

50-million-year-old clam shells provide indications of future of El Niño phenomenon

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Earth warming will presumably not lead to a permanent El Niño state in the South Pacific Ocean. This is the conclusion drawn by an international team of researchers after it investigated 50-million-year-old clam shells and wood from the Antarctic. The growth rings of these fossils indicate that there was also a climate rhythm over the South Pacific during the last prolonged interglacial phase of the Earth's history resembling the present-day interplay of El Niño and La Niña.

Floods in Peru, drought in Australia: When the South Pacific Ocean warms up at an above-average rate every three to six years and "El Niño" influences weather patterns, the world in the coastal countries affected is turned completely around. Fishermen come back with empty nets, crops are lost, food prices increase and nearly everyone hopes the warm phase of the climate phenomenon "El Niño Southern Oscillation (ENSO)" will abate as quickly as possible.

The ENSO phenomenon still changes regularly from its cold phase (La Niña) to the warm phase (El Niño) and back. But what will things be like in the future? How will the worldwide temperature rise influence ENSO? Will there perhaps be a permanent El Niño? To answer this important question, scientists are looking at the past – particularly at the Eocene period 60 to 37 million years ago. "The Eocene is considered to be the last real prolonged warm period. At that time the Antarctic was ice-free and green. Even trees grew and we know about the water temperature of the ocean that it fluctuated between 10 and 16 degrees Celsius over the year," says Thomas Brey, biologist at the Alfred

Wegener Institute for Polar and Marine Research in the Helmholtz Association.

He and colleagues from the USA and Germany have now succeeded for the first time in verifying a rhythm according to the pattern of the ENSO phenomenon in the growth patterns of fossil clams and wood from the early Eocene. Their results will soon appear in the journal *Geophysical Research Letters* and are already available on its website in a text entitled "El Niño in the Eocene greenhouse recorded by fossil bivalves and wood from Antarctica".

Brey and his colleagues investigated shells of the bivalve species *Cucullaea raea* and *Eurhomalea antarctica* that are 50 million years old as well as a piece of wood from Seymour Island in the Antarctic. "Like trees, clams form growth rings. We measured their width and examined them for growth rhythms," states Brey.

Whether clams grow depends on the availability of food and heat. "That means the change from "good" and "poor" environmental conditions at that time is still reflected in the width of the growth rings we find today. And as we were able to show, this change took place in the same three to six year rhythm we are familiar with in connection with ENSO today," says Brey.

The shells are a real piece of luck for him. "To verify ENSO, we need climate archives that cover the largest possible period year by year. Back then clams lived for up to 100 years. This is a good basis for our work."

To examine the significance of the growth rings of clams and wood, the researchers compared their measurement results with current ENSO data as well as with the ENSO-like fluctuations produced by a climate model of the Eocene. The result: all patterns correspond. "Our results are a strong indication that an ENSO phenomenon which fluctuated between

warm and cold phases also existed in the warm Eocene," says Brey.

Good news! Should the scientists be right, these findings mean for the future that in all likelihood the worldwide temperature rise will not disrupt the ENSO climate rhythm above the South Pacific Ocean.

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