Ocean crust could store many centuries of industrial carbon dioxide

December 4 2013

Researchers from the University of Southampton have identified regions beneath the oceans where the igneous rocks of the upper ocean crust could safely store very large volumes of carbon dioxide.

The burning of fossil fuels such as coal, oil, and natural gas has led to dramatically increasing concentrations of CO2 in the atmosphere causing climate change and ocean acidification. Although technologies are being developed to capture CO2 at major sources such as power stations, this will only avoid further warming if that CO2 is then safely locked away from the atmosphere for centuries.

PhD student Chiara Marieni, who is based at the National Oceanography Centre, Southampton, investigated the physical properties of CO2 to develop global maps of the ocean floor to estimate where CO2 can be safely stored.

At high pressures and low temperatures, such as those in the deep oceans, CO_2 occurs as a liquid that is denser than seawater. By estimating temperatures in the upper ocean crust, Chiara and her colleagues identified regions where it may be possible to stably store large volumes of CO_2 in the basalts. These fractured rocks have high proportions of open space, and over time may also react with the CO_2 so that it is locked into solid calcium carbonate, permanently preventing its release into the oceans or atmosphere. As a precaution, Chiara refined her locations to areas that have the additional protection of thick blankets of impermeable sediments to prevent gas escape.

They identified five potential regions in off-shore Australia, Japan, Siberia, South Africa and Bermuda, ranging in size from ½ million square kilometres to almost four million square kilometres.

Postgraduate researcher Chiara says: "We have found regions that have the potential to store decades to hundreds of years of industrial carbon dioxide emissions although the largest regions are far off shore. However, further work is needed in these regions to accurately measure local sediment conditions and sample the basalt beneath before this potential can be confirmed."

The new work, which is published in *Geophysical Research Letters*, shows that previous studies, which concentrated on the effect of pressure to liquefy the CO_2 but ignored temperature, have pointed to the wrong locations, where high temperatures mean that the CO_2 will have a low density, and thus be more likely to escape.

More information: "Geological storage of CO_2 within the oceanic crust by gravitational trapping" by Chiara Marieni, Timothy J. Henstock, and Damon A.H. Teagle is published in *Geophysical Research Letters* and can be viewed at: onlinelibrary.wiley.com/doi/10 … 013GL058220/abstract

Provided by University of Southampton