THE RESEARCH

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A WINTER GRAVE - The Research

In 2020, during lockdown, I wrote “The Night Gate”, the book that finally fulfilled my contractual obligations to my publisher. And I figured I was all set for retirement.

What I didn’t anticipate was the anger that would fuel my passion to write another book.

“The Night Gate” was published in Spring of 2021, and I undertook all the required promotional events - online, of course, since travel was still out of the question. When that was done, I breathed easy and saw a future in which I had the time to indulge my twin passions of music and reading after producing one, sometimes two books a year for more than twenty years.

I had turned down all offers of further contracts and looked forward to celebrating my 70th birthday at the end of the year.

Then something quite unexpected happened. The COP26 climate conference in Glasgow.

I read and watched the coverage of it with a growing sense of disbelief. After all, just three months earlier the IPCC (the United Nations Inter-Governmental Panel on Climate Change) had published their scariest prediction yet - that on current carbon emissions we were set to reach a 1.5° Celsius increase in global temperatures within the next two decades, leading to catastrophic environmental disaster.

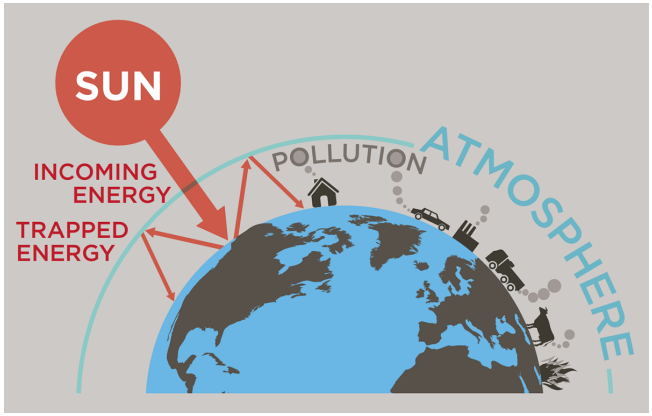
Disbelief turned to anger as governments from around the world caved in to commercial interests and failed to set the required targets to avoid the unthinkable. The kind of short-termism that would have appalled our

ancestors, who planned cities and their infrastructure, cathedrals and other building projects that would take generations to complete. Our current crop of politicians was selling out the future of our children and grandchildren for profit today.

Little wonder, then, that the conference chairman, Alok Sharma, fought to hold back the tears as he apologised for the abject failure of the world to act.

CLIMATE CHANGE

I still had no thoughts of writing another book, but felt I needed to know more about climate change - what was causing it, why did some people doubt it, what the world would be like in thirty years if we didn't act now.



So employing all the skills I had learned as a journalist in another life, I embarked on a major research project. It took me three months. I read countless reports, watched hundreds of videos, interviewed a leading light in the IPCC, and endeavoured to keep as open a mind as possible.

But what I learned not only scared me, and filled me with sadness for the future of our species and our planet, it infused me with a fury I find hard to describe.

Because the very people who are poisoning our atmosphere - the fossil fuel industry - know exactly what they doing. They have known about the effects of burning fossil fuels since an Exxon scientist in 1981 revealed the truth in a report that rocked his company. Not only did Exxon endeavour to bury his findings, they convened a conference to determine a strategy for casting doubt on the scientific evidence behind it.

And whose example did they follow? Well, Big Tobacco of course, who for most of the second half of the 20th century spent vast amounts of money

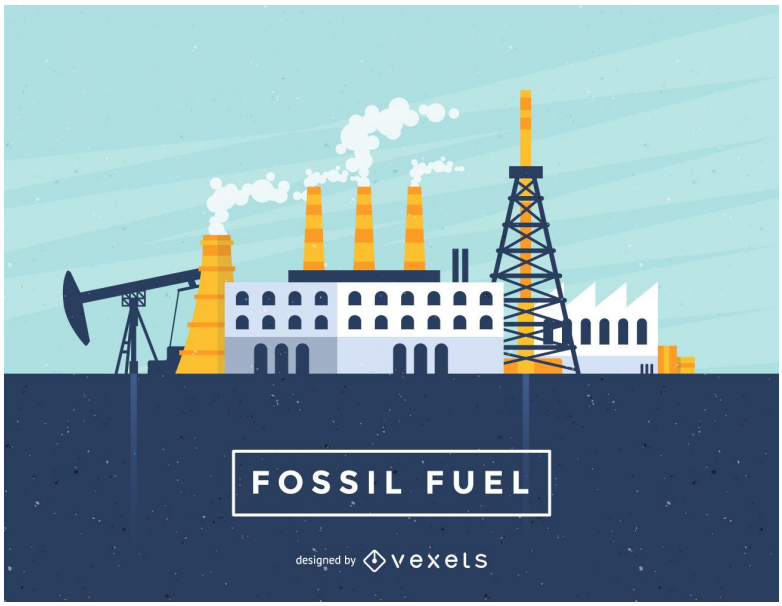
trying to cast doubt on medical evidence which showed that smoking caused lung cancer.

And doubt was the key. Because, just like the fossil fuel industry, all the scientific evidence was against Big Tobacco. The only way to counter it was by disseminating misinformation and casting doubt on facts - probably the earliest manifestation of fake news. (https://www.bbc.com/news/stories-53640382)

THE FOSSIL FUEL INDUSTRY

The big energy companies are making staggering amounts of money extracting fossil fuels from our planet, refining and shipping them to every corner of the earth. Unfortunately, they are also poisoning us.

But they don't care. In the second quarter of 2022, Exxon Mobil made a profit of $18 billion. Shell and Chevron each made nearly $12 billion. Others have also reported record figures. The war in Ukraine has only served to drive energy prices higher, making those companies even more profitable.



For the past 50 years the oil industry as a whole has made profits of more than $1 trillion a year. That's nearly $3 billion a day. Enough money to corrupt politicians, cause wars, and shape public opinion through massively funded propaganda campaigns - sowing doubt through fossil-fuel funded junk journalism, and financing right-wing think tanks to produce reports that pour skepticism on scientific evidence.

As a result, many people have been persuaded that climate change is scaremongering by the Left, even a hoax by the Chinese. They have been told that the move away from fossil fuels towards renewable energies is

going to destroy their way of life - a way of life shaped and fuelled by oil and gas. And large swathes of the population are now so determined to protect their “way of life” that they are only too eager to ignore and dispute the very thing that actually threatens it most - climate change.

A CLIMATE CHANGE PRECIS

Climate change, in its detail, is a complex subject, but in essence is quite simple. Human activity is pumping greenhouse gasses, primarily carbon and methane, into the atmosphere at a rate which the planet simply cannot re-absorb. These gasses trap the heat of the sun, like a greenhouse, and are increasing the temperature of the globe. As the air warms, more of our oceans evaporate, and the subsequent water vapour in the atmosphere escalates the greenhouse effect. The ice at the poles melts in increasing quantities, reducing the covering of snow and ice there which serve to reflect the heat of the sun away from the planet. It’s a vicious cycle, a positive feedback loop, that will only get worse unless emissions are reduced and the Earth is given a chance to rebalance.

The skeptics will argue that human activity accounts for much less Co2 than is naturally produced by the planet itself. Which is true. Natural land and ocean processes produce far more. But they also reabsorb it, a system that was in balance until the industrial revolution came along, powered by the burning of fossil fuels.

A NEW BOOK?

The more I learned, the more alarmed I became, and gradually grew to realise that this was something I had to write about.

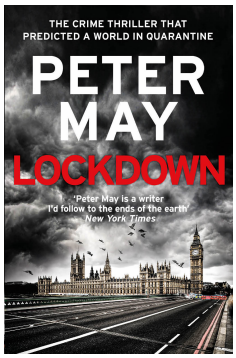
But I’m a crime/thriller writer. And I didn’t want to preach to my readers, or bombard them with endless figures and scary predictions.

So how to write about this? That was the question that I found myself wrestling with.

I ran many scenarios through my mind, and they all kept leading me back to the same solution. I wouldn't write about climate change at all. I would write a classic thriller, set in my home country - Scotland. But I would set it almost thirty years from now, in a world transformed by a changing climate. It would not be the focus of the story, but the background to it. And I chose the year 2051, because that is when, if I were to live that long, I would reach my one hundredth birthday.

That appealed to me, because I will almost certainly not be around by then to hear the critics lampooning me if my predictions are wrong.

The scenario I chose as the climate background for the book almost certainly goes against the grain of expectation. But it is one of several possible futures faced by the planet, and on the basis of my research, one of the most likely. So I'll stick my neck out right now and say that the percentage possibility of my having got it right is pretty high.



Remember my book, "Lockdown", written 15 years before Covid? I predicted a world living with a viral pandemic, and 15 years later was shown to have got almost every detail of it right.

I'll come back to my climate scenario a little later. Because in writing a book set 30 years in the future, I faced other problems - primarily in predicting the advances in technology that would affect our daily lives. Transport and communications were top of the list.

TRANSPORT

The future of transport will almost certainly be driven by electricity and green hydrogen (hydrogen produced with renewable energies). I was intrigued by the development of what have become known as eVTOLs - electric vertical take-off

and landing vehicles. In other words, grown-up drones, or electric helicopters.

The first prototypes have already been produced. There are one-and-two-person private vehicles. And an array of much larger passenger drones. The eVTOL in the book, which is called “Eve”, was based on an air-taxi produced by an American company, Joby Aviation (https://www.jobyaviation.com). It has six rotors that swivel from the horizontal to the vertical and can seat five. Producing zero emissions it is fast, quiet and reliable and is already achieving a flight range of 150 kilometres, which can only grow over the coming decades. Many other companies are producing similar.

COMMUNICATIONS

Likewise, phone companies are working on the next generation mobile phones, which are moving away from handheld devices to communicators we wear like spectacles, allowing us to receive and send videos as well as audio. Some companies are even developing prototypes that function purely by the power of our thoughts.

https://www.androidauthority.com/amp/future-phones-927528/

If this were possible, using smartphones would be a lot faster. You would no longer have to search for an app to open it, or tap a screen. You could perform any task in a heartbeat just by thinking it. Motorola is even developing phones that can recharge themselves simply by being in proximity to a charging transmitter.

In “A Winter Grave”, police have just been issued with the latest in mobile communications - the iCom. It is voice rather than mind controlled, is worn like glasses, sends and receives video and audio and can identify anyone you direct your gaze at with facial recognition software.

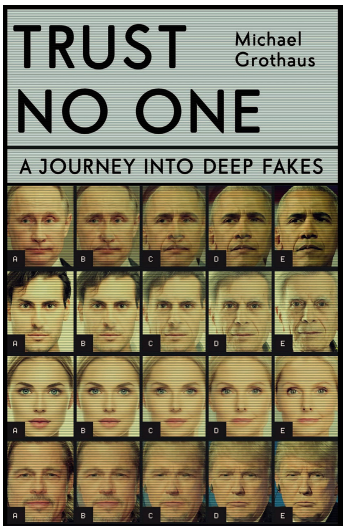
This is not really science fiction. Even in today’s world it is bordering on science fact.

DEEP FAKE

Other technological developments I looked at included the evolution of software able to produce what used to be known as “deep fake” videos. These are videos that employed software called GAN (generative adversarial network) to alter images and audio using AI (artificial intelligence). Initially it was employed for frivolous purposes on social media, and using the faces of famous celebrities to replace those of porn stars in pornographic videos.

Early versions of the software were easily detected. But already it has evolved to the point where altered images in videos are virtually undetectable. Now known as Neural Masking, the technology is set to replace CGI (computer generated imagery) in movies, making it possible in the future to shoot films with unknown actors, then replace their faces and voices with those of movie stars of the past. Thus Cary Grant could play Batman, or Marilyn Monroe could feature as herself in a brand new biopic.

But more sinister applications are possible. Politicians could be “seen” or “heard” making statements designed to lose them votes. It could be employed by criminals for blackmail, or to disseminate fake news and manipulate public opinion. And none of us would be any the wiser.



Author Michael Grothaus has explored this technology in a very readable book, “Trust No One: Inside the World of Deepfakes”. A review of it can be found here:

https://www.heraldscotland.com/politics/19762760.neil-mackays-big-read-deep-trouble-prepare-dark-digital-future-political-chaos-fraud-sexual-blackmail-immortal-stars/

VIRTUAL FLIGHTS

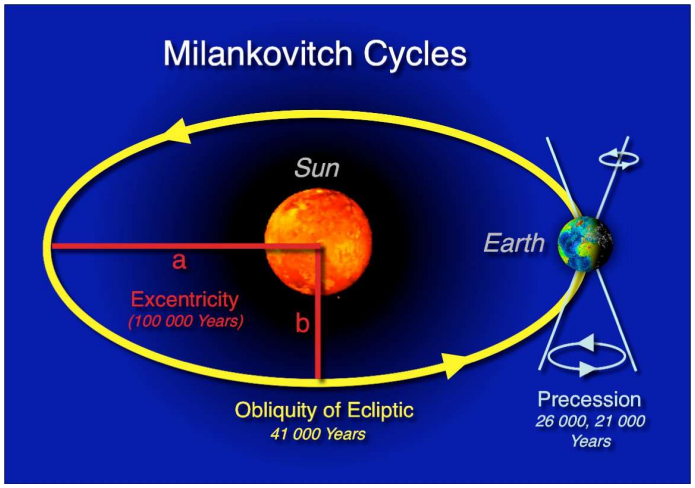
Because of Covid my ability to travel for research was limited. So I chose a location I already knew - Kinlochleven, at the head of Loch Leven in the West Highlands of Scotland. But as I developed my story, I needed more intimate details about my location, and employed my friend, photographer Mo Thomson, to make several trips to the village and its surrounds to take still photographs and aerial footage. Mo is renowned for his extraordinary drone

footage shot around Scotland, and particularly in the Outer Hebrides (https://mothomson.com).

Mo also employed the Microsoft Flight simulator (https://www.flightsimulator.com) to programme passenger drone flights that my primary character makes in the book - from Helensburgh to Mull, and through Glencoe to Loch Leven. The simulator uses Bing satellite maps to get a realistic contour map and surface details for the flights, and in that way I was able to experience them for myself (in winter conditions), fully immersed in a VR headset. I was even able to fly to the top of the mountain that dominates the loch, Binnein Mòr, and swoop down into the north-facing corrie where the body is found at the beginning of the book.

THE CLIMATE

Before delving into the climate scenario I chose for the book, we should look at how the world's climate changes naturally, and the forces that control it.



Our climate, both hot and cold, is dependent upon how close or far we are from the sun at any given time, and the angle at which sunlight hits the planet.

Three things determine this. They are known as the Milankovitch Cycles, named after the man who discovered them.

The first cycle involves our orbit around the sun. It is not a perfect circle. Gravitational forces exerted by other, larger, planets in the solar system deform our orbit, making it elliptical. Over many millions of years,

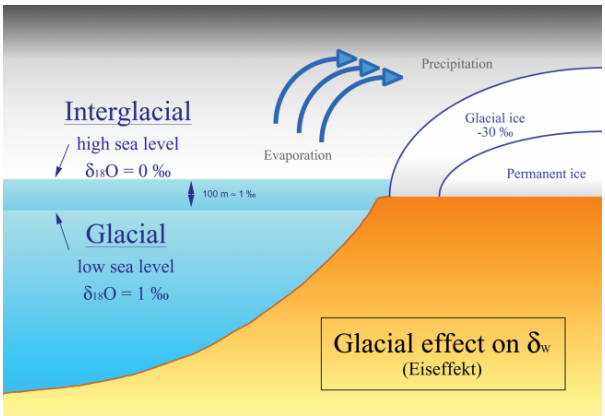
that orbit is in turns squished and stretched, so that during different seasons the earth is either closer to or further from the sun.

The second cycle deals with the axis on which the earth spins. It rotates through 360 degrees over approximately 26,000 years. And at the same time, the long axis of Earth's elliptical orbit also rotates. And together these two effects determine where in the orbit the seasons occur. They combine to produced a 21,000 year cycle known as "the precession of the equinoxes". So that what might start as relatively mild winters in the north, will eventually turn very cold indeed.

The third cycle deals with the tilt of the earth. This also changes. The spin axis of the planet oscillates relative to the axis of our orbit by between 22.1 and 24.5 degrees over 41,000 years. We are currently at 23.5 degrees. The higher the angle, the more extreme the seasons, but the lowest angle ultimately leads to a colder global climate, because the highest latitudes, where glaciation begins, never get much sun.

So, yes, natural processes radically alter the Earth's climate over many thousands of years. It shifts between short periods of warm, and long periods of frigid cold. Believe it or not, we are currently living through an ice age which has lasted two-and-a-half million years so far, though at the moment we are in a brief, inter-glacial phase, which began around 11,000 years ago. By rights, we should be heading back into a period of extreme cold.

But human activity is interfering with these natural cycles, and artificially warming the planet at a speed never before seen.



How do we know that? A science called paleoclimatology, which deals with the climates prevalent at particular times in the past. Paleoclimatologists can reconstruct our climate history by digging holes in Arctic and Antarctic ice (glacial ice cores), and in the sea bed (oceanic sediment cores).

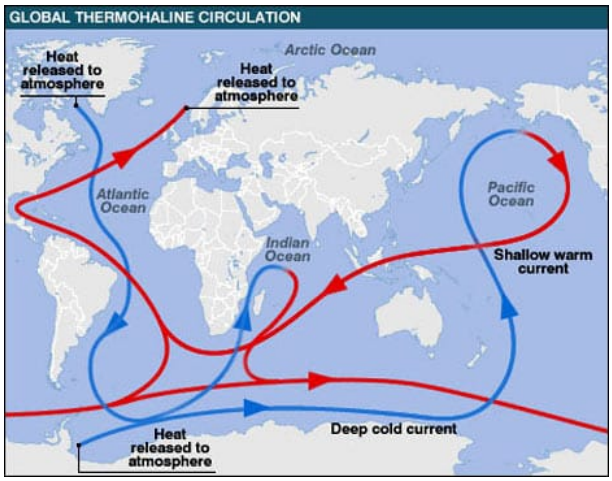
The most famous glacial ice core is a nearly four kilometre deep hole drilled in the Vostok Glacier in Antarctica. This glacier was built up by millennia of snowfall. Each year's layer carries bubbles of the earth's atmosphere from that time. Isotope ratios and greenhouse gas content in those bubbles trace the global climate over the past 420,000 years.

Oceanic sediment cores reveal the changes in ocean floor sea life whose composition also depends, sensitively, on ocean temperatures and salinity (saltiness). Ocean cores provide a climate record going back tens of millions of years.

So we know, and understand our climate history, and can see quite clearly how our human activity is changing it.

MY CLIMATE SCENARIO

Air and sea temperatures are generally distributed around the globe by a circulation of surface and deep-sea currents known as the Thermohaline Circulation.



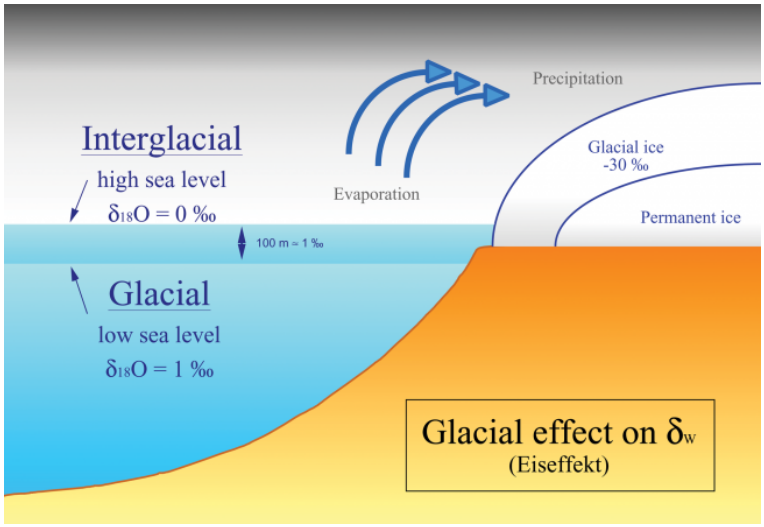
Warm water from the Gulf of Mexico moves up the east coast of America before heading off north-east across the Atlantic and ending up generally somewhere between Iceland and Norway. As it moves east its heat is dissipated to the surrounding areas, i.e. Europe, making the near continent much warmer than it should be. Without it Scotland, for example, would be much colder, sharing similar weather to the Alaskan Panhandle which is at the same latitude.

The main movers of deep ocean water are temperature and salinity. As warm water evaporates and leaves more salt in the ocean, the seawater becomes more dense, though it doesn't sink while it's still warm. But as it moves across the Atlantic it becomes colder, and denser. And as it reaches the far north, some of it turns to sea ice, making the water even saltier and again more dense. The cold salty water is now too dense to remain near the surface.

THE CHIMNEYS

The Gulf Stream moves 100 million cubic metres of water per second, and when it becomes too cold and salty all that water starts to sink. It sinks down around four kilometres in what are known as chimneys - each of which is about 15 kilometres wide.

They might be described as the greatest waterfalls anywhere on earth, moving around 17 million cubic meters of water per second down to the ocean floor. Once there it starts to travel south, making a meandering tour of the world's ocean beds and taking anything up to 1500 years to return to the surface - the Thermohaline Circulation.



The process of sinking water in the North Atlantic is know as the Atlantic Meridional Overturning Circulation, or AMOC. And this is a process that will continue as long as the two driving forces involved remain in balance - temperature and salinity.

But human activity is messing with both those things on a global scale. Carbon emissions from the burning of fossil fuels, and other factors, are causing the composition of the earth's atmosphere to change, pushing up the temperature of the earth. Warmer air temperatures at higher latitudes make the water there warmer, too. And therefore less dense. So the water in the AMOC doesn't sink as readily in the chimneys. But also, warmer temperatures mean melting ice, and as ice in the Arctic Ocean and Greenland melt, they flood the North Atlantic with huge quantities of fresh water, lowering the salinity even further, and making the water even less likely to sink.

For the conveyor belt of ocean currents to work, the waters of the North Atlantic must be cold and salty. But climate change is making them warmer and less salty, slowing the circulation of water - and, in the worst case

scenario, causing it to shut down. A study published in 2015 showed that the Thermohaline Circulation has slowed by 15 to 20 percent in the last two hundred years.

If the AMOC were to end, or drastically slow down, there would be no more giant waterfalls, no more warm water heading north-west across the Atlantic. The heat around the equator would tend to be retained there, making it hotter than it is now. There would be droughts, storms. Agriculture would be devastated. By contrast, without ocean currents carrying warm water north, the higher latitudes would become much colder.

In my scenario, rapidly rising temperatures in the Arctic, which are increasing at four times the rate of the rest of the world, have melted the Greenland Ice Sheet more quickly than anyone predicted. As a result the Gulf Stream has ground to a halt, or at the very least drastically slowed down, causing tumbling temperatures in the most northerly parts of Europe.

THE JET STREAM

The Jet Stream - an air flow created by warm air from the south colliding with cooler air from the north - has been deformed into peaks and troughs by extreme temperatures rising from the Equator. The peaks pull up hot air creating heatwaves and unstable, stormy weather in southern Europe, while the troughs drag down ice cold air from a donut of freezing air circulating high above the Arctic, known as the Polar Vortex, creating icy conditions in the north.

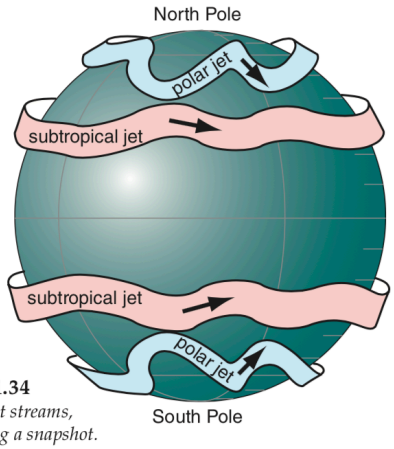


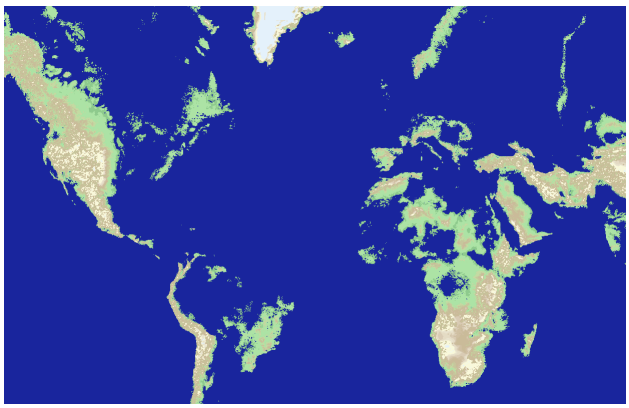
Figure 11.34
Sketch of jet streams, representing a snapshot.

Remember the “Beast from the East”? That was caused by a trough in the Jet Stream, dragging Arctic air down over northern Europe.

SEA-LEVELS

In “A Winter Grave”, Scotland is experiencing much colder, wetter summers, and freezing winters, with more snow and frequent ice storms, while at the

same time the Equator and sub-Saharan Africa have become uninhabitably hot.



Sea levels have risen by a metre and more, and combined with storm surges, have created devastating flooding around the world.

To predict exactly how Scotland might be affected by this in 2051, I used an online coastal risk screening tool, which allowed me to enter factors, including date and Co2 emission forecasts.

(https://coastal.climatecentral.org/map/8/-4.6749/56.5862/?theme=sea_level_rise&map_type=year&basemap=roadmap&contiguous=true&elevation_model=best_available&forecast_year=2050&pathway=rcp45&percentile=p50&refresh=true&return_level=return_level_1&rl_model=gtsr&slr_model=kopp_2014).

In truth, Scotland escapes relatively lightly because of its topography. Large parts of England are not so lucky, and many other parts of the world are completely submerged.

Imagining the rise in sea levels at a global level (largely due to melting ice), raised the question of what would happen to the populations in all those coastal cities and settlements. Around 40 percent of the world's population live within 100 kilometres of the sea. And it is estimated that expected coastal flooding could displace 2 billion people or more.

That's a lot of homeless people to be on the move. Mass migration into countries already struggling to feed their own populations because of an agriculture devastated by climate change, will almost certainly lead to immigration wars. It is a topic explored in an excellent book by Dr. Parag Khanna, "Move: How Mass Migration Will Reshape The World And What It Means For You". You can read an excellent interview with the author and summary of his book here:

(https://www.heraldscotland.com/politics/19850946.neil-mackays-big-read-mass-migration-coming-future-scotland-asian-says-leading-migration-expert-dr-parag-khanna/)

Finally…

CARBON BOMBS

A carbon bomb is an oil or gas project which will result in at least a billion tonnes of Co2 emissions over its lifetime.

There are currently 195 such projects in the works, with the dozen biggest players in the fossil fuel industry planning to spend at least $103 million a day on exploiting new oil and gas fields. Together they will produce around 646 gigatons of Co2 (a gigaton is one billion metric tons). New fracking projects in the US alone will release 140 billion metric tons of planet-heating gases over their lifetimes - which is four times more than the entire world produced in 2021.

These people have to be stopped. And if our politicians won't do it, then it is up to us, if we want any kind of a future for our children and our grandchildren.

I felt that I couldn't write a book set in a future affected by climate change without fully understanding the scientific rationale behind it. I know this is a lengthy document, but I hope it goes some way to explaining the solid science behind my fiction.

I don't claim that my prediction for 2051 will come to pass, only that it might. Many scientists believe we have already passed the tipping point, beyond which there will be no going back for our planet or our species. I take the view that if we take drastic action now, it might not yet be too late.

It's why I wrote the book.

Peter May
Autumn 2022