

The Boyle Lecture 2018

“Apocalypses Now: Modern Science and Biblical Miracles”

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A Vote of Thanks to the Lecturer will be proposed by

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Background to The Boyle Lectures

The original series of Boyle Lectures ran from 1692 until the early 1730s. Funded by a bequest from Robert Boyle, the celebrated seventeenth-century natural philosopher, the lectureship was re-established at St Mary-le-Bow in 2004. It now provides an annual platform for a distinguished scientist or theologian to explore the contemporary relationship between the two disciplines. The lectures aim to be faithful to the intention of their founder, who viewed religious faith and experimental science as mutually enriching.

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Apocalypses Now: Modern Science and Biblical Miracles”

Mark Harris

The Revd Dr Mark Harris is Senior Lecturer in Science and Religion at the University of Edinburgh. As a physicist working in a theological environment, he is interested in the complex ways in which science and religion relate to one other.

Active in physics for many years, Dr Harris is known as co-discoverer of 'spin ice', currently a major research area in the physics of magnetism. Midway through his scientific career he discovered theology, which he describes as 'a moment of awakening not unlike that provided by my first chemistry set at the age of ten.' After ordination as an Anglican priest and spells in university chaplaincy at Oxford and cathedral ministry in Edinburgh, he now combines his academic interests in physics and theology with running the Science and Religion programme at Edinburgh.

Dr Harris is currently working on a project to create online distance learning programmes in Philosophy, Science, and Religion (funded by the John Templeton Foundation). His research interests include the relationship between the physical sciences and theology, and the impact of science on modern views of the Bible, especially in thinking on miracles and divine action. He is working on a book on naturalism (the philosophical basis for the natural sciences) and the ways that historical debates on naturalism in geology provide a new way of looking at miracles.

Introduction

You will probably be wondering about my title, 'Apocalypses Now'. It's a reference to *Apocalypse Now*, the famous film of the Vietnam War. But this film is a far cry from science and theology: why did I choose this title? Well, the film is a re-telling of Joseph Conrad's novel, *Heart of Darkness*. Both *Apocalypse Now* and *Heart of Darkness* explore the culture clash between the technologically-advanced West and a supposedly-primitive culture, raising questions about imperialism and the 'heart of darkness' in our modern world. For those of you familiar with our own culture wars, and especially the supposed conflict between science and religion, talk of imperialism raises the spectre of

scientism, of the assumption that the natural sciences provide the most authentic route to knowledge, and that religion provides little better than primitive superstition in comparison.

Well I don't want to wade into the debate around scientism, since previous Boyle lecturers have covered that,¹ but instead to tell you about several un-expected reversals which have gone under the radar, as it were, of the standard science-and-theology conversation. These reversals concern the big miracle and catastrophe stories at the heart of the Bible, where God's purposes are revealed in nature: apocalypses from the ancient world. I'll introduce these stories, and will explain how modern science, far from dismissing them as fantastic and primitive fairy tales, instead gives us new ways of hearing these ancient stories of revelation, new re-tellings, if you like: apocalypses now.

Let me say a little more by way of an extended introduction. The contemporary science-and-theology scene has long been fascinated by the Bible's first few chapters, the Genesis creation stories (Gen.1-3). Clearly, that's at least partly because the culture wars are so fixated with creation versus evolution. I've played my own part in this area,² but I'm more intrigued by the rest of the Bible, particularly the many stories that tell how God redeems his people, sometimes punishes them, sometimes reveals his purposes to them, often in spectacular and terrifying ways through the natural world, through miracles and catastrophes. Prime examples are found in the Book of Exodus, such as the story of God's revelation to Moses in the Burning Bush (Ex.3), or the Plagues of Egypt (Ex.7-12) or the Crossing of the Red Sea (Ex.14-15).

¹ Alister McGrath notably, in the 2014 Boyle Lecture.

² Mark Harris, *The Nature of Creation: Examining the Bible and Science* (Durham: Acumen, 2013); David de Pomerai and Mark Harris, 'Creationism and Evolutionary Biology: Science or Pseudo-Science?' In *Philosophy, Science and Religion for Everyone*, Harris and Pritchard, eds. (Routledge, 2017), 27-39; Mark Harris, 'The biblical text and the functional interpretation of the *imago Dei*.' In *Finding Ourselves after Darwin: Conversations on the Image of God, Original Sin, and the Problem of Evil*, ed. Stanley P. Rosenberg (Baker Academic, 2018).

These biblical stories where nature runs riot to deliver God's purposes aren't so much supernatural as *hypernatural*:³ nature itself becomes transcendent to reveal the divine. You find this motif appearing again and again, obviously in the psalms and prophets,⁴ but many other places too, including the classic apocalypses, of which the prime example stands at the very end of the Bible, the Book of Revelation. What has particularly intrigued me about these hypernatural texts is that I'm by no means the only scientist to be intrigued by them. In fact, there exists quite a substantial body of scientific writing that proposes naturalistic and scientific explanations for these bizarre and spectacular stories, working on the assumption that the biblical text presents accurate observations of things that actually happened in history. The biblical stories become scientific data, if you like, descriptions of freak events and natural disasters that can be modelled scientifically.

This scientific interest in the Bible's stories of miracle and hypernature isn't new. Some notable scientists of the 17th and 18th centuries took an interest in applying their naturalistic wisdom to the Bible's miracle stories, including some Boyle lecturers such as Samuel Clarke (1675-1729) and William Whiston (1667-1752).⁵ In fact, there's a story to be told about the positive influence of these biblical texts on the historical development of science. The story of Noah's Flood (Gen.6-9), for one, was highly significant in shaping early scientific thinking on the earth.⁶ Whiston, for instance, proposed that the Flood was caused by a comet encountering the earth, which precipitated apocalyptic falls of rain, and a vast tide that covered the planet.⁷

³ Terence E. Fretheim, *God and World in the Old Testament* (Nashville: Abingdon, 2005), 119-20.

⁴ Many examples could be cited here, but the most notable tend to be descriptions either of God's theophany in natural elements of storm and earthquake (e.g. Judges 5:4-5; Ps.18:7-16; 29; Zech.14), or creation's praise of its Creator (e.g. Ps.65:12-13; 98:7-9; Is.55:12).

⁵ Peter Harrison, 'Newtonian Science, Miracles, and the Laws of Nature.' *Journal of the History of Ideas* 56(1995)531-553; here, pp.542-4.

⁶ E.g. Norman Cohn, *Noah's Flood: The Genesis Story in Western Thought* (New Haven: Yale University Press, 1996).

⁷ William Whiston, *A New Theory of the Earth, From its Original, to the Consummation of all Things*

Of course, the science has moved on since Whiston's day,⁸ although the fascination of many scientists with the stories remains. And what's remarkable is that the contemporary studies – bringing to bear the much-advanced rigour of today's sciences – have been able to find naturalistic explanations for even the most spectacular and unlikely of the biblical stories. I'll give you some examples shortly. But my point is that there's almost nothing in the Bible that the modern sciences can't explain if sufficient ingenuity is brought to bear. This flies in the face of our usual understanding of a miracle as an 'impossible' event in natural terms, since these studies show that the seemingly impossible biblical stories are quite 'possible' in naturalistic terms, if unlikely. The incredible happens, but no laws of nature are violated.

So what's going on? Do these studies *disprove* the miraculous nature of the stories by finding scientific explanations? Or do they *affirm* it? A clue to what's at stake here is a surprising disagreement between the relevant experts. While the scientists believe their naturalistic explanations represent a major advance in understanding the stories, professional biblical scholars show little interest, or are openly disdainful, claiming that these scientific explanations are implausible and that the scientists misunderstand the texts. Well it turns out that this contemporary disagreement has a precedent, back in nineteenth century geology, when what was then a fairly new science was setting out its methodological stall.

(London: Boyle's Head, 1737), 461-78.

⁸ But note that Whiston's comet explanation still holds water today according to some contemporary scientists interested in asteroid and meteorite impacts on earth. E.g. Richard J. Huggett, *Cataclysms and Earth History: The Development of Diluvialism*, (Oxford: Clarendon, 1989); E. Kristan-Tollmann and A. Tollmann, 'The youngest big impact on Earth deduced from geological and historical evidence.' *Terra Nova* 6 (1994): 209-217; Mike Baillie, *Exodus to Arthur: Catastrophic Encounters with Comets* (London: Batsford, 1999); W. Bruce Masse, 'The Archaeology and Anthropology of Quaternary Period Cosmic Impact,' in P. Bobrowsky and H. Rickman, eds., *Comet/Asteroid Impacts and Human Society: An Interdisciplinary Approach* (Berlin: Springer, 2007), 25-70. But see the following for objections: A. Deutsch et al., 'The Impact-Flood connection: Does it exist?' *Terra Nova* 6 (1994): 644-650.

I'll point out the striking parallels here between how the various experts – scientists and biblical scholars – interpret the scriptural witness on the one hand, and how geologists interpret the witness of the rocks on the other. In both cases – Bible and geology – we're faced with the question of how to interpret evidence from the past when there are competing explanations. In other words, this dispute about the Bible equally concerns how you do science. I'll close by suggesting that the dispute also points us towards a rather-overlooked kind of natural theology, which exposes the transcendent quality of the Bible's stories. Here, we find that the scientific interpretations are 'apocalypses now'.

Naturalistic explanations for the Parting of the Red Sea

So, with that extended introduction in mind, let me take you through some case studies. My favourite among these apocalypses is the Parting of the Red Sea, where Moses leads the children of Israel, desperate to escape from slavery in Egypt, across the sea.⁹ Moses stretches out his hand over the sea, and it divides (Ex.14:21), forming a wall to the right and to the left (vv.22, 29). Moses and the people cross, but when Pharaoh follows, the sea crashes in on the Egyptians, drowning every one (v.28).

Easily the most spectacular and incredible miracle story in the Bible, film makers have had a field day with the special effects here, from Cecil B. DeMille's first version of *The Ten Commandments* in 1923, up to Ridley Scott's *Exodus: Gods and Kings* of 2014.¹⁰ I'm sure you've seen the visuals, of towering walls of water held magically apart

⁹ There's a famous debate over the location of the 'sea', whether it is indeed the deep Red Sea that we know today, or a 'Sea of Reeds' somewhere in the Isthmus of Suez, i.e. a shallow lake or lagoon. The debate here is notoriously contorted, and takes in many questions beyond mere translation of the Hebrew terminology. To some degree the two sides of the debate part along plausibility lines for the various naturalistic scenarios presented for the parting of the sea. This is a case where history and science become inextricably entangled with theology, which perhaps leads to a more secure understanding of miracle than Hume's well-known definition of a miracle as a violation of a law of nature.

¹⁰ A history of attempts to visualise the parting of the sea offers an excellent illustration of how cinematography has evolved over the past 100 years (<https://www.youtube.com/watch?v=T4H5tjx2Zpg>).

while the Israelites scurry over the dry seabed like ants in comparison. Scientists have also had a field day with this story, and in spite of its seemingly-impossible nature, there have been many scientific proposals which claim to explain the miracle in natural, if unusual, terms.¹¹ Two approaches tend to dominate.

The first suggests that the sea was a lagoon, which parted because of an enormous tsunami from a volcanic eruption. The obvious candidate is the eruption of Thera, the volcanic island in the Aegean we now call Santorini. It was devastated by one of the largest eruptions in human history, probably in the late 1600s BCE, and the eruption caused large tsunamis, and spread volcanic ash far and wide across the Eastern Mediterranean. (Incidentally, Santorini is quite the most stunning place to do fieldwork on the Bible's miracles: if you've ever seen a picture of the quintessential Greek island, with sapphire seas and whitewashed houses perched on rugged cliffs, that's Santorini).

Let's picture the scenario. Transport yourself from Santorini to Egypt, where the Israelites are enslaved. The eruption is hundreds of miles away, but it creates atmospheric storms, earthquakes, and ash falls across the Eastern Mediterranean, including Egypt in this scenario. The first nine plagues of Egypt – where water is turned into blood, then a plague of frogs appears, followed by lice, swarms of flies, a devastating sickness of cattle, boils, hail, locusts, and darkness for 3 days – all of these

¹¹ I'm sure it hasn't escaped your attention that these scientific explanations of the Bible's most spectacular miracle story fly in the face of our conventional understanding of a miracle, as an event caused by God that breaks a law of nature. That definition is usually attributed to David Hume (1711-1776), the leading philosopher of the Scottish Enlightenment, from my home town of Edinburgh. Hume defined a miracle as '*a transgression of a law of nature by a particular volition of the Deity, or by the interposition of some invisible agent*' (David Hume, *Enquiry concerning Human Understanding* (Oxford: OUP, 2007 [1777, 1748]), X.12, Endnote [K]; italics are Hume's). The point of Hume's definition was to propose a universal yardstick for defining the natural against the supernatural, and a miracle against a natural event: we can all agree on what constitutes a law of nature, his reasoning goes, so a miracle would need to be a violation of one of those universally-agreed laws. Hume's definition has survived remarkably well since the 1700s, since it's virtually ubiquitous in our modern world. But it's also notoriously problematic, not least because most miracle stories can be explained naturalistically, as the Parting of the Red Sea illustrates, *and yet many people still believe they're miracles*. You might ask why Hume's definition is ubiquitous if it's so problematic. I don't have the scope to explore this here; I'll simply suggest that Hume's definition is so ubiquitous not so much because of whether it works well (or not), but because it props up the modern secular agenda of naturalism extremely well.

can be explained as consequences of the unfolding eruption, far away. The plagues are what allow the Israelites to escape. By the time of the final, most explosive, stage of the eruption, where the island literally blows itself apart, the Israelites have escaped to the Mediterranean coast, and are standing on the shore of a lagoon.¹² The volcano's enormous magma chamber, now empty, fills with seawater, which causes the sea to ebb away, and then creates a giant tsunami. First the lagoon empties, and Moses crosses, with the Egyptians in hot pursuit. But just as the Israelites reach higher ground, the tsunami appears, and the Egyptians are swept away.¹³

This is a typical scenario for reconstructing the sea crossing using the eruption of Thera, and you can find it developed in many scientific articles, books, and TV documentaries over the last few decades. I'm a sceptic myself though. I worry about the lack of material evidence that the eruption of Thera actually had any impact on Egypt, and there's also a notorious problem about timescales, since the eruption of Thera took place centuries before the usual scholarly timeframe for the exodus in the 1200s BCE.¹⁴ Remarkably though, problems like this don't seem to stop the Thera theories: they keep being proposed as the ideal solution, not only for the exodus, but for other outstanding mysteries of the second millennium BCE, especially the end of Minoan civilisation on Crete, and the legend of Atlantis. This tells us something about the imaginative appeal of the Thera theories, as 'apocalypses now'. I'll come back to that.

¹² The Thera theories therefore place the sea crossing at a Sea of Reeds rather than the Red Sea itself, and probably on the Mediterranean coast.

¹³ The recent film, *Exodus: Gods and Kings* (2014), pictures the sea crossing rather like this, as being enabled by an enormous tsunami.

¹⁴ But it's fair to note that the dating of both the Thera eruption and the exodus are accompanied by a significant degree of controversy themselves. Radiocarbon dates for the eruption of Thera tend to fall around 1620 BCE, while some prominent archaeologists prefer a date closer to 1500 BCE. For the exodus, two dates tend to prevail in scholarly accounts, either the so-called 'traditional' date of around 1450 BCE, or a Ramesside date in the late 1200s BCE. The latter tends to attract the widest scholarly support, and is the closest to a 'consensus'.

Let's move on to the second naturalistic approach to the parting of the Sea. This one makes use of tremendous winds to push the sea aside, and it has the advantage over the tsunami explanation of being exactly what the biblical text specifies (you have the passage on your handout): 'Then Moses stretched out his hand over the sea. The Lord drove the sea back by a strong east wind all night, and turned the sea into dry land; and the waters were divided' (Ex.14:21). There's a further advantage: the wind explanation works for pretty much any body of water you think might be the one that Moses crossed, whether it's one of the shallow inland 'seas' in the Isthmus of Suez,¹⁵ or the deep Red Sea. As you might expect, the most spectacular location is the Red Sea itself, and several models have been proposed where a storm-force wind is funnelled down the Gulf of Suez or the Gulf of Aqaba. Here, the topography of land and seabed is such that violent winds blowing in the right direction for the right length of time can have a substantial effect on the sea level.

One calculation, for instance, suggests that the sea in the Gulf of Suez could recede from the shore by nearly a mile under such conditions, exposing a large portion of seabed, such is the unusual topography hereabouts.¹⁶ When the wind dies down, the sea returns. So you have Moses and the Israelites on the edge of the Red Sea when the storm arrives, and they're able to cross over during the night while the wind blows. In the morning when the wind subsides, the sea returns and destroys the pursuing Egyptians.

It's important to point out that this kind of storm wind is by no means an everyday event. The model predicts that the conditions are right only every 1000 to

¹⁵ Many suggestions have been made for a possible inland 'Sea of Reeds' which could have been parted by a strong wind. See my article, 'How did Moses part the Red Sea? Science as salvation in the Exodus Tradition.' In *Moses in Biblical and Extra-Biblical Traditions*, eds. Axel Graupner and Michael Wolter (Berlin, New York: de Gruyter, 2007), 5-31 or the more recent piece, Carl Drews and Weiqing Han, 'Dynamics of Wind Setdown at Suez and the Eastern Nile Delta.' *PLoS ONE* **5** (2010): e12481.

¹⁶ Doron Nof and Nathan Paldor, 'Are There Oceanographic Explanations for the Israelites' Crossing of the Red Sea?' *Bulletin American Meteorological Society* **73** (1992): 305-314; Doron Nof and Nathan Paldor, 'Statistics of Wind over the Red Sea with Application to the Exodus Question.' *Journal of Applied Meteorology* **33** (1994): 1017-1025.

3000 years. So it's certainly not a miracle in the sense of laws of nature being broken; more in the sense of being such an unusual happening on a human timescale that it's not going to be remembered from one occurrence to the next.¹⁷ In human terms then, a storm which exposes the seabed to such a degree is un-precedented, unique, and if you're at the right place at the right time, providential. Clearly, then, in this model, if there's a miracle to speak of, it's that Moses and the Israelites happened to be in the right place at the right time.

One scientist who makes a great deal of currency out of this point is the Cambridge materials scientist Colin Humphreys, who's written a book-length treatment of the miracles of Exodus, claiming that they can all be explained by naturalistic models such as this.¹⁸ He doesn't want to explain the miracles away – far from it – but rather to strengthen belief in the miracles. It isn't the nature of an event that makes it miraculous, he thinks, since a naturalistic explanation can be found for most claimed miracles; rather, the miracle is in the timing.

Humphreys explains this by looking at the end of the Exodus story (Josh.3), where Joshua and the Israelites have wandered in the wilderness for 40 years, and are finally ready to cross into the Promised Land. Only one barrier stands in their way, the River Jordan. Miraculously, it stops flowing to allow them to cross. Humphreys points out that the Jordan is, in fact, well known to stop flowing for short periods when an earthquake dislodges the riverbanks further upstream. This means that the miracle is in the timing: Joshua and the Israelites were standing on the banks of the Jordan at just the right time after an earthquake. For Humphreys, the fact that a naturalistic explanation is so readily at hand for this biblical story means that the miracle is more believable, not less.¹⁹

¹⁷ Nof and Paldor, 'Statistics of Wind', 1023-4.

¹⁸ Colin J. Humphreys, *The Miracles of Exodus: A Scientist's Discovery of the Extraordinary Natural Causes of the Biblical Stories* (London, New York: Continuum, 2003).

¹⁹ Humphreys, 5.

Now Humphreys isn't doing anything new here. Go back to the eighteenth century Boyle lecturers I mentioned earlier, Samuel Clarke and William Whiston. This was exactly their point about biblical miracles. If science can confirm that the miracles are plausible natural events, then that supports the authenticity of the Bible as a credible record of God's dealings with the world.²⁰ Theirs is an apologetic argument, using science to *uphold* the biblical witness, not to *downgrade* the miracles to mere unusual events. The miracle is in the timing: God led Moses, Joshua and the Israelites to the right place at the right time. To a sceptic, this might be coincidence; to a believer, it's providence. No laws of nature are violated, but still God's providential purposes are achieved miraculously, and science provides confirmation, according to this view.

Here we see the first unexpected reversal in the relationship between science and theology that I mentioned earlier. Science and theology are *not* in conflict in this view; rather, science is serving theology. Hence, scientific studies of the Bible, far from disproving it as an ancient record of primitive superstition can, if you're so disposed, be taken as evidence of the credibility of the Bible, and of its witness to divine providence. The important assumption here is that the Bible 'tells it like it really happened'. But does it? Here we need to turn to the biblical scholars: the professional historians, archaeologists and linguists who bring a very different set of skills to the scientists. What do they think of this scientific work on the Bible's apocalypses?

Biblical scholarship on the Parting of the Red Sea

Not a lot, it seems. If you plough through the heavy scholarly commentaries, or scour the research literature on Exodus, you'll be hard-pressed to find this scientific work even being mentioned. When it is, the assessment is usually dismissive. To give you a

²⁰ Harrison, 543-4.

flavour, here are three colourful statements from biblical scholars.²¹ First up is Maxwell and Hayes, from their classic textbook, *A History of Ancient Israel and Judah* (quotation (a) on your handout):²²

Theories of this sort attempt to give naturalistic and scientifically acceptable explanations for the more fantastic and miraculous biblical claims. In our opinion, however, these theories presuppose such hypothetical scenarios, such a catastrophic view of history, and such marvellous correlations of coincidental factors that they create more credibility problems of their own than the ones they are intended to solve.

The Thera theories, and other naturalistic 'theories of this sort', they say, are simply implausible. (And note that this is quite an accusation when we're dealing with an incredible miracle story to begin with. More on plausibility issues later). Here's the second assessment of scientific models from a biblical scholar. It's Bill Propp, from his magisterial commentary on Exodus (quotation (b)):²³

Any rigorous attempt to explain the whole Plagues narrative as a naive but basically accurate report of a chain of natural calamities is doomed from the start. Rationalistic explanations for miracles...are anachronistic today. To believe that the Bible faithfully records a concatenation of improbable events, as interpreted by a prescientific society, demands a perverse fundamentalism that blindly accepts the antiquity and accuracy of biblical tradition while denying its theory of supernatural intervention.

²¹ I should add that these are almost the only explicit statements I've ever been able to find: the silence is deafening.

²² Miller, J. Maxwell and John H. Hayes, *A History of Ancient Israel and Judah* (London: SCM, 1986), 65.

²³ Propp, William H. C., *Exodus 1-18: A New Translation with Introduction and Commentary*. The Anchor Yale Bible (New Haven: Yale University Press, 1999), 347-8.

So Propp is also worried about plausibility, but he adds more. Notice his phrase, 'perverse fundamentalism'. His concern is that the scientific models treat the text at face value, ignoring the fact that the text arose in a world very different from our own. The scientists read the Bible like a *fundamentalist* would, Propp thinks: literally, under the assumption that it reports straightforward eyewitness testimony, as it happened. And the scientists also read it *perverse*ly, Propp tells us, not recognising the theological presuppositions underlying the text, presuppositions that a true fundamentalist would recognise immediately.

There's also a concern about professional rivalry. Look at this final assessment from a biblical scholar, this time William Johnstone writing on Colin Humphreys' scientific explanations of Exodus miracles (quotation (c)):²⁴

Humphreys' predominant ignoring of scholarly tradition is matched by a breathtaking self-belief and self-reliance on his own personal experience.

This provides us with one final reason why biblical scholars are sceptical of scientific explanations of the Bible's miracles: professionalisation. The scientists are so caught up in their professional bubbles, seems to be Johnstone's point, that they overlook the highly-specialised theological, historical and linguistic problems raised by the text, problems that take years of painstaking training to master; a scientific training simply doesn't provide the correct expertise.

Let me sum up so far. The scientists and biblical scholars couldn't be more different. If the scientists assume that the biblical text provides data about amazing events from ancient times, the biblical scholars insist that we can't even begin to say 'what really happened' back then before taking full account of the text we possess

²⁴ William Johnstone, Review of Colin Humphreys, *The Miracles of Exodus*. *Journal of Semitic Studies* **50** (2005) 373-379; here p.378.

now.²⁵ The stories certainly weren't recorded at the time: they circulated in oral form for centuries before being written down, slowly gathered together, and edited into what we now call the Book of Exodus, which, in any case, comes to us from copies of copies produced centuries later still. There's plentiful evidence that in all that time, rich and creative theological thinking was being applied to make sense of what was being told, thinking that made its way into the stories themselves as they were told and re-told, recorded and re-recorded. The text of the Parting of the Sea, for instance, is highly composite: it seems to consist of perhaps four slightly different traditions that have been woven together, traditions that don't exactly agree on the details of what they describe, but you'd hardly notice it on a surface-level reading.²⁶

More importantly, there are signs that the story has been heavily influenced by a creation myth that was widespread in the Ancient Near East, where the creator deity battles with the sea personified as a dragon, and divides her in two, thus forming heavens and earth.²⁷ The Parting of the Sea in Exodus, then, might look to us like an incredible miracle in time and space, but in the thought-world of the time it also echoes a creation story telling of figurative new beginnings on a cosmic scale. I could go on, but the point is that if you want to discern what really happened back then, the text we have now is the starting point of your journey, not the end. You need to carefully sift through layers and layers of mythological, theological, and cultural interpretation *which*

²⁵ To the critical biblical scholars, the scientists adopt an almost quaint and pre-critical naivety. This naivety is not unlike that described by Hans Frei as being widespread in the Western Christian approach to the Bible's stories, before the Enlightenment introduced a 'reversal in the direction of interpretation' and introduced the critical approach to history (Hans Frei, *The Eclipse of Biblical Narrative: A Study in Eighteenth and Nineteenth Century Hermeneutics* (New Haven, London: Yale University Press), 9).

²⁶ Many Exodus commentaries discuss this in detail, such as the following: Martin Noth, *Exodus: A Commentary* (London: SCM, 1962), 102-120; Brevard S. Childs, *The Book of Exodus: A Critical, Theological Commentary* (Louisville: Westminster Press, 1974), 215-230; William H. C. Propp, *Exodus 1-18: A New Translation with Introduction and Commentary*. The Anchor Yale Bible Commentaries (Yale (CT): Yale University Press, 1999), 476-485.

²⁷ Again, this is discussed extensively in the Exodus literature, but the following are notable: N. H. Snaith, 'רָדִים־יָם: The Sea of Reeds: The Red Sea.' *Vetus Testamentum* **15** (1965):395-398; Frank E. Eakin, Jr., 'The Reed Sea and Baalism.' *Journal of Biblical Literature* **86** (1967):378-384; Bernard F. Batto (1983) "The Reed Sea: Requiescat in Pace" *Journal of Biblical Literature* **102** (1983):27-35; Thomas B. Dozeman (2009) *Commentary on Exodus* (Grand Rapids (MI), Cambridge: Eerdmans, 2009), 304.

are built into the very story itself before you get to the supposed historical kernel, if it's indeed there in the first place.

In other words, we have a fundamental disagreement between two kinds of expert over the same basic evidence. The scientists believe they can find naturalistic models to explain what happened to Moses; the biblical scholars insist that the everyday human phenomenon of story-telling, reflection, explanation, and re-telling of the story, over and over again, account for much of what we find in the text before we bring scientific models to bear.

You may be suspecting by now that my sympathies lie with the biblical scholars. And so they do. I've spent decades of my life in scientific research, but I've also spent quite a number of years teaching and working in biblical studies too, and I'm firmly convinced that there's more to the matter of determining what really happened in miracle stories than finding an appropriate scientific model. However, my point here isn't to take sides, but to explain how this divide between scientists and biblical scholars – between science and theology, if you like – leads us to the second unexpected reversal between science and theology. For we now see that the scientists are the believers in the integrity and literal reliability of the Bible, while the biblical scholars (the theologians) are the sceptics. The tables are turned. Science has become faith; theology has become disbelief.

The Uniformitarianism-Catastrophism Debate

How did this divide between scientists and biblical scholars arise, and what does it mean for the culture wars between science and religion? Is it mere professional rivalry, or is there something deeper at stake? I suggest to you that there's something very deep at stake here, and to see it we need to go back to the 1830s, to a controversy known as the 'uniformitarianism-catastrophism debate', over how the then new science of geology should interpret the evidence of the past.

For the most part, doing geology is very different to the classic laboratory work that goes on in much of physics and chemistry, where experiments can be repeated again and again in real time, where key parameters can be isolated and varied at will, and where spurious effects can be controlled by adapting the environment. Geologists can do little of this: they simply can't replicate in the laboratory the enormous spatial and temporal effects they're interested in; instead, much of their work needs to be carried out in the field, interpreting the fragmentary, scrambled and highly context-dependent evidence that's available of the earth's past. Does this sound familiar? It is, of course, an analogous problem to interpreting an ancient text like the Bible: dealing with the fixed, fragmentary, and perhaps scrambled evidence that has come down to us from a long-vanished culture, with all its potential messiness and historical contextuality.

This is where the 19th century debate in geology comes in, since it concerns exactly this question of how to reconstruct the past given limited evidence. I'll give you the soundbite version which, like most soundbites, isn't entirely truthful, but it does capture the issues at stake. Put simply, the school of thought that we've come to call catastrophism assumes that, from time-to-time in the earth's past, the geology was shaped by sudden and dramatic cataclysms ('apocalypses' in effect), the likes of which we simply don't see today. Noah's Flood was often taken as probably the most recent such cataclysm: worldwide and devastating in extent. And mountain chains like the Andes, for instance, were assumed to have been thrown up suddenly, perhaps in a matter of minutes, hours or days, by immense, planet-shattering earthquakes.²⁸ The opposing school of thought, uniformitarianism, insists that the rocks should be interpreted in completely the opposite direction, reading them largely in terms of gradual, imperceptible changes over vast time periods. Unless there's strong evidence

²⁸ L. Élie de Beaumont, *Recherches sur Quelques-unes des Révolutions de la Surface du Globe, présentant différens exemples de coïncidence entre le redressement des couches de certains systèmes de montagnes, et les changemens soudains qui ont produit les lignes de démarcation qu'on observe entre certains étages consécutifs des terrains de sédiment* (Paris: Chez Crochard, 1830).

to the contrary, goes this way of thinking, we should assume that the geological processes of the past are uniform with those mostly rather gentle, imperceptible processes we see today; hence the name uniformitarianism. But time is the key. Given enough time even the jagged immensities of the Andes can be explained by uniformity, as the mountains inch their way skywards, infinitesimally slowly on a human scale, but no less certainly for that.

Well the argument was eventually seen to be won in favour of uniformitarianism, which has dominated geology ever since. Or at least until around 1980. At that point a major shift in thinking occurred, because it was discovered that the mass extinction at the end of the Cretaceous period (when the dinosaurs died out) was probably precipitated by a massive asteroid impact, a global catastrophe in other words. Since 1980 the pendulum has swung back some way towards catastrophism, and geology today exists in a happier medium between the two schools of thought.²⁹

But my point in rehearsing this debate, albeit briefly and crudely, is to shed light on the divide between scientists and biblical scholars over how we interpret the Bible's stories of miracles and hypernature. There are clearly parallels here between the rocks and the Bible over how to *read* limited evidence in order to reconstruct history. (And I've put a schematic on the handout to illustrate). Should we interpret the evidence in terms of one-off dramatic events (as catastrophism would have it)? Or will the evidence succumb to a more complex, mundane and gradualist view (that of uniformitarianism)?

²⁹ It's interesting to note that the debate between uniformitarianism and catastrophism is often described by means of religious rhetoric. It's not unusual to hear geologists, prior to around 1980, describing catastrophism as 'heretical', for instance, while uniformitarianism was the geological 'orthodoxy'. And for sure, the rhetoric in the 1830s debate descended quite openly to the level of religion (or should that be ascended?). Charles Lyell, in particular, is guilty of much of this. Not only did his famous *Principles of Geology* virtually create a two-sided debate where one hardly existed before, but he also accused his opponents (those who we have come to call 'catastrophists') of peddling superstition and 'dogma', of indulging in 'boundless speculation' (Charles Lyell, *Principles of Geology* (3 vols.; London: John Murray, 1830-1833), 3:2-3). After all, some of their geological catastrophes effectively involved a suspension of the laws of nature as we know them; they were virtual miracles. Those on the uniformitarian side (or Lyell, at any rate), proudly saw themselves as the guardians of 'exact science'. Not for nothing has this debate been portrayed as yet another example of science and religion at war with each other.

All things being equal, which should be the preferred approach, or is there a middle way?

Take the sea crossing again. Is it best analysed by a naturalistic model that takes the text at face value and explains the incredible events by means of a nearly-as-incredible volcanic eruption and a series of amazing one-off coincidences where Moses just happens to be in the right place at the right time? Or should the narrative be seen in terms of an evolutionary process, where a much more mundane original story slowly accrues layers and layers of theological and mythological interpretation through the telling and re-telling over generations, until it becomes the spectacular tradition we possess? While the first corresponds to the 'catastrophist' approach favoured by many scientists who write on the biblical stories, the second is the 'uniformitarian' view, defended by the majority of biblical scholars.

So I'm suggesting that the divide between scientists and biblical scholars over how to read the Bible's apocalypses is parallel to the long-running debate on how to do an historical science like geology. In each debate, there are two schools of thought, both working with the same evidence, but applying radically different methodologies to reconstruct the past, one emphasising the remarkable, and the other emphasising the mundane. Consequently, the two schools arrive at radically different conclusions about that past. Which one is right? Either? Both? Neither?

Well, the fact that geological science has itself shifted ground on this dilemma over the last two centuries suggests that there's no easy answer, although if we're to take contemporary geology as our guide, then a creative synthesis of the two opposing camps – of catastrophism and uniformitarianism – would seem to be our best bet when looking at the Bible. And I want to move to my last section on natural theology by suggesting that this creative synthesis might in fact be the best way forward for appreciating the Bible's miracle stories and apocalypses.

Natural theology

Let's return to plausibility issues. Remember that I quoted several biblical scholars who were, frankly, incredulous of the scientific models, wondering how anyone would take these unlikely naturalistic scenarios and amazing coincidences seriously. The irony won't have escaped you that the Bible's stories of miracle and hypernature themselves are unlikely and amazing. Have the biblical scholars missed the irony here? No. For them, the story we have is so far removed from whatever might really have happened, that there's little point in modelling it in natural terms. If there ever was *one* original story of the Parting of the Sea (which is unlikely), we're incapable of discerning it at this remove, because the story has slowly shifted like the sands, and has gathered accretions and layers of truth over generations.

The biblical scholars have probability on their side.³⁰ All other things being equal, a catastrophist interpretation – where a one-off unlikely event explains the evidence – is inherently unlikely compared to a uniformitarian interpretation, which works with an evolutionary, everyday explanation. The probability of the remarkable naturalistic event is low by its very nature; the probability of the human processes of myth-making and story-telling are virtually certain by comparison. This point alone explains much of the disinterest that biblical scholars show towards naturalistic explanations.

So when looked at as a human document, I'm with the biblical scholars: the scientific models of the Bible's miracles and apocalypses are frankly implausible. But, as a Christian and a theologian, the Bible is also, for me, a record of God's dealings with the world, and this is where the scientific models have a place, a third reversal. I think it's unlikely that the scientific models can tell us much about 'what really happened': they're not much use from the perspective of doing history with the text. From the

³⁰ This is another very long story, but David Hume's arguments in Section X of his *Enquiry concerning Human Understanding* (on how we assess reported claims of miracles) provides an invaluable starting point (in spite of the criticism that he has received for his *definition* of miracles).

perspective of doing theology though, especially *natural* theology, the models are invaluable, I suggest.

Remember that I've been emphasising these biblical stories as apocalypses, as moments of revelation. In spite of their speculative and fantastic nature, I suggest that the scientific models offer a uniquely modern purchase on the transcendent quality of these stories, on their ability to reveal the remarkable in the mundane: the sign of the divine. The fact that there are often multiple scientific models for the same story, often competing with each other, is a bonus, not a problem to be resolved. The scientific models are, to me, creative and imaginative re-tellings of the stories in the language of our own scientific world, highlighting for us the remarkable and stupendous character of God's relationship with nature.

So my final message to you is: let's have more of these scientific models, not fewer. Let the scientists be more imaginative, and the biblical scholars more hard-headed and rational. Let science be more theological, and biblical studies more scientific. Because it's at the level of natural theology that I suggest we understand these scientific models, as theological animations and re-animations of the evidence before us, the text of the Bible. The models are 'apocalypses now'.

Response to the Boyle Lecture delivered by Mark Harris

John Hedley Brooke

John Hedley Brooke was educated at Cambridge University, obtaining a first-class degree in the natural sciences (1965) and a doctorate for work on the history of chemistry (1969). For 30 years he taught at Lancaster University, becoming a member of the International Academy of the History of Science in 1993. In 1995, with Professor Geoffrey Cantor, he gave the Gifford Lectures at Glasgow University. From 1999 to 2006, he was the first Andreas Idreos Professor of Science & Religion at Oxford University, Director of the Ian Ramsey Centre and Fellow of Harris Manchester College. Following retirement, he has spent time as a 'Distinguished Fellow' at the Institute of Advanced Study, University of Durham (2007).

A complaint we sometimes hear about the discussion of 'science & religion' is that it can be too abstruse, too preoccupied with abstractions about the grounds of knowledge and belief. The concern is that questions of more immediate interest to religious believers (scientists among them) are side-lined. The subject of Dr Harris's lecture - the implications of modern science for the interpretation of the biblical miracles – surely is of mainstream interest. In thanking him for an enthralling lecture, I also want to congratulate him for the exceptional clarity he has brought to a topic that remains ever topical. When interviewed recently about his new book on William Tyndale, Melvyn Bragg explained why he himself is a "believing unbeliever": "I find the Resurrection of Christ impossible to accept". And on the question of eternal life: "Biology and Physics won't let that happen" (*The Times*, 20.1.18).

From time to time we must all have considered what we mean by miracles and whether they need be understood as supernatural intervention. The word still thrives in popular parlance, referring to highly improbable events of deep personal significance to those who experience them. For the parents of the baby born with a heart outside its body, the unprecedented surgery that successfully led to restoration was a miracle. We

have been treated to a lecture rich in insight and full of implications for further reflection. I was particularly struck by the conundrum that Mark has put to us all. If a scientific explanation can be found that shows a biblical miracle to have been possible, does that render the story more or less credible? I shall return to that question in a moment.

But, first, a word about Mark's thesis that the professionalization of science and the professionalization of biblical study – both nineteenth-century developments - have led to serious divergence on how the miracle stories should be approached. For a historian of science, his argument becomes more arresting with the claim that this divide between scientists and biblical scholars is "parallel to the long-running debate on how to do an historical science like geology." I see what he means. There is an analogy. In the uniformitarian geology of Darwin's mentor Charles Lyell, the historical sculpting of the Earth's surface was explained by invoking only natural causes, acting with the same intensity as forces in evidence today. In the procedures of many biblical scholars, as they trace the historical processes that led to the biblical texts as we know them, only natural human agency is presupposed. Just as Lyell marginalised Noah's flood from the science of geology, so the biblical scholars to whom Mark refers marginalise a literalistic reading of the miracles. In the process, science-based apologias for the veracity of the narratives are generally sidelined as implausible and misconceived.

There would be much to discuss here, but I would like to pick out a related feature of the nineteenth century debate. It concerns an ambiguity in the theological implications of naturalistic explanation. In retrospect, as part of a secularist narrative, the "uniformitarian" geologists who followed Lyell became the heroes who expunged miracles from the Earth's history. Lyell's avowed aim had been to "rid the science of Moses". The "catastrophists", with their supposed preference for dramatic divine intervention, were the losers.

Quite apart from the fact that catastrophes have made a comeback, geologically if not theologically, there is a particular reason why the secularist narratives, when projected back to the 1830s, get the story wrong. This is because one could be a uniformitarian like Lyell and still subscribe to a providentialist reading of nature. Lyell prided himself on having found a new argument for God's supervision of the world. It consisted in the fact that, wherever on Earth there was an environment that could support particular life forms, those very species had been introduced. In the adaptation of newly introduced species to their environmental niches there was surely evidence of intelligent foresight? And was there not a miraculous plenitude in nature as these niches had been filled?

Conversely, but still contrary to the secularist caricature, there were geologists who did not identify their cataclysmic events with instances of divine intervention, just as with the asteroid collisions postulated today. Crucially, whether one was a uniformitarian or a catastrophist, it was not a case of having to choose *between* natural causes and the involvement, at some level, of a deity.

This is a point that has rather receded from view in our secular age. More often than not, from the mid-seventeenth to the mid-nineteenth century, scientific explanations invoking natural causes were interpreted theistically. This was possible because the natural causes could be interpreted, as they were by Robert Boyle and Isaac Newton, as instruments of a divine will. For two hundred years and more, the very existence of natural laws testified to God's existence. It was not simply that laws presupposed a legislator. For the Cambridge polymath William Whewell, who first coined the word "scientist" in the 1830s, it was the remarkable *combination* of laws, making intelligent life possible, which provided compelling indications of a Creator. In this sense scientific naturalism was deeply embedded in a Christian culture not an alien threat from outside.

This explains why Robert Boyle would compare God's relation to nature with that of an author to a book. Pen, paper and ink were the natural instruments of the writer, who was nevertheless in immediate control of what went onto the page. It is why Isaac Newton could propose an analogy between God's activity in nature and our ability to move our limbs at will. It is why one of the original Boyle lecturers, Samuel Clarke, could equate the normal course of nature with the way God normally chooses to act, but is not constrained to do so. It is why Anglican geologists of the early nineteenth century found in the fossil record a refutation, not a vindication, of atheism. Species had not existed from eternity as atheists classically argued. The new science of palaeontology showed that new ones had kept appearing. It is why Darwin – *even* Darwin – could say when explaining what he meant by nature: "By nature, I mean the laws ordained by God to govern the universe". In short, during its fascinating history there has been no "natural" nature of naturalism. It has existed in a variety of theistic and non-theistic forms.

An important corollary is that scientific progress alone can never be a *sufficient* explanation for the expulsion of God from the world. Mark has reminded us that there is "almost nothing in the Bible that the modern sciences can't explain if sufficient ingenuity is brought to bear". Which leads us back to the conundrum he has voiced so well: "Do these scientific accounts *disprove* the miraculous nature of the stories? Or do they *affirm* it"?

Put crudely, his sophisticated answer is that it depends on where you are coming from. It depends on what you are *disposed* to believe in the light of your own experience, which may include education in a scientific discipline or in the historically based discipline of biblical studies. I welcome his analysis because it has great fertility. It generates questions that we may even, with profit, ask of ourselves. What account would we give of the origins of our own predispositions? It is, of course, a question historians have to ask when interrogating their biographical subjects.

And here is the interesting point: the reasons given for their loss of faith by major figures in the secularist movements of the late-nineteenth and twentieth centuries rarely refer to the primacy of science. From the autobiographical testimony of some hundred and fifty unbelievers in the period 1850 to 1960, the Oxford social historian Susan Budd discovered that conversions to unbelief often mirrored a change from conservative to more radical politics. Religion was rejected as part of established, privileged society. The reading of radical texts, such as Tom Paine's *Age of Reason*, was another prominent influence. Ironically, another frequently mentioned subversive book was the Bible itself. But it was not that science had proved the biblical miracles impossible. Disenchantment had been rooted in a moral sensibility, in a recoiling from Old Testament depictions of a vengeful and anthropomorphic deity. In 1912 the President of the National Secular Society in Britain protested that biblical stories of "lust, adultery, incest and unnatural vice" were "enough to raise blushes in a brothel."

Not wishing to end this response in a brothel, I have a couple of questions that, were this a dialogue, I would put to Mark. The first relates to naturalistic assumptions in the historical practices of biblical scholarship. History is one of the most secular academic disciplines in that references to divine activity have long been excluded from conventional historical explanation. This is where Mark's analogy with geological uniformitarianism has substance. In his own words, the biblical scholar has to carefully "sift through layers and layers of mythological, theological, and cultural interpretation *which are built into the very story itself* before you get to the supposed historical kernel, if it's indeed there in the first place".

Layers and layers, just as the geologists have had to sift through their strata upon strata. But, if there is a methodological naturalism inherent in biblical scholarship, as there is in the sciences, how do biblical scholars decide whether their historical trajectories for the content of biblical texts are destructive or affirmative of faith? What predispositions come into play when they ask whether the miracle stories do, as Mark suggests, possess a "transcendent quality" as "moments of revelation"?

My second question comes from a glance back to Mark's assertion that there is "almost nothing in the Bible that the modern sciences can't explain if sufficient ingenuity is brought to bear". I am wondering about the "*almost* nothing". What still lies beyond scientific encroachment? For Robert Boyle, writing in the seventeenth century, there were matters "above reason" and they would have included the Resurrection of Jesus Christ. As he wrote in a text of 1675, the Resurrection "is not to be brought to pass according to the common course of Nature, I presume, after the universal experience of so many Ages, which have afforded us no instances of it" (*Some Physico-Theological Considerations About the Possibility of the Resurrection*).

One of Boyle's most original contributions to a Christian natural philosophy was his explanation for how it might be possible for personal identity to survive death without persons having to reside in a body identical to their earthly one. But the primary miracle, as for the majority of Christians before and since, was the Resurrection of the dead Christ. Is this not a case where the scientific impossibility of the event remains sacrosanct? A dialogue between Melvyn Bragg and Robert Boyle would, I think, not be without interest.

Thank you, once again, Mark for such an accessible, authoritative, and stimulating lecture.

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