An Organogenic Model for Carbon Sequestration

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Increasing CO_2 emissions are causing climate change and ocean acidification with predicted severe consequences for ecosystems and for human society. A portfolio of strategies are being sought to mitigate emissions, including the storage of CO_2 within different parts of the geosphere. Although capture of CO_2 from large point sources is a practical option, most anthropogenic releases of CO_2 come from smaller, more widely-distributed sources that do not lend themselves to current capture technologies. Investigating methodologies that can remove CO_2 from the atmosphere may therefore play a crucial role in reducing overall anthropogenic CO_2 build up.

Under the terms of the Kyoto Protocol (now ratified by a majority of countries), signatories can meet part of their obligations to reduce greenhouse gas emissions from fossil fuel consumption by increasing land carbon sinks. However, there are serious concerns about the permanence of current carbon sinks (typically involving afforestation), and the accuracy with which carbon sequestration can be quantified and verified. A novel organogenic model for carbon sequestration in dolomite, based on natural systems and proven in laboratory experiments, is offered as a long-term option for large-scale carbon management. The model employs microbially-induced mineralisation with the potential for significant sequestration of atmospheric carbon and can satisfy the Kyoto criteria for permanence, quantification, verification and additionality.

The technique uniquely provides a low-energy technological solution for significantly reducing atmospheric CO_2 levels by mineral sequestration. It can be located where land is unsuitable for agriculture, and requires low levels of capital investment and maintenance costs. Model projections indicate annual sequestration of some 45 MT of atmospheric carbon with sufficient engineered systems, while initial rates of dolomite precipitation achieved in the laboratory indicate that this can be increased by at least an order of magnitude.

Multiphase Palaeochannel Development on the Great Barrier Reef Shelf, Australia

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Multiple paleochannel systems across the Great Barrier Reef Shelf have long been recognised and several studies conducted that showed channel width and depth and have been assigned to modern fluvial systems. In most cases, simple cross-section have been presented and interpreted to be the result of the sea level lowstand during the last glacial maximum. This despite the fact that channel tracking, for example of the Paleo-Burdekin River Channel, has been proven to be difficult because of several "branches" that apparently developed in the mid and outer shelf area.

Here we present a high-resolution analysis of a short section (1 km x 1 km) of the Paleo-Burdekin River system in the mid shelf area that illustrates that both erosional as well as infilling structures are complex and are the result of multi-phase channel development rather than from the last glacial lowstand only. This is in contrast to most published work but in agreement with studies from the Fraser River Paleochannel system. The analysis shows that several erosional features can be depicted based on seismic analysis. The sedimentary structures also demonstrate that the infilling of the channel features was complex.

In addition, we show new evidence of the shelf edge Paleo-Burdekin River system that exceeded well our expectations of magnitude of the "delta" system. The size illustrates that during the lowstand, significant erosion and deposition must have occurred along the shelf slope as a result of the River system discarding directly onto the shelf slope.