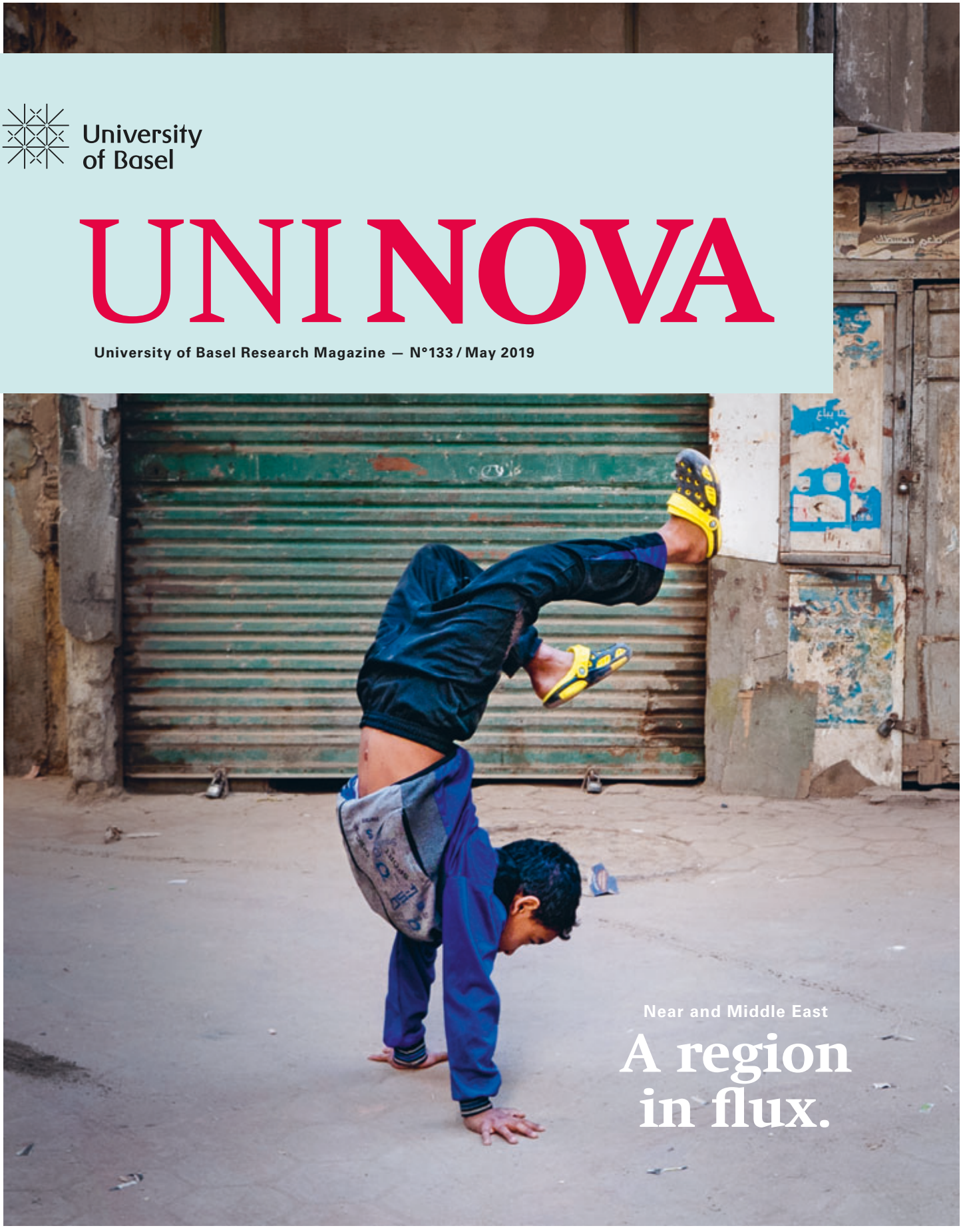
University of Basel

UNI NOVA

University of Basel Research Magazine — N°133 / May 2019



Near and Middle East

A region in flux.

In conversation
Communication in medicine.

Debate
Research into rare diseases.

Album
Tracing tsunamis.

Essay
On the need for narration.

On the trail of tsunamis.

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Text: Reto Caluori

The Caribbean island of Anegada may look like a tropical paradise, but tsunamis are capable of wreaking havoc on this northernmost of the British Virgin Islands. Rising just 8.5 meters above sea level, the coral island is threatened with devastation by strong winds and huge waves during the annual hurricane season.

Besides leaving a trail of destruction, flooding events also leave sediment deposits on the ground. Researchers can use this geological testimony to deduce the intensity and frequency of hurricanes and tsunamis that struck even many hundreds to thousands of years ago.

In September 2017, the Caribbean island experienced the highest category of hurricane, category 5, when it found itself in the path of Hurricane Irma. Yet, the island's sediments preserved signs of far greater events than Irma. When a team of researchers led by geologist Dr. Michaela Spiske from the University of Basel conducted field work on Anegada, they uncovered evidence of two major tsunamis that struck the island within the last 800 years. One of these tsunami events was triggered by the 1755 Lisbon earthquake.

In the field, the geoscientists measure and map flood parameters, such as water levels and inundation distances, as well as documenting morphological changes on the surface and collecting samples of deposited sediments. In combination with laboratory analyses, this data helps to improve existing tsunami models, allowing researchers to estimate the long-term risk of a region and to adapt the early warning systems accordingly.

Almost two years after Irma, washed-up flotsam serves as a reminder of the hurricane that swept through the British Virgin Islands. The angle of the palms indicates that they were bent over by a storm surge rather than high winds.

Dr. Michaela Spiske samples sandy hurricane deposits in the remains of a beach bar. As this sand undoubtedly originates from Irma's storm surge, its chemical profile and the contained marine microorganisms can be compared with the deposits from a tsunami (right).

Some 800 years ago, a tsunami tore a huge piece of coral from the reef and washed it 500 meters onto the land. Measuring points are used to create a 3D model that allows researchers to determine its volume and weight. In turn, this helps them calculate the wave height and flow velocity needed to transport the coral boulder, which weighs about eight metric tons, such a large distance inland.

Along the coast, historical hurricanes have created coast-parallel ridges composed of coral fragments. A trench uncovers the inner structure of the coral ridge. The orientation of the flat clasts tells researchers that this material was transported onto the beach by thousands of individual storm waves – rather than by the turbulent waters of a tsunami wave (left).

The green line marks the ridge crest and would disappear if the material was moved by a storm. Irma was too weak to wash new material onto the land – and was therefore not even close to the worst-case scenario on Anegada.

Michaela Spiske is a private lecturer of exogenous geology and sedimentology at the Department of Environmental Sciences of the University of Basel. Her research focuses on erosion, transport and deposition processes during natural hazards such as tsunamis and storm surges, which can significantly alter or even destroy a coastal region within a few hours.

A shovel slice of sediments from a salt pond in the island's interior contains hundreds of years of geological history: Between typical salt-pond deposits, the researchers find two layers containing shell fragments and limestone chunks from the open ocean and the shore platform. These bear evidence to the several-meter high tsunamis that washed over the island some 800 years ago and in 1755.