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Deep-Sea Researcher Demonstrates: Human Activity Impacts “the Most Inaccessible Corners of the Earth”

2018 German Environmental Prize: Individual
Recognition of Marine Biologist Prof. Dr. Antje
Boetius

Bremerhaven. “Her scientific achievements in deep-sea- and polar research are crucial for understanding the global climate and the diversity of life. On the basis of her research results, she makes it clear that human activities such as greenhouse gas emissions, overfishing and water pollution affect even the most inaccessible corners of the earth. At the same time, she has an extraordinary talent for presenting the social significance of her research results to a broad public in an understandable way.” – with these words Alexander Bonde, Secretary General of the German Federal Environmental Foundation (Deutsche Bundesstiftung Umwelt, DBU), recognized today the award of the 2018 German Environmental Prize to marine biologist Prof. Dr. Antje Boetius (51), Director of the Alfred Wegener Institute Helmholtz Center for Polar and Marine Research, of Bremerhaven. German President Frank-Walter Steinmeier will present the award on 28 October in Erfurt. Boetius receives prize money of EUR 250,000.

Microbes from the deep sea protect against global warming through methane degradation

Bonde: “Ms. Boetius' most frequently quoted scientific publications deal with marine microbiology, especially with so-called anaerobic methane oxidation.” This involves research into the microorganisms that are responsible for the degradation of natural gas (methane) in large quantities in the ocean floor, to the exclusion of oxygen: Her research results are “of central importance in connection with global warming, since the impact of methane as a greenhouse gas is 25 times that of carbon dioxide. These microbes ensure that very little methane escapes from the oceans into the atmosphere and thus prevent the planet from heating up faster,” said Bonde. The microbes were said to have helped to stabilize the earth's climate for several billion years. In recent decades, however, humans have

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caused such a rapid and high increase in carbon dioxide and methane in the atmosphere that the natural buffers cannot prevent increasing global warming. Leading scientists therefore agree that the average global temperature in this century will rise by two to four degrees due to man-made carbon dioxide and methane emissions if measures are not taken quickly to control it. Bonde: "Predicted consequences: declining sea ice at the polar caps, sea level rise, drought, and accumulation of extreme weather events."

Two-degree target in the Arctic already long exceeded

To prevent these consequences, around 200 countries agreed at the United Nations Climate Conference in Paris in 2015 to keep man-made global warming well below two degrees Celsius compared to pre-industrial levels. According to the concept of "planetary boundaries" developed by leading international scientists, the consequences of warming beyond this so-called tipping point can no longer be foreseen, said Bonde. "In terms of the Arctic, we have long since exceeded the two-degree target," according to – the air temperature there has risen more than twice as fast as the global average, and the consequences of this warming are most evident in the steadily dwindling sea ice cover. "In 2012, I led an expedition with the research vessel *Polarstern* to the Arctic as the sea ice melted faster than ever before. We were thus direct witnesses to accelerated climate change and its consequences," Boetius has stated. "We not only watched the sea ice disappear, but also the accelerating melting of glaciers and the permafrost thaw. The unscientific word 'dramatic' can certainly be used here." She says that scientists now believe that in less than 40 years the North Pole could be ice-free in summer. However, along with the sea ice countless habitats and with them a large number of animals, plants and microorganisms would also disappear, as they would then have no means to survive.

No untouched nature remains

The prize recipient points out that, due to the high concentration of carbon dioxide in the atmosphere, more and more of that gas is dissolving in the surface water of the oceans. This acidification and habitat loss also has a direct impact on life in the deep sea, according to Boetius: "Climate change is also changing the algae and microorganisms on the sea surface. They sink by gravity and are the food of deep-sea animals. Therefore, the changes that take place at the top have a direct effect even in the deepest deep-sea trenches." Because of the man-made share of global warming, no untouched nature remains on the planet, says the prize recipient; this is also demonstrated by the almost omnipresent plastic waste and other traces of man. The researchers at AWI were able to detect microplastics in the Arctic sea ice as well growing amounts of waste in the deep sea. "The disturbing aspect: So far, there is no reliable knowledge of the extent to which microplastics can harm marine organisms or even become dangerous

to humans. The oceans and polar systems have become a kind of warning signal for the state of the earth," according to the AWI Director.

Oceans already impacted by overfishing and whale hunting

In addition to her scientific work on deep-sea microbiology, Ms. Boetius has an extraordinary talent for interdisciplinary and systematic thinking, said Bonde. Many experts from different disciplines are involved in the expeditions she coordinates, and are jointly developing hypotheses concerning the world's oceans, underpinning them with scientific results, communicating directly about them and quickly publishing the results and data – a key outstanding achievement, he went on: Boetius strongly wishes to promote a discussion of the relationship between human activity and the state of the oceans, as well as solutions for a good environment. According to Boetius, for example, the high level of fishing pressure on the oceans has long been a problem. She points out that some of our interventions can hardly be reversed, such as the collapse of whale populations as a result of worldwide hunting in the 19th century. According to Germany's Federal Environmental Agency as well, overfishing is considered to be the most serious intervention in marine ecosystems; the oceans are seen as one of the world's most important food sources. Without improved and sustainable fisheries management with reduced catch quotas, they are said to be threatened with being increasingly impacted.

Marine mammals globally important for natural "food webs"

"I had overexploitation of the seas in my head even as a child," says the marine biologist. "My grandfather was a whaler. He explained to me that we humans are responsible for this." Whale populations were extremely depleted by the 1930s and have not recovered to this day, she stated. "Sperm whales, fin whales, blue whales and other marine mammals cross the oceans and are globally important for natural food webs," said Boetius. "Today's populations have shrunk enormously compared to the 19th century." The ecosystem scientist points out that this also influences the rest of the ecosystem, including deep-sea microbes. "And we have never researched the natural state of the oceans, at the time when whales and large fish were still part of the ocean ecosystem in much larger numbers. We can no longer imagine this and unfortunately can no longer reconstruct it scientifically," said the deep-sea researcher.

Exploitation of metal recycling instead of deep-sea raw material extraction

However, the deep sea is not only a habitat for largely unexplored ecosystems, but also for natural resources such as nickel, cobalt and other rare metals of which deposits are limited on land, it was pointed out; high-tech products such as mobile phones will require much more of such raw materials and will arouse interest in deep-sea exploitation. "The exact effects of deep-sea mining are still largely unknown and must first be investigated. In Boetius, the ecosystems affected have a strong advocate,"

said Bonde. Boetius: "Personally, I would say that we do not need deep sea mining because we have not yet exhausted the possibilities for metal recycling, for reprocessing, for closing the value cycle of metals". Based on her perception, this "strange hype about deep-sea resources comes from the fact that many people still think that there is no life down there, that there is a desert down there, since no people live there". When, for example, she is invited by the United Nations (UN) to sit at the negotiating table as a science communicator with representatives of the ocean industries, her goal, according to Boetius, is "to make it clear that the still barely-explored world of the deep sea is understood as part of the planet and our future, to which the UN Goals for Sustainable Development also apply. Important findings from research into deep-sea species and their diversity and special adaptation could be lost forever to future generations in the event of unsustainable mining".

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