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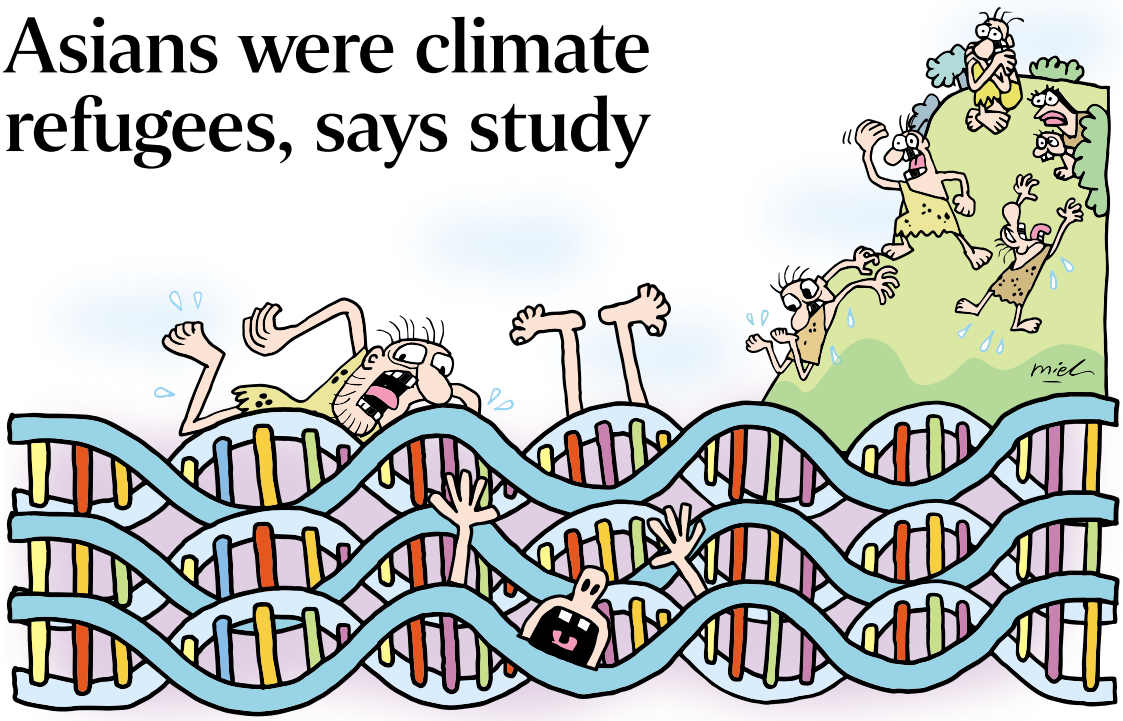
Page 4 | Section: INSIGHT,| INSIGHT

Science

# Prehistoric S-E Asians were climate refugees, says study



## People fled due to rising sea levels and resettled elsewhere over 20,000 years ago

Gena Soh

Where will people go if Singapore were to go underwater due to climate change? This question may find an unlikely answer from its geographic history more than 20,000 years ago.

A new study by Nanyang Technological University (NTU) finds that prehistoric people living in South-east Asia similarly fled due to rising sea levels, and resettled elsewhere as climate refugees.

This contributed to the genetic diversity found in the world today, with genetic fragments of indigenous Malaysian populations detected in indigenous populations of eastern India.

"Environmental changes have profound impacts on human history, driving population migration, growth and split," said the study's lead investigator, Assistant Professor Kim Hie Lim. She is from NTU's Asian School of the Environment (ASE) and the Singapore Centre for Environmental Life Sciences Engineering (SCELSE) at NTU.

"However, less discussed is how environmental changes can shape the genetic profile of populations," she added.

The interdisciplinary study, published in Communications Biology in February, was conducted by ASE, SCELSE and Earth Observatory of Singapore (EOS).

SHAPING GENETIC PROFILES

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**ASSISTANT PROFESSOR KIM HIE LIM**, from NTU's Asian School of the Environment and the Singapore Centre for Environmental Life Sciences Engineering.

It used data for South-east and South Asia's sea-level history and constructed paleogeographic maps dating from 26,000 years ago to the present.

Such maps illustrate how coastal lines have changed and how the past locations of mountains, lowlands, shallow seas and deep ocean basins have altered over long periods of time.

Additionally, NTU scientists generated genome sequencing data from 59 ethnic groups, including that belonging to populations native to South-east and South Asia from 50,000 years ago.

This data allowed the team to infer the genetic ancestry and demographic history of the ethnic groups, including their population size changes over time.

By drawing comparisons between the two methods, Prof Kim said the team found that changes in ancestries and population sizes could be directly correlated to the changes in landscape over the last 26,000 years.

"Around 20,000 years ago, the Malay Peninsula, the islands of Sumatra, Borneo and Java were originally part of a large land mass of rainforests and coastal mangroves in the South Asia continental shelf known as the 'Sundaland'," she added.

The world was in what is known as the Glacial Maximum period – the most recent ice age to modern times – and glaciers were at their maximum area across the globe. This led to low sea levels and larger amounts of terrestrial space.

As the world exited this period of prolonged cooling, temperatures began to rise and glaciers began to melt over the next 20,000 years into the Holocene – the current geological epoch.

Over this period, sea levels rose 130m – which broke the land bridges in Sundaland and split it into smaller islands of the region today.

During this time, Prof Kim said there were two periods of rapid sea-level rise that promoted the eventual separation of populations into smaller groups across Sundaland.

The periods occurred 14,000 and 11,000 years ago, when the temperature finally hit a habitable zone for populations in the South-east Asian Peninsula to flourish.

But this burgeoning population was squeezed over the next 4,000 years, as rising temperatures that promoted glacial melt ate away at land space.

She noted that this resulted in migration inland and northwards, as people began to search for new places to settle with less competition for resources.

Genetic analysis done in the study confirmed this hypothesis, with the study finding common genetic ancestry between the Malaysian and South Asian indigenous groups.

Specifically, genetic fragments from the ancestors of the Malaysian indigenous group – commonly referred to as the "Orang Asli" – have been found in South Asian tribal groups that speak Austroasiatic languages, in the eastern part of India.

Dr Li Tanghua, co-author of the study, said the Orang Asli Malaysian indigenous group can be considered the first "casualties" of sea-level rise, or what are known as "climate refugees" today.

"The population had no choice but to move from their original territory due to environmental pressures... This forced migration caused an indelible change to the genetic footprint of South Asians, contributing to one of the most ethnically diverse regions in the world," added the senior research fellow at NTU's EOS.

Prof Kim noted that while this ancestral migration occurred over many millennia, modern migration due to climate change is likely to take place more instantly and in a more complicated manner.

This is due to a plethora of other factors, such as the presence of jobs in some countries and not others, and immigration-related restrictions.

Despite this, she said it remains important to understand migration patterns because they affect genetic composition.

"The genetic composition of individuals is important for various health reasons, such as developing more effective personalised medication against ailments," said Prof Kim.

"Thus it is important to understand the natural history and genetic ancestry of humans as we show in this study."

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