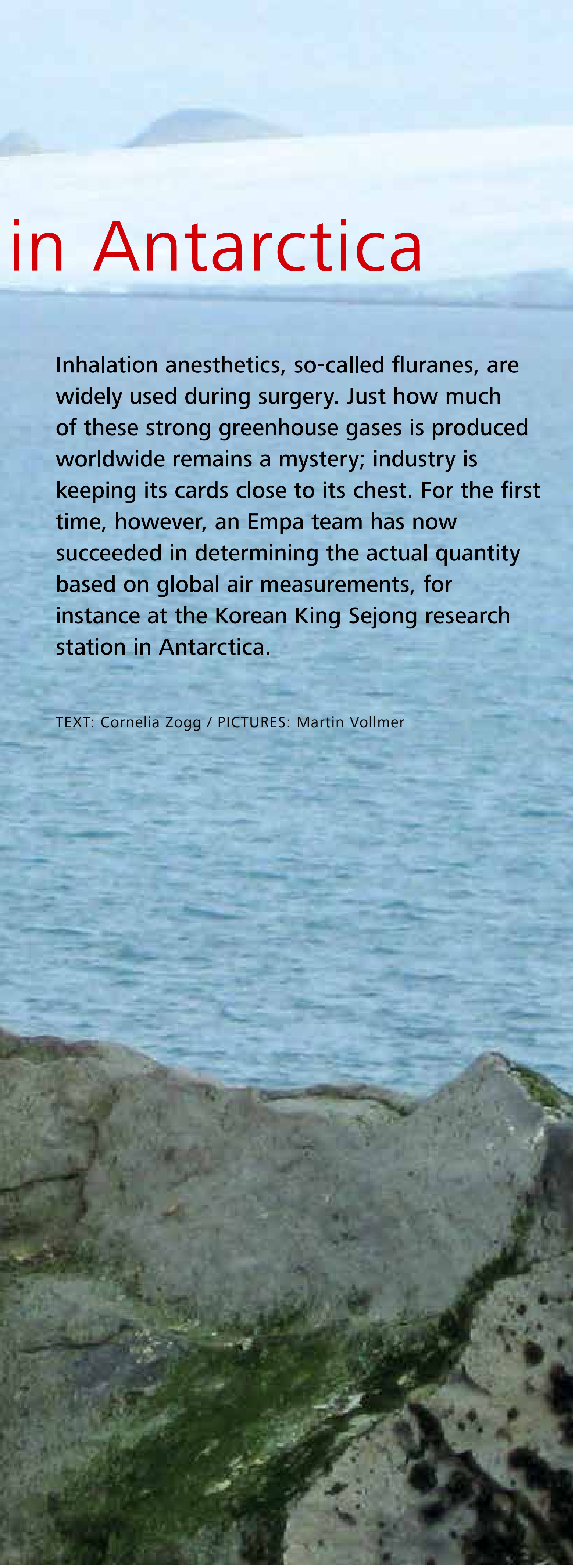
Anesthetics



in Antarctica

Inhalation anesthetics, so-called fluranes, are widely used during surgery. Just how much of these strong greenhouse gases is produced worldwide remains a mystery; industry is keeping its cards close to its chest. For the first time, however, an Empa team has now succeeded in determining the actual quantity based on global air measurements, for instance at the Korean King Sejong research station in Antarctica.

TEXT: Cornelia Zogg / PICTURES: Martin Vollmer

They are called desflurane, isoflurane and sevoflurane and put patients in a deep sleep while surgeons patch them back up again on the operating table. But fluranes also have a dark side: they considerably heat up the Earth's climate. As a greenhouse gas, desflurane is 2'500 times more potent than carbon dioxide, or CO_2, for instance. A global inventory would, therefore, be very much in the spirit of the Kyoto Protocol. However, this is proving more difficult than anticipated as industry is remaining tight-lipped. To date, only estimates are available, which were obtained using a bottom-up approach by projecting the consumption in hospitals the world over and deducing an approximate production quantity.

A team of Empa researchers headed by Martin Vollmer has now taken the opposite approach: top-down. They analyzed air samples from various stations in the global AGAGE measuring network (Advanced Global Atmospheric Gases Experiment, see map on p.14 – 15) for traces of inhalation anesthetics and used the results to calculate the global production quantity – which turned out to be equivalent to around three million tons of CO_2. While that might sound like a lot, says Vollmer, Switzerland's public transport system alone produces around three times as much every year. So a comparatively low amount of greenhouse gas actually gets into our atmosphere via operating theaters. Nonetheless, especially desflurane is thought to have an impact on the climate and, with a half-life of around 14 years, is extremely long-lived. By comparison, sevoflurane and isoflurane break down in only one to three years.

After two years gases show up at the south pole

Measurements in Antarctica also revealed that these substances reach the remotest regions of our planet. It takes the greenhouse gases around one to two years to make the journey to the poles. Atmospheric scientist Vollmer traveled to the Korean King Sejong research station in Antarctica already twice to carry out measurements, take probes and analyze the samples. As this is too time-consuming for long-term monitoring, however, Korean colleagues at the station regularly fill flasks with air and send them to Dübendorf.

>>

And Vollmer's team can also fall back on samples from an air archive for their analyses: Australian researchers have regularly been collecting air from the atmosphere and storing it for later studies since 1978.

But what is the next step now that effective statistics are available and we know that these substances are not just found in urban centers – i.e. where they are predominantly used – but travel to the ends of the Earth? Nobody can really agree, says Vollmer. Fluranes have already been produced since the 1980s, and even back then had their opponents and supporters. Although they are extremely strong greenhouse gases, their absolute amounts are so low that it hardly makes any difference in the big scheme of things. In contrast, they have no end of advantages for human and veterinary medicine. Vets use fluranes to anaesthetize livestock quickly and easily before castrating piglets, for instance, which is considerably more cost-effective than drugging one animal after another with injections. While cost plays a lesser role in human medicine, inhalation anesthetics is certainly more pleasant for the patients.

As for the threat of climate warming, however, the question remains as to whether more atmosphere-friendly alternatives can be developed. //

Prestigious EU grant for Swiss scientist

Climate physicist Hubertus Fischer from the University of Berne received one of the prestigious ERC Advanced Grants for his research on polar ice cores. Within the scope of the project "deepSLice" (Deciphering the greenhouse gas record in deepest ice using continuous sublimation extraction / laser spectrometry), his team is looking to develop a novel method to extract air from ice cores and a special analytical method to measure both greenhouse gas concentrations and carbon dioxide (CO_2) isotopes. During the project, Fischer will be supported by Lukas Emmenegger's team from Empa, which leads the way in the development and application of laser-spectroscopic methods for gas analytics in atmospheric research.

Laser-based gas analysis is extremely accurate and only requires very small quantities of gas – both of which will play a crucial role in the measurement of samples from an international ice core drilling project in the Antarctic that is scheduled for 2019/20. This should expand the history of greenhouse gases over the last 1.5 million years. To date, science has only been able to look 800'000 years into the past with the aid of ice cores. The European Research Council (ERC) has granted almost EUR 2.3 million for deepSLice over the next five years.