let’s hear from the Arizona geologist.

Arizona: (silence)

Paleozoic: Arizona, are you there?

Arizona: (silence)

Paleozoic: We must be experiencing technical difficulties. Next, in the Silurian Period, scorpions are on the land. They are the first land animals I’ve noticed. It’s 420 million years ago, around March 25 of the last year in our time voyage.

Checking back in the Devonian Period, about 370 million years ago, I’m starting to see sharks in the ocean.

Now it’s the Mississippian Period. We have a report from Arizona. What happened?

Arizona: __ (Paleozoic’s name) ____, the rocks of the Grand Canyon are missing about 170 million years of Earth history. Apparently, around the end of the Cambrian, the land just stopped going down. This area was mostly out of the water. Soil formed and some erosion happened. Finally, in the Mississippian, the bottom started to go down again and the sea came back in. The layers in the canyon suggest a big coral reef, with clear, warm water.

Instructor: [lowers model and puts down gray layer for limestone; points out Redwall limestone on #02 Bright Angel Creek overhead].

Paleozoic: I’m checking in now at the end of the Pennsylvanian period. From outer space, I see that all the continents have come together as Pangaea. What happened in Georgia?

Georgia: Africa and North America collided. Metamorphic and igneous rocks tell part of the story. They were formed deep underground about 350 million years ago by great heat and pressure. Look for these metamorphic rocks in your back yard, or see the igneous rock at Stone Mountain.

Instructor: [shows #03 Stone Mountain and explains magma cooled deep underground at this time to form granite, was only revealed at surface much later after millions of years of erosion.]

Georgia: While Stone Mountain Granite was forming underground, high mountains must have been above it. You can see the evidence in northwest Georgia, at an attraction called Rock City. Geologists think the sandstone here washed in as sand from the direction of Atlanta, where it eroded off great mountains.

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Instructor: [shows #04 Rock City and explains that the thick ledge of sandstone came from sand laid down in rivers and beaches at this time]

Paleozoic: Did the collision affect Arizona?

Arizona: Red clay and sand, coming from mountains around Texas, put an end to the coral reef, and filled things up above sea level. There are tracks of amphibians here and there. Later there were desert sand dunes, with tracks of some of the first reptiles.

Instructor: [lowers platform to put down two red layers for Supai, one tan layer for Coconino / Kaibab - shows layers on #02 & 05 Bright Angel Creek. Explains that these are the rim rocks; Coconino has the reptile tracks].

Paleozoic: The Kaibab belongs to the Permian Period, the last period in the Paleozoic Era. That means it’s almost time for me to go. Sadly, the end of the Paleozoic, 248 million years ago, was time for a lot of things to go. About 90% of species living in the ocean, including all the trilobites, were wiped out. It was the greatest extinction event ever, and people still don’t know why.

Next – big scary monsters, after this review.

Instructor: [asks students to give answers for each matching item from 544 to 248 million years]

Mesozoic: This is _____ in the Mesozoic Era. After a big extinction, there is more room for new talent. It’s now 221 million years ago, and I see little animals with fur, the first mammals. Of course, as you see on page 314 in your text, the big new star is the dinosaur.

Instructor: [Shows overhead corresponding to textbook page; points out dinosaurs, birds, mammals, flowering plants]

Mesozoic: Are there dinosaur fossils in the Grand Canyon?

Arizona: Not a one. Because none of the rocks in the canyon are Mesozoic, not a trace of a dinosaur can be found. But east of the canyon in the Painted Desert, Navaho people can show you dinosaur tracks.

Instructor: [shows #06 Dinosaur Track and points out dinosaur track].

Arizona: Dinosaurs left behind other kinds of evidence, too.

Mesozoic: What kind of other evidence?

Arizona: The guide will try to tell you it’s a dinosaur egg, but really it’s a coprolite (COP-roh-lite).

Mesozoic: What’s that?

Arizona: Better not ask.

Instructor: [discusses that coprolites, fossil feces, are valuable fossils because they help us know what animals ate. Shows #07 Painted Desert, pointing out the line below which no dino fossils can be found (why?); explains that Mesozoic rocks were probably also deposited at the canyon area (what removed the layers later?); places last two layers in model].

Mesozoic: Now I’m reporting from 155 million years ago, in the Jurassic Period. From space, I see that Pangaea has pulled apart, beginning to make the Atlantic Ocean. Coming down to earth, I see the first bird, and huge longneck dinosaurs. Do we have a report from Georgia?

Georgia: At Providence Canyon, near Columbus, you can climb around in sand that was on the beach in the Cretaceous period. This sand was never buried deeply enough to become sandstone.

Instructor: [shows #08 Providence Canyon – explains it’s a deep gully formed when poor farming practices led to erosion, made easier because this is loose sand, not sandstone – deposited on an ancient beach but never buried deeply enough to be cemented into rock.]

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Mesozoic: It’s 65 million years ago, and I am watching the Mesozoic go out with a bang. An asteroid just landed with an explosion that would make a nuclear bomb seem like a firecracker. When the dust cleared, all the dinosaurs – in fact almost every animal bigger than a book bag – has gone extinct.

Next – the Cenozoic. Are people ever going to show up? Find out when we come back.

Instructor: [asks students to give answers for each matching item from 221 to 65 million years]

Cenozoic: This is _____, speaking from the Cenozoic. This is a big time for the mammals: whales, cats, horses, people, and many more. Now it is 36 million years ago. In less than a month, my time voyage will be over. I am seeing the first primates, the ancestors of monkeys and apes. Maybe you can see where this is leading. But first, let’s check in with our geologists. What’s the story in Georgia?

Georgia: Erosion is the main story. The mountains wear down, and wash to the sea. The sediment forms new land, shifting the Atlantic shoreline eastward. The tough granite of Stone Mountain is revealed, as rock around it washes away.

Instructor: [Uncovers #03&09 Stone Mountain overhead slowly showing how the granite was revealed as the more easily eroded rock around it was removed.]

Cenozoic: Anything coming up in Arizona?

Arizona: In the Cenozoic, the area of the Grand Canyon begins to come up. By 20 million years ago, the Colorado River is in the area. It cuts itself a little valley.

Instructor: [displays cutaway model version with river; removes first piece to show valley]

Arizona: The land rises gradually and the valley deepens into a canyon.

Instructor: [raises model platform and removes second cutaway portion]

Arizona: About 2 million years ago – mid-afternoon December 30 on our time scale – a fault to the west helps the area make its most recent leap upward and the canyon is carved to its present form.

Instructor: [raises model platform until base is again above sea level. Removes last portion. To a geologist this is like looking back into time: here are Precambrian rocks (before hard fossils), then layers with trilobites, layers put down in warm ocean, layers in which reptiles and amphibians appeared. (Are there any dinosaur fossils in canyon? No; you would have to go to Cedar Mesa, bump of remaining Triassic at edge of model, to find any.)]

Cenozoic: As the Colorado cuts the canyon, in Africa something even more exciting is going on. It’s only two days till the end of our eight-year time journey - 4 million years before the present - and I see the first upright-walking human ancestors.

Now it’s 500,000 years ago – mid-afternoon on the last day of our journey - and strange-looking people are using tools.

I check in again at 50,000 years ago, less than an hour before our time voyage will end. I see people, living in caves and grass shelters, who look like us - they are *Homo sapiens sapiens*.

Now it’s 5000 years ago - just five minutes before our time journey ends. Writing has been invented in the place people will call Iraq. The rest, as they say, is history.

Instructor: [Appreciation to readers; asks students to give answers for each matching item from 36 million to 5,000 years.]