

Can a Materials Scientist Move Mount Sinai?

Colin Humphreys

Most readers will agree that materials science is a key subject for our future wealth and health, but probably few will concur that it is also important for reconstructing biblical history. However, it is my belief that the interdisciplinary approach to problem-solving we learn as materials scientists provides us with the breadth of thinking required to solve a wide range of fascinating historical puzzles. In this article, I will describe the science which may underlie two remarkable events recorded in the Bible: Moses' obtaining water from a rock, and the fire blaze on the top of Mount Sinai.

Why may materials science be more important than other physical sciences in studying biblical history? The director of a leading engineering company recently told me that he preferred to employ materials scientists to other scientists. I asked him why.

"Because of the flexibility of their thinking," he said. "They see connections between different subjects much more readily than do most physicists, chemists, or engineers."

I believe the same is true when applying science to biblical history. Materials scientists not only have a breadth of scientific knowledge, but also the flexibility of thought to be particularly good at applying their minds to complex historical problems. This requires not only interdisciplinary scientific skills but also the ability to be *extradisciplinary*, and bring in knowledge from history, ancient texts, and their interpretations.

My interest in this intersection led me to an intensive investigation and collaboration with historians, linguists, scientists, and religious scholars over several years to look at the miracles described in the biblical book of Exodus and the subsequent publishing of a book with my conclusions and the detective work that led me there.¹ I give a few examples here of some of the more materials-oriented findings.

As an example, consider the "water from the rock" miracle recorded in the book of Exodus (17:5–6). Moses has led the Israelites out of Egypt into the Sinai desert. The people were thirsty, so Moses

struck a rock with his staff and water gushed out. Most people, even most biblical scholars, believe this story to be a myth, because they think it is impossible to obtain water from solid rock.

As I thought about this, it dawned on me that many solid materials are porous. For example, some ceramic materials prepared by sintering can have a high porosity. Similarly, there are porous metal foams. So I wondered if rocks could be porous. The answer is that some rocks are highly porous, and sandstone and limestone can absorb and store huge quantities of water from rain.

In a desert, rocks undergo a particular type of weathering because of sandstorms, in which sand, dust, and organic matter from decayed plants and animals are swept against the rocks at high speed by the wind. Over time, this can result in a hard impervious crust forming on the surface of the rock, rather like a layer of cement. If this crust is broken by a sharp blow, then water can flow out of a porous

rock. This effect is well known to hydrogeologists and has been documented.² The account in the book of Exodus fits so closely with what is known from geology, that I suggest this is the natural mechanism underlying Moses' ability to obtain water from a rock.

I would like to add that the event can still be regarded as a miracle: The miracle lies in the timing. Just when the Israelites were desperate with thirst in the desert, Moses broke the crust on the porous rock, and water rushed out.

What can a scientist deduce from the description of Mount Sinai in the Bible? A few years ago, I was on holiday in Egypt. In the red light of the rising sun, I climbed up Mount Sinai in the Sinai Peninsula. To be sure, this mountain was majestic, but so were the other mountains visible from the top. There appeared to be nothing special about this particular mountain. So why had Moses led the Israelites there in about 1300 BC after bringing them out of Egypt?

And then I looked down to the dry and truly barren land below. How could two million Israelites, or even 20,000 with their flocks and herds of animals, have survived for about a year at the desolate foot of this mountain? There was little water and virtually no vegetation, apart from stunted acacia bushes dotted sparsely about. This really puzzled me. Like most scientists, I am curious about nature, and I had just become hooked on a fascinating historical problem!



View from the top of the traditional Mount Sinai, Jebel Musa, in the Sinai Peninsula.



Volcanic fire.

The evidence for locating Mount Sinai at its traditional site in the Sinai Peninsula is based on traditions that go back to AD 300. Yet the Exodus occurred about 1500 years before these traditions started, so they may not be reliable. Can science be used either to confirm or to change these traditions? There are many examples of science being used to change traditional views when scientific evidence emerges. For example, we now know from science that the earth moves around the sun and not vice versa. So I wondered if science could be used to locate Mount Sinai.

In descriptions of Mount Sinai, the Old Testament says it "blazed with fire to the very heavens, with black clouds..." (Deuteronomy 4:11).^{*} What sort of mountain could this have been? I have also climbed up the volcanic Mount Etna in Sicily. When I was there, people were forbidden to climb to the top because of the black clouds being emitted. White clouds from a volcano are safe, but black clouds, which contain black ash particles, signify that an eruption may be imminent. So, was the true Mount Sinai an erupting

^{*}From the New International Version of the Bible.

volcano? Or was the biblical description of fire and black clouds from the top of Mount Sinai a metaphor for a thunderstorm on an ordinary mountain, as many biblical scholars believe?

Now to apply some materials science, particularly geology. The Old Testament describes Mount Sinai as "flowing" or "melting." (The Hebrew word used in Judges 5:5 is *nazal*, which means "to flow" or "to melt." Hence, *nazalet* means a runny nose.) To a scientist, a melting, flowing mountain can surely mean only one thing: lava flows. Hence, here we have a scientific fingerprint that Mount Sinai was indeed a volcano.

One point puzzled me in the biblical description. The book of Exodus (19:16) says that the sound of a very loud trumpet blast came from the mountain. Is this poetic language or did the sound of a trumpet really come from Mount Sinai? I then found that the Roman historian Dio Cassius (*Roman History*, Book 66) described a loud trumpet blast coming from Mount Vesuvius when it erupted in AD 79 and covered Pompeii with lava and ash. How astonishing that two different mountains are described as emitting a sound like a trumpet. Could these mountains have something in common? How can a mountain produce a trumpet-like sound? There is, in fact, a physical mechanism for a particular type of mountain, a volcano, producing a sound like a trumpet: Hot erupting gases are forced under pressure through cracks in the rocks and, hence, can produce a trumpet-like sound. So the sound of a trumpet is another fingerprint of an erupting volcano.

In fact, the biblical description of Mount

Sinai contains no fewer than seven characteristic features of an erupting volcano. In addition, the well-known pillar of fire and pillar of cloud that guided the Israelites to Mount Sinai, were, I suggest, the volcanic pillars of fire and of cloud from the top of the mountain that guided the Israelites to it. I believe that the biblical account of Mount Sinai is the oldest known description of an erupting volcano in the world, but this interpretation has gone largely unnoticed by biblical scholars because they are not scientists, and vice versa. Understanding the nature of Mount Sinai provides a good example of what scientists can offer to biblical history.

Because there are no historical active volcanoes in the Sinai Peninsula, and also because of other biblical clues detailed elsewhere,¹ I have proposed the volcanic Mount Bedr in Saudi Arabia to be the true Mount Sinai. It is known from the relatively fresh lava flows that Mount Bedr has erupted in the last 10,000 years. Good scientific theories make predictions, and my theory predicts that Mount Bedr erupted at the time of the Exodus from Egypt, in about 1300 BC. If this can be demonstrated scientifically, by dating the lava and the ash, then science will have been used to provide evidence both for the date of the Exodus and for the location of Mount Sinai.

References

1. C.J. Humphreys, *The Miracles of Exodus: A Scientist's Discovery of the Extraordinary Natural Causes of the Biblical Stories* (HarperCollins Publishers, New York, 2003).
2. C. Jarvis, *Yesterday and Today in Sinai* (W. Blackwood, Edinburgh, 1943).

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