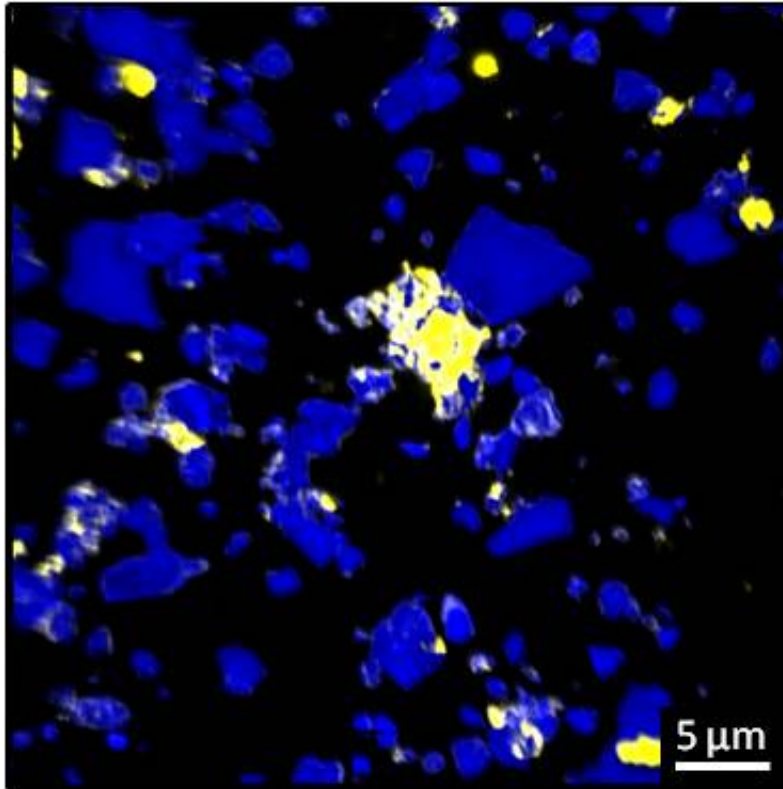


How does soil store CO₂?

January 8 2014



Carbon tends to bind to specific rough mineral surfaces, known as hot spots (yellow areas). Credit: C. Vogel/TUM

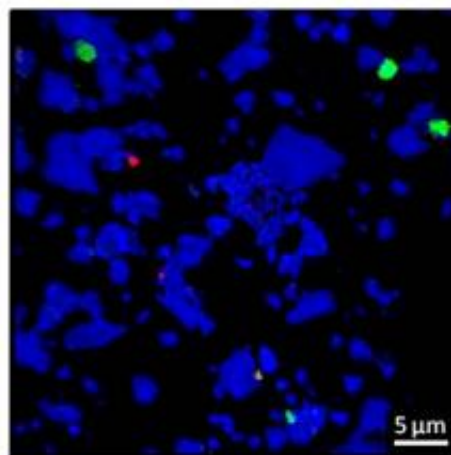
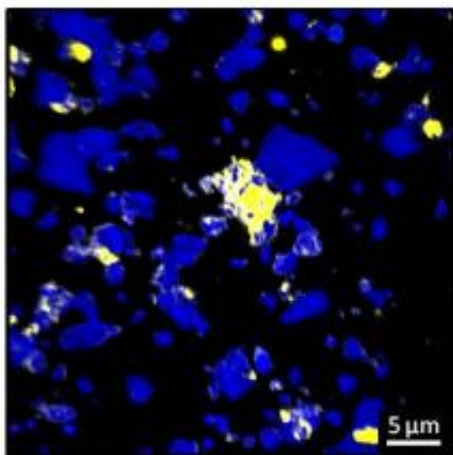
Global CO₂ emissions continue to rise—in 2012 alone, 35.7 billion tons of this greenhouse gas entered the atmosphere. Some of it is absorbed by the oceans, plants and soil. They provide a significant reservoir of carbon. Scientists have now discovered how organic carbon is stored in soil: The carbon only binds to certain soil structures. This means that

soil's capacity to absorb CO₂ needs to be re-assessed and incorporated into today's climate models.

Previous studies have established that carbon binds to tiny mineral particles. In this latest study, published in *Nature Communications*, researchers have shown that the surface of the minerals plays just as important a role as their size. "The carbon binds to minerals that are just a few thousandths of a millimeter in size – and it accumulates there almost exclusively on rough and angular surfaces," explains Prof. Ingrid Kögel-Knabner, TUM Chair of Soil Science.

The role of microorganisms in sequestering carbon

It is presumed that the rough mineral surfaces provide an attractive habitat for microbes. These convert the carbon and play a part in binding it to minerals. "We discovered veritable hot spots with a high proportion of carbon in the soil," relates Cordula Vogel, the lead author of the study. "Furthermore, new carbon binds to areas which already have a high carbon content."



Left: Mineral surfaces with all accumulations of carbon (yellow). Right: Mineral surfaces with new organic substance (green and magenta). Credit: C. Vogel/TUM

These carbon hot spots are, however, only found on around 20 percent of the mineral surfaces. It was previously assumed that carbon is evenly distributed in the soil. "Thanks to our study, we can now pin-point the soil that is especially good for sequestering CO₂," continues Kögel-Knabner. "The next step is to include these findings in [carbon cycle](#) models."

Mass spectrometer helps to visualize molecules

The sample material used by the team was loess, a fertile agricultural soil found in all parts of the world – which makes it a very important [carbon](#) store. The researchers were able to take ultra-precise measurements using the [NanoSIMS mass spectrometer](#). This procedure allowed them to view and compare even the most minute soil structures.

More information: "Submicron structures provide preferential spots for carbon and nitrogen sequestration in soils": Cordula Vogel, Carsten W. Müller, Carmen Höschen, Franz Buegger, Katja Heister, Stefanie Schulz, Michael Schloter & Ingrid Kögel-Knabner, *Nature Communications*, www.nature.com/ncomms/2014/140...full/ncomms3947.html.

Provided by Technical University Munich

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