

# A repeat lesson for us all

BY PAUL TAPPONNIER & KERRY SIEH FOR THE STRAITS TIMES

**A**NOTHER hammering home that we are not living sustainably on our dynamic Earth! Large disasters developed a doleful cadence through the first decade of the 21st century. First it was India, then Iran, Indonesia, Pakistan and China. And now, in the first month of the century's second decade, it is Haiti. The anguishing post-earthquake scenes of monumental devastation have become all too familiar.

In the last half of the last century, we built too much, too inadequately, in too many dangerous places, with too little regard for how the Earth works. Winston Churchill's ominous words a few years before World War II are apt: "Owing to past neglect, in the face of the plainest warnings, we have now entered upon a period of (greater) danger... The era of procrastination, of half-measures, of soothing and baffling expedients, of delays, is coming to a close. In its place, we are entering a period of consequences..."

Last week's Haiti earthquake was caused by the sudden rupture of a tectonic fault that traverses the entire length of a long peninsula that juts out to the west from the capital Port-au-Prince. The rupture occurred at quite a shallow depth as earthquakes go, and ran for a few tens of kilometres just south-west of the impoverished city of about two million. The proximity of the rupture and the lack of infrastructural defences conspired to magnify the severity of the catastrophe in Port-au-Prince. The death toll may well exceed the 40,000 that we witnessed in the Bhuj (2001) earthquake in India or the 100,000 in the Lungmen Shan (2008) earthquake in China.

The fault that generated last week's earthquake is known to geologists as the Enriquillo-Plantain Garden Fault Zone (EPGFZ). It is part of the northern boundary of the Caribbean Plate, which currently moves about 2cm a year towards the north-east.

Preliminary seismological data suggests that it was a section of the fault

west of the capital that ruptured last Tuesday. In less than a minute, the mountains south of the fault slipped eastwards by a couple of metres, likely over a length of about 70km.

History shows that the EPGFZ has the potential to produce large, destructive earthquakes. Two in the 18th century were well recorded. Recent measurements of deformation of the region using GPS satellite technology had singled out the fault as a site of dangerously accumulating crustal strain (at a rate of 7mm to 9mm a year). Warnings of the potential for damaging earthquakes, as well as calls for detailed scientific study, were issued in recent years, most recently after small shocks occurred beneath Port-au-Prince in September 2008.

In the second half of the 18th century, not just one but two huge earthquakes, only 19 years apart, razed the colonial town of Port-au-Prince. As related by the French historian Moreau de Saint-Méry, the first occurred at 2pm on Oct 18, 1751. It even toppled several buildings in the Spanish harbour of Santo Domingo, more than 250km to the east. It was followed by strong aftershocks for about two months. In Port-au-Prince, only one masonry building did not collapse.

The second earthquake, on the evening of June 3, 1770, was more violent than the first. It turned the reconstructed town into a vast field of ruins, with only aligned trees marking the tracks of former streets. Rock falls and landslides cascaded down mountain slopes, and watery quicksand fountains erupted on the plains. Aftershocks continued for four months. Several small shocks that jolted the region in the preceding three years were unrecognised portents of the great earthquake to come.

Why is it that Port-au-Prince was no more prepared for last week's earthquake than it was for the twin earthquakes two and a half centuries ago? The answer is quite simple: just as we humans cannot hear sounds or see colours that are emitted at frequencies beyond what our ears or our eyes have evolved to perceive, we are not naturally attuned to events that happen less frequently than every few

decades.

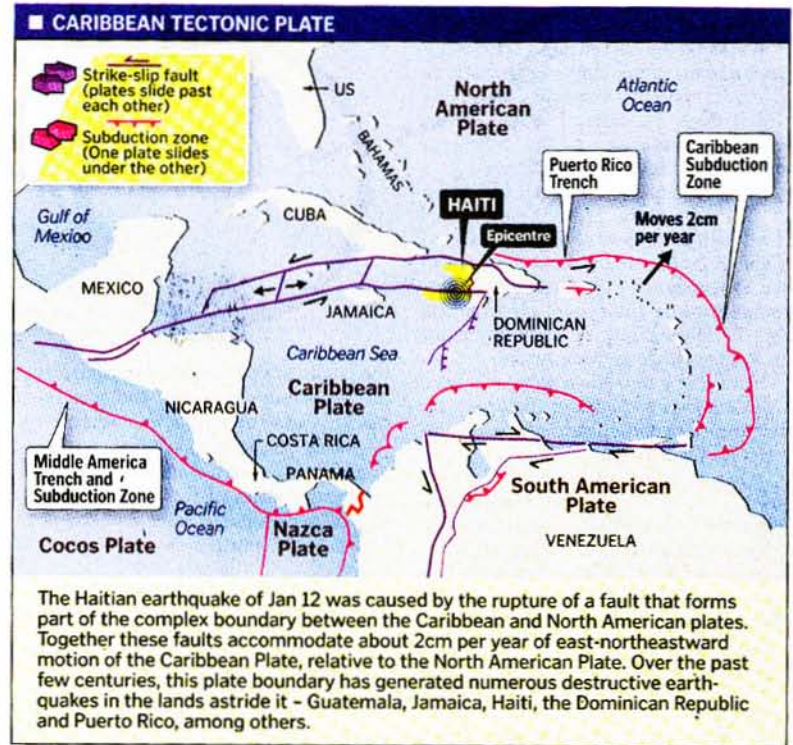
We teach our children to look both ways before crossing the street because cars come by every few seconds or minutes. We regulate the financial markets because financial debacles occur every few decades. But a seismic, volcanic or climatic disaster that might occur every few centuries or millennia or even longer? Should we lose sleep worrying about them?

For the sake of the future of civilisation, the answer is most assuredly "yes". Our modern civilisation, dependent upon intricate machines and complex economic, political and cultural institutions, will likely not make it unless it pays attention to the sciences that have enabled humanity to extend our "eyes" and "ears" in order to see and hear the inner workings of the Earth's tectonics and climate. And once we perceive these dangers, we will need to utilise the powerful "hands" that modern engineering has afforded us in order to build safely.

This applies particularly to Port-au-Prince and Haiti. It is quite possible that last week's earthquake is the beginning of a sequence, analogous but likely not identical to that of the late 18th century. We now know that large earthquakes on long quiescent, "locked" fault zones commonly trigger one another, and hence cluster together in time. It is thus reasonable to suspect that another large earthquake will strike the city in the coming decades.

Cities in a similar predicament include Istanbul and Padang, where history indicates that clusters of earthquakes are common and where science has indicated that another is likely within the next few decades.

Insofar as this tragic event focuses the world's attention on Haiti, it could well provide the opportunity to turn things around there. Recall the billions of dollars that poured into Aceh for its reconstruction after the great 2004 earthquake and tsunami. Those who are planning for the reconstruction of Haiti would do well to expect another shock at least as violent as last week's within the next few decades. This means that it would be smart to build the physical and human infrastruc-



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ture of Port-au-Prince to be more resilient to another strong shake. An investment in scientific infrastructure would be an important part of that resilience - to measure the strains as they accumulate and understand possible forewarnings.

The lessons of the Haitian earthquake apply here in Asia too. We too have earthquake-generating faults close to some of our important cities.

Istanbul, for instance, sits just a few kilometres away from a great fault. The only section of that fault that has not yet broken is the underwater section nearest that great city straddling the boundary of Europe and Asia.

Mandalay, the famous ancient city of northern Myanmar, lies less than 10km from the Sagaing fault, whose northern stretch has not ruptured since March 23, 1839. Myanmar's new capital Naypyidaw straddles a section of the fault that has not broken in recorded history. Padang in Sumatra is only 40km from the Sumatran fault, a fault very similar to Haiti's EPGFZ; Bukittinggi sits virtually atop it,

and Banda Aceh halfway between two of its branches. Wellington in New Zealand has a similar fault running right through the city. So too the suburbs of Manila.

At the dawn of the second decade of the 21st century, the Haitian tragedy illustrates the dangers that supercities, megacities and their hinterlands face from natural hazards: We are largely unprepared, overexposed and naturally disinclined to do things differently so as to protect ourselves. Unless we embrace a new man-nature paradigm, we are in for an endless litany of disasters, similar to what has just happened in Haiti.

Best if we show that the writer E.B. White was wrong about us in this century: "I would feel more optimistic about a bright future for man if he spent less time proving that he can outwit nature and more time tasting her sweetness and respecting her seniority."

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