A natural analogue study for geosequestration, Kapuni Field, Taranaki Basin

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New Zealand petroleum reservoirs may provide an option for geosequestration of anthropogenic CO_2 in relation to reducing NZs greenhouse gas emissions. However, little is known about the potential effects of CO_2 on New Zealand reservoir rock. The presence of naturally high-CO_2 porefluids in parts of the Kapuni Group, onshore Taranaki, provides an opportunity to study a natural analogue for the geosequestration process.

Ongoing research at GNS uses integrated petrographic and basin modeling techniques to assess the influence of CO_2 on rock texture and composition. Preliminary results demonstrate clear differences in the abundance of authigenic minerals in samples from CO_2-rich wells compared to relatively CO_2-poor wells. Sandstones from the Kapuni Field (containing c. 40-45% CO2) contain extremely high volumes of authigenic kaolinite. These clays are thought to have formed by reaction of detrital feldspars and authigenic chlorite with CO_2. Minor carbon has been fixed as iron-rich carbonates. Samples from other wells in the Taranaki Basin (mostly <6% CO_2) display much lower kaolinite volumes but locally more abundant illite and authigenic quartz.

It is clear from the results that CO_2-rich pore-fluids have affected rock texture and composition. Reactions are most advanced in the Kapuni Field, probably due to the high present-day %CO_2. Current work at GNS is focussed on understanding the timing of CO_2-charge and resident time necessary for reaction through integration of the petrographical data with fluid inclusion data, K-Ar dating techniques and burial modelling.

Work of this kind has not previously been undertaken in New Zealand, yet there are several hydrocarbon fields with depleting reserves (e.g. Maui Field), that may provide a suitable sink for CO_2. This research is therefore fundamental in the investigation of geosequestration in New Zealand and may ultimately help to reduce levels of atmospheric greenhouse gas.

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