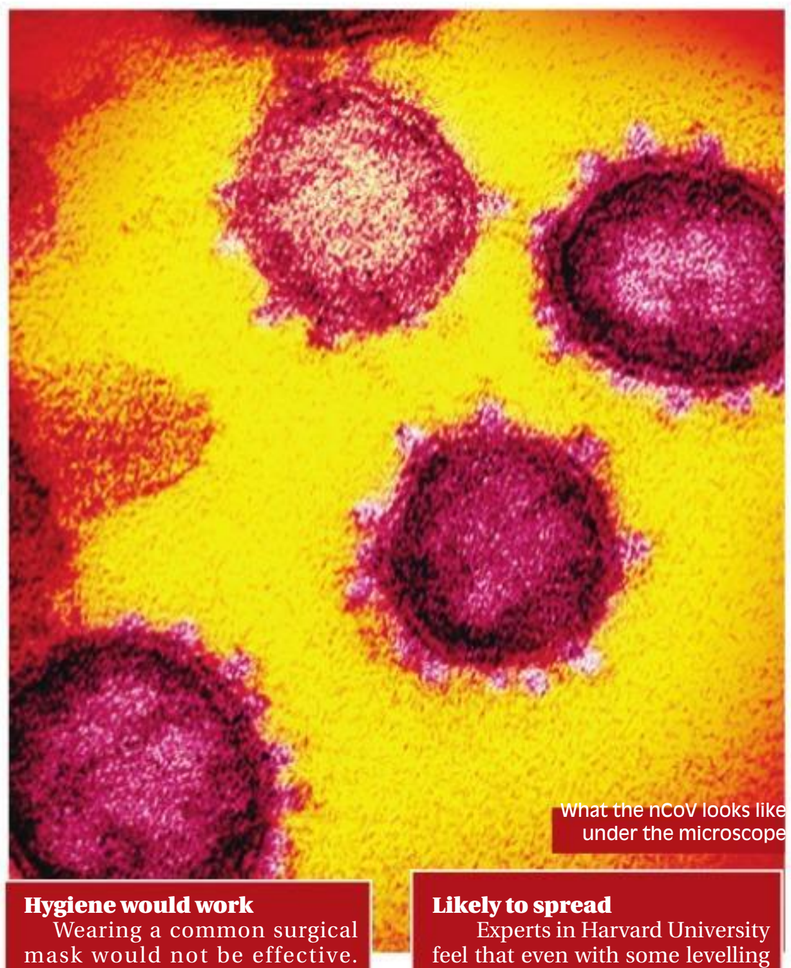
Dethroning the new coronavirus

The administration of Wuhan in China is dealing with an unparalleled medical emergency



What the nCoV looks like under the microscope

Hygiene would work

Wearing a common surgical mask would not be effective. Washing one's hands, disinfecting frequently touched surfaces and objects and avoiding touching one's face, eyes and mouth can greatly lower the risk of infection.

Likely to spread

Experts in Harvard University feel that even with some levelling of new cases in China, it is a matter of time before the virus reaches other countries. Even Singapore, which is good at tracing cases, has found some cases that were not linked to known cases. This is really a global problem that is not going to disappear in a week or two, a Harvard staff writer says.

S ANANTHANARAYANAN

The World Health Organization convened a two day forum at Geneva to assess the level of knowledge about the 2019-nCoV, or novel coronavirus, and identify gaps and accelerate research needed to help stop the outbreak, which has affected thousands in the short time since December 2019.

Hubei province in Central China, where the city of Wuhan lies, has redefined what it considers a reportable case of the disease, so that treatment and isolation can be started early, to control severity and spread. The result was that some 13,000 new cases were reported on 12 February 2020, a 33 per cent increase over the previous day. The new policy is because lab tests to confirm cases of nCoV take time, says Wu Zunyou, chief epidemiologist at the Chinese Center for Disease Control and Prevention. "The clinicians in Hubei made a very strong request to widen the criteria," because of their heavy work load and so that patients are properly isolated, he says.

Coronaviruses, so called because spiky projections on the outer surface of the virus resemble the points of a crown, are a large group of viruses that infect birds and mammals, including humans. Many coronaviruses arise in animals and evolve to infect humans. The four most common coronaviruses that affect humans, which include the viruses that cause common cold, however, appear to be native to humans, and may have evolved for efficiency in spread amongst the population, rather than virulence. This may explain why the coronaviruses that cause SARS, MERS and the current, nCoV, which are transmitted from animals, trigger more severe diseases in humans. At the same time, there is the advantage, that these virulent viruses may not have efficient means of survival and spread.

Like all viruses, the way coronavirus acts is by injecting its genetic material into a host cell and taking over the cell's resources for its own multiplication. The function of the host cell is thus impaired, which manifests as disease, while the virus multiplies. The projections on the coronavirus surface are shape-matches with features of host cells, which allow the viruses to "latch on" to specific target cells, so that the virus DNA can flow into the host.

SARS, or Severe Acute Respiratory Syndrome, broke out in 2002-03, first in Southern China, causing 8,098 cases and 717 deaths — a 9.6 per cent fatality rate, mostly in mainland China or Hong Kong. The symptoms were flu-like and could include fever, muscle pain, lethargy, cough, sore throat, and could lead to shortness of breath and pneumonia. Chinese researchers traced the source to horseshoe bats in caves in the Yunan province, through the intermediary of the civet group of mammals.

MERS, or Middle East Respiratory Syndrome, also known as "camel flu", was first detected in Saudi Arabia in 2012. The symptoms were like those of SARS and a mortality rate of about one third. The spread was thought to be from camels, but it spread between humans only on close contact and rarely outside hospitals.

The current outbreak of nCoV has similar symptoms and can lead to severe respiratory disease, with a mortality rate of about two per cent. The mortality ratio, however, would fall, now that the policy is to include, in the count of infected persons, all those who show symptoms and could be considered to have come in contact with infected persons. The number infected, however, has crossed 65,000 and there have more than 1,700 fatalities.

The present methods to test patients for coronavirus infections are by analysing respiratory specimens and serum isolated from their blood. The US Centre for Disease Control stated in a conference in January 2020 that it has developed an equivalent protocol. Once trials show that it works, diagnostic kits would be distributed to health care facilities in the US and abroad. Turkey has announced that a fast tool that gives results with 99.6 per cent accuracy in 90 to 120 minutes has been developed, with the help of WHO inputs.

Just as for other viral diseases, there is no method of treatment that is available. Those who catch a common coronavirus usually recover on their own and can ease the process by medication to relieve pain and fever, using a humidifier, taking hot showers, drinking plenty of fluids and staying home to rest. Similar regimens are used to relieve the symptoms of more severe coronavirus infections.

There are some antiviral medications, which disable viruses by interfering with their attempts to replicate in host cells, originally intended to treat Ebola and malaria, and these may show some efficacy against nCoV. Another class of drug, called "protease inhibitors," which helps to alert the immune system against viral invaders, is also reported to have promise.

A candidate vaccine had been developed for SARS during the pandemic of that virus. A potential MERS vaccine also performed well in preliminary clinical trials, but neither of those has hit the market. And now, research groups around the world are racing to develop a vaccine for nCoV.

The way coronaviruses are transmitted between humans is by respiratory droplets that infected people expel when they breathe, cough or sneeze. A typical surgical procedure cannot block the viral particles contained in these droplets, but simple measures — such as washing one's hands, disinfecting frequently touched surfaces and objects, and avoiding touching one's face, eyes and mouth — can greatly lower the risk of infection. The viruses generally cannot survive for more than a few hours on surfaces outside a human host, but the window of time within which people can pick up a coronavirus from a contaminated surface is still not properly known.

The Chinese authorities, in the meantime, have resorted to extreme measures in Wuhan, to try to halt the spread of nCoV, with house-to-house surveys and transferring the sick to quarantine centres. The mortality rate in Wuhan, a city of 11 million people, was found to well above the rest of the country's rate, and while the city administration deals with its own sick, the Chinese government and the world are taking measures to contain the spread of the virus.

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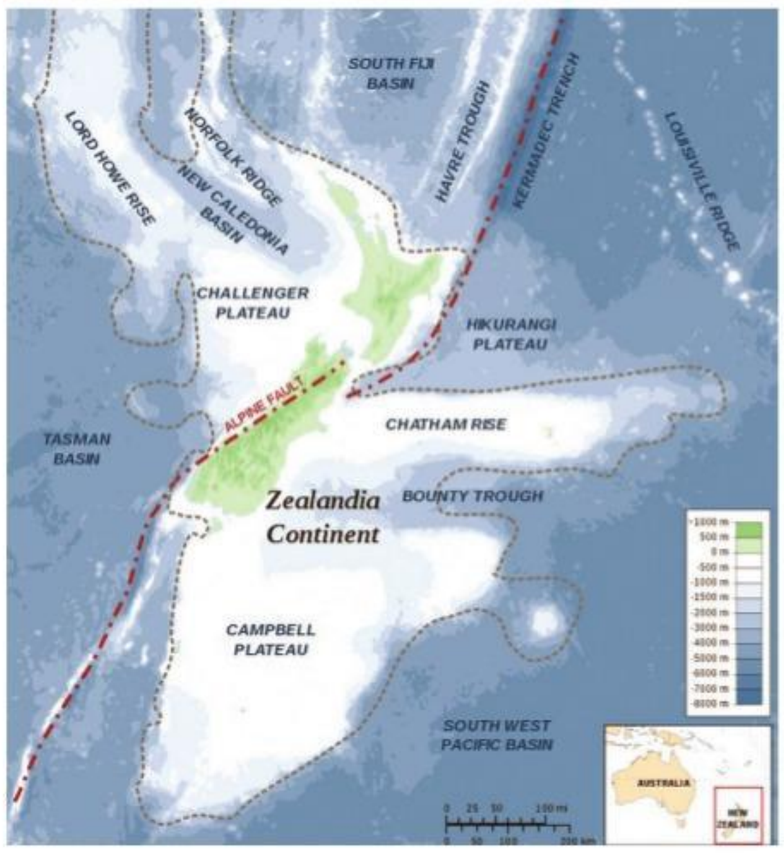
Zealandia's violent birth

New research has found that Earth's underwater continent was forged in a ring of fire during the time of dinosaurs

RUPERT SUTHERLAND & GERALD DICKENS



Three years ago, the identification of Zealandia as a continent made global headlines. Now, newly published results from our scientific drilling expedition reveal the largely submerged Zealandia continent, which stretches across five million square kilometres beneath the southwest Pacific Ocean, was shaped by two tectonic events.

First it was ripped away from Australia and Antarctica, and then it was carved by forces that started the Pacific Ring of Fire.

Why Zealandia is so different to other continents

Zealandia has an unusual geography for a continent. More than half the surface area of Earth's other six continents are composed of low-lying land and shallow seas, and they have relatively narrow mountain ranges and steep continental slopes in the deep ocean.

In contrast, Zealandia is mostly hidden beneath more than one kilometre of water and could be classified as more than 90 per cent continental slope. This makes it a challenge to explore.

The first scientific drilling expedition to sample in the area where we now know Zealandia to be took place in 1972 between Australia, New Zealand and New Caledonia. The results suggested tectonic forces stretched and thinned Zealandia's crust until it was ripped from the ancient supercontinent Gondwana about 85 million years ago, during the time of dinosaurs. This created a deep ocean — the Tasman Sea.

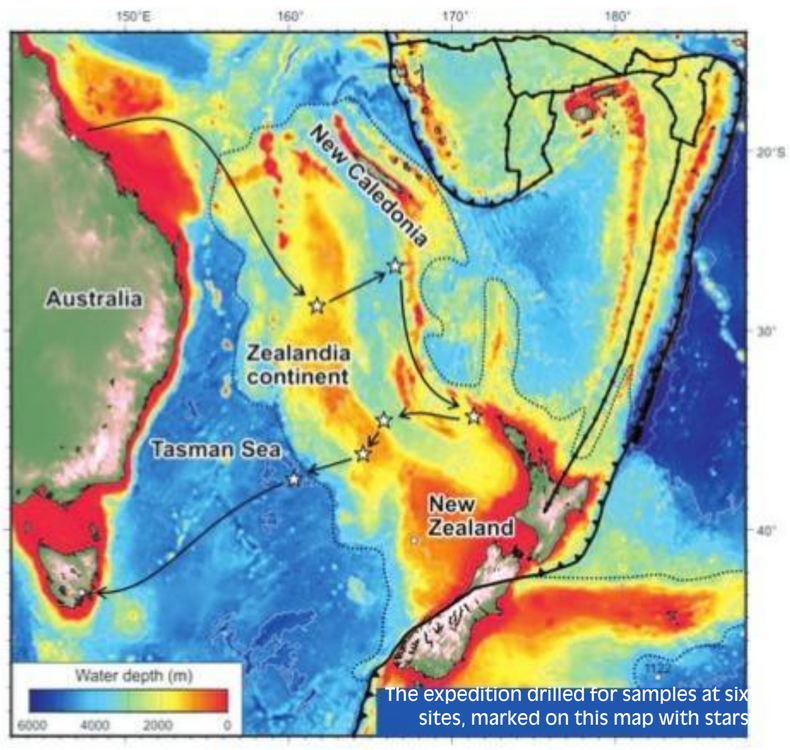
The evidence remains compelling that this is at least part of the answer to how the geography of Zealandia formed. But detailed surveys during the 1990s and 2000s, carried out to establish sovereignty over the Zealandia continental mass by New Zealand, Australia and France, suggested other contributing factors.

How the Pacific Ring of Fire shaped Zealandia

In 2017, we led a nine-week expedition into the southwest Pacific as part of the International Ocean Discovery Program, with 32 scientists on board the research vessel JOIDES Resolution. Our aim was to unravel why Zealandia is so different from the other continents.

Our newly published results in the Geological Society of America have been drawn from that expedition, where we collected new samples and sought to test our hypothesis that formation of the Pacific Ring of Fire played a key role in shaping Zealandia.

We collected sediment cores from up to 864 metres beneath the seabed at six sites far away from land or shallow water. At the deepest site, the water was five kilometres deep and our drill weighed 300 tonnes. We used fossils from three of the sites to show northern Zealandia became much shallower and likely even had land areas between 50 and 35 million years ago. At about that time, two other sites became submerged into deeper water, and then the whole region subsided an additional kilometre to its present depth.



The expedition drilled for samples at six sites, marked on this map with stars

These dramatic changes in northern Zealandia, an area about the size of India, coincided with buckling of rock layers (known as strata) and the formation of underwater volcanoes throughout the western Pacific.

The Pacific Ring of Fire is a zone of volcanoes and earthquakes running along the west coasts of north and south America, past Alaska and Japan, and then through the western Pacific to New Zealand. The violent geological activity in this zone reflects deeper unrest at the boundaries of tectonic plates, caused by "subduction processes" — where one tectonic plate converges on another and sinks back deep into the earth.

We know the Pacific Ring of Fire formed about 50 million years ago, but the process remains a mystery. We propose a "subduction rupture event" — a process similar to a massive slow-moving earthquake — spread around the whole of the western Pacific at that time. We suggest this process resurrected ancient subduction faults, which had lain dormant for many millions of years but were primed to start moving again.

This concept of "subduction resurrection" is a new idea and may help explain a range of different geological observations. The subduction rupture event included unique geological phenomena that that have no present-day comparison, and there may have been fewer than 100 such massive events since Earth formed. Our new evidence from Zealandia shows these events can dramatically alter the geography of continents.

What were the consequences of these geographic changes for plants, animals and regional climate? Can we make a computer model of the geological processes that happened at depth? We are still figuring some of this out, but we do know the event changed the direction and speed of movement of most tectonic plates on Earth.

It was an event of truly global significance — and we now have really good observations and ideas to help us get to the bottom of what happened and why.

Rupert Sutherland is professor of tectonics and geophysics, Te Herenga Waka, Victoria University of Wellington, New Zealand, and Gerald Dickens is professor, Rice University, US. This article first appeared on www.theconversation.com

PLUS POINTS

Search for life beyond

Scientists have launched a major new search for alien life. The new scheme uses the latest techniques to scour the skies in the hope of finding data that could be an indication of extraterrestrial intelligence. And they will also make the data from their searches available to the public in the hope that citizen scientists can spot potential evidence in what they have found.

The researchers at the US-based Search for Extra Terrestrial Life Institute, which is devoted to looking for alien life, are hunting for "technosignatures", or hints in the data that suggest they could be coming from planets that are home to other beings. They could be anything from sniffing hints of chemicals on alien worlds to indications that there could be structures or lasers on other planets. Tony Beasley, director of the National Radio Astronomy Observatory telescope based in Virginia, US, said, "Determining whether we are alone in the universe as technologically capable life is among the most compelling questions in science."

Seti scientists plan to develop a system that will "piggyback" on the Very Large Array telescope based in Mexico and provide data to their technosignature search system. Beasley added, "As the VLA conducts its usual scientific observations, this new system will allow for an additional and important use for the data we're already collecting."

Life forms, whether intelligent or not, can produce detectable indicators such as large amounts of oxygen, smaller amounts of methane, and a variety of other chemicals, the experts said. So in addition, scientists are also developing computer models to simulate extraterrestrial environments that can help support future searches for habitable planets and life beyond the solar system.

Victoria Meadows, principal investigator for Nasa's Virtual Planetary Laboratory at the University of Washington, which studies to detect exoplanetary habitability, said, "Upcoming telescopes in space and on the ground will have the capability to observe the atmospheres of Earth-sized planets orbiting nearby cool stars, so it's important to understand how best to recognise signs of habitability and life on these planets. These computer models will help us determine whether an observed planet is more or less likely to support life."

Meanwhile, Seti's Breakthrough Listen Initiative, which launched in 2015 to "listen" for signals of alien life, has released nearly two petabytes of data from the most comprehensive survey yet of radio emissions from the plane of the Milky Way galaxy and the region around its central black hole.

The organisation is now inviting the public to search the data, gathered from various telescopes around the world, and look for signals from intelligent civilisations. Scientists hope that citizen scientists will be able to find interesting things in the data — whether that is unknown natural phenomena, or something even more unexpected, such as alien life.

"Since Breakthrough Listen's initial data release last year, we have doubled what is available to the public," said Breakthrough Listen's lead system administrator, Matt Lebofsky. "It is our hope that these data sets will reveal something new and interesting, be it other intelligent life in the universe or an as-yet-undiscovered natural astronomical phenomenon."

Yuri Milner, an entrepreneur and founder of the Breakthrough initiative, said, "For the whole of human history, we had a limited amount of data to search for life beyond Earth. So, all we could do was speculate.

"Now, as we are getting a lot of data, we can do real science and, with making this data available to general public, so can anyone who wants to know the answer to this deep question."

The initiatives and strategies in expanding the search for extraterrestrial life were presented at the annual meeting of the American Association for the Advancement of Science in Seattle.

The independent