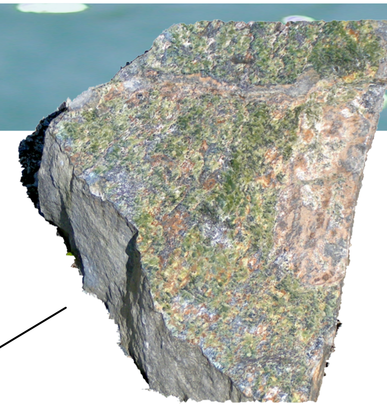
# Mineral Carbon Dioxide Sequestration: Still a Viable Option

Sam Krevor
The Center for Carbon Management
Columbia University
www.ccm.columbia.edu

## What?

$CO_2$

$MgCO_3$



Magnesium Silicate

## Why?

Mineral carbonation offers the opportunity for:

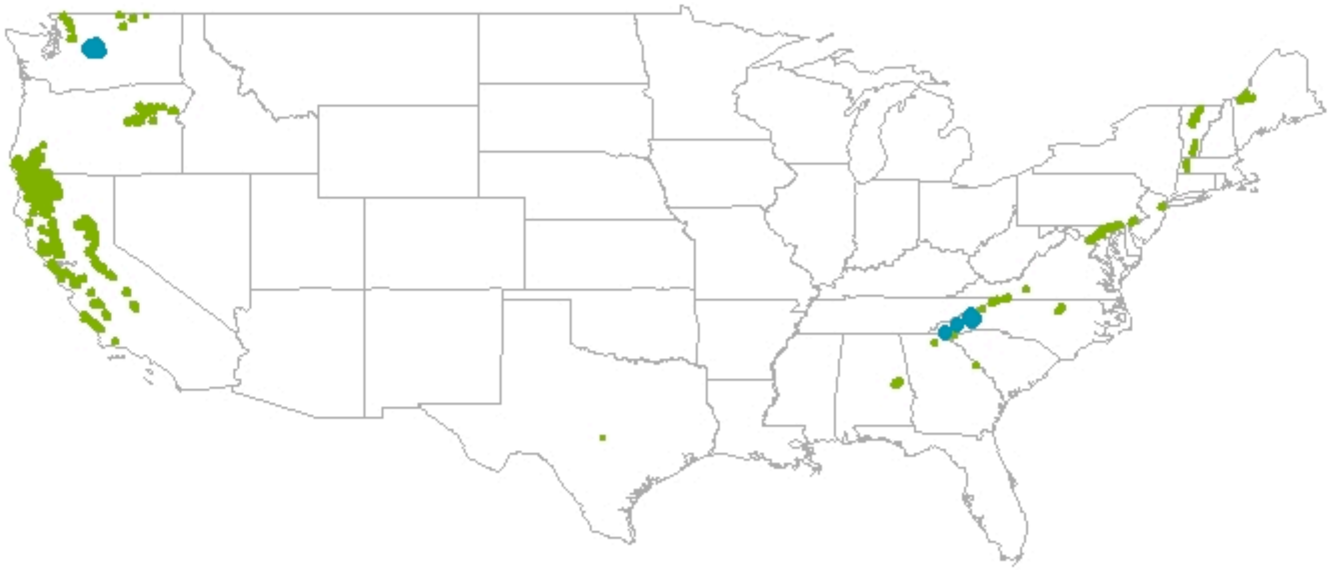
1. Virtually unlimited storage capacity for $CO_2$
2. Permanent storage as solids over geological timescales
3. Simple and cheap verification of emissions reduced

# Cost

Olivine[1] - \$80/ton $CO_2$

# Cost

The technology is more broadly applicable if serpentinites are considered in addition to olivine



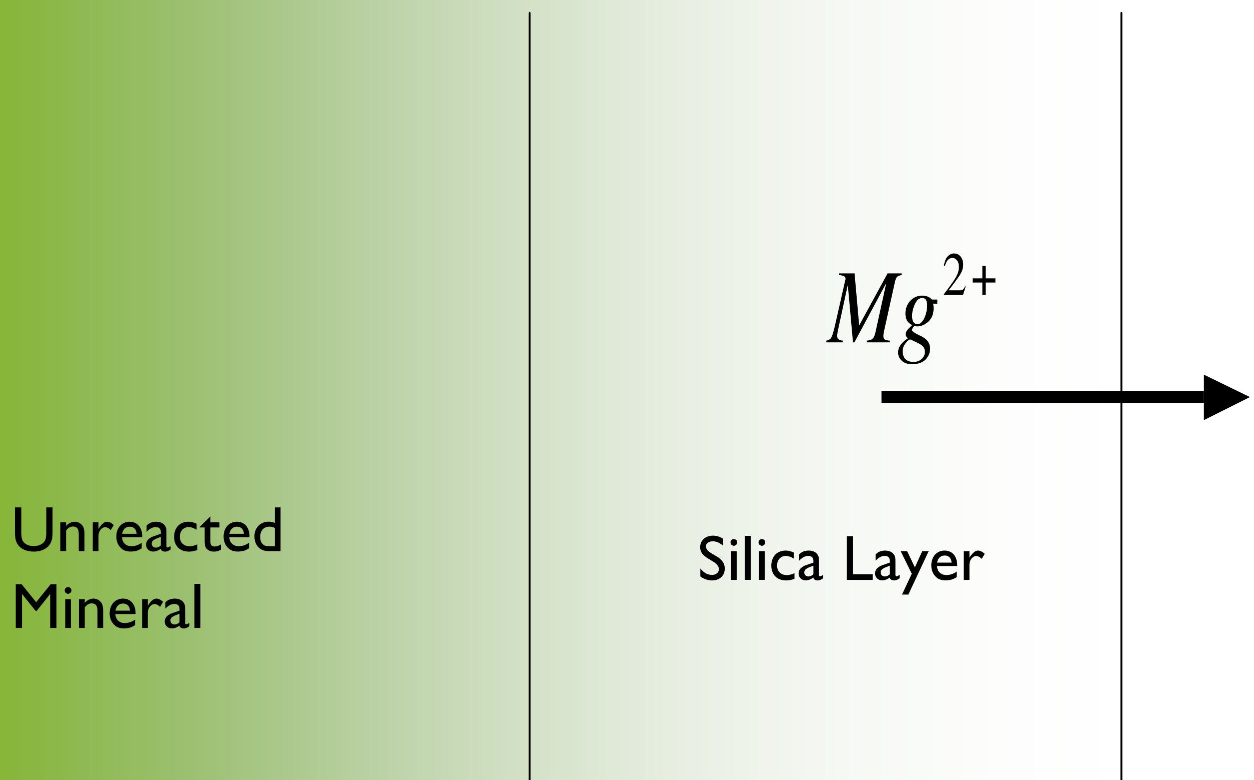
Olivine[1]- \$80/ton $CO_2$
Serpentine[2]- \$110/ton $CO_2$

# Cost

The cost of industrial rate mineral carbonation can be significantly reduced for olivine and serpentinites if we can efficiently dissolve the minerals in a weakly acidic environment.

Ideal Scenario:
- No Energy Input
- No Loss of Chemicals

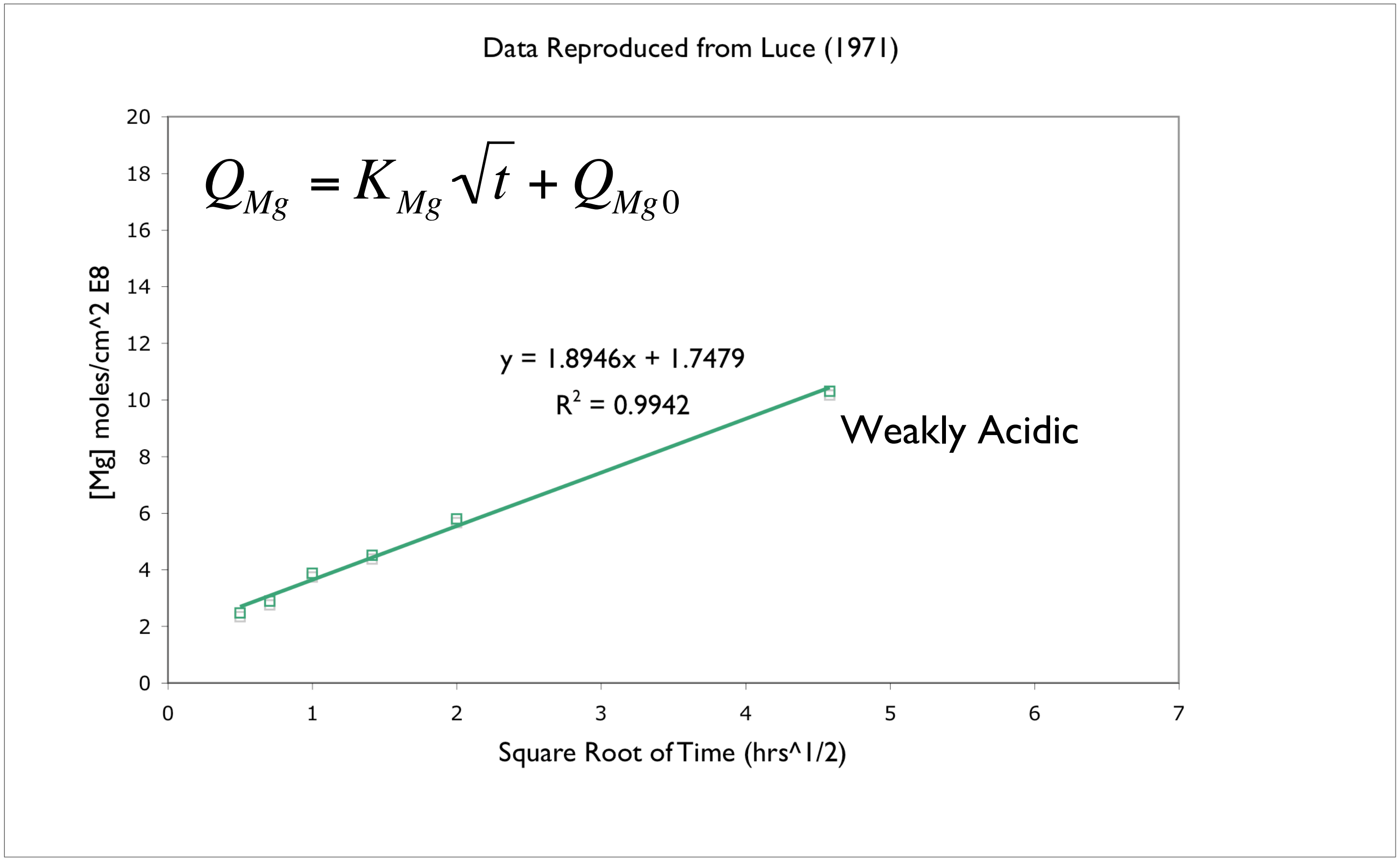
The dissolution of the minerals is limited by the diffusion of magnesium through a magnesium deficient silica layer[3,4]




$$Q_{Mg} = K_{Mg}\sqrt{t} + Q_{Mg0}$$ [3]

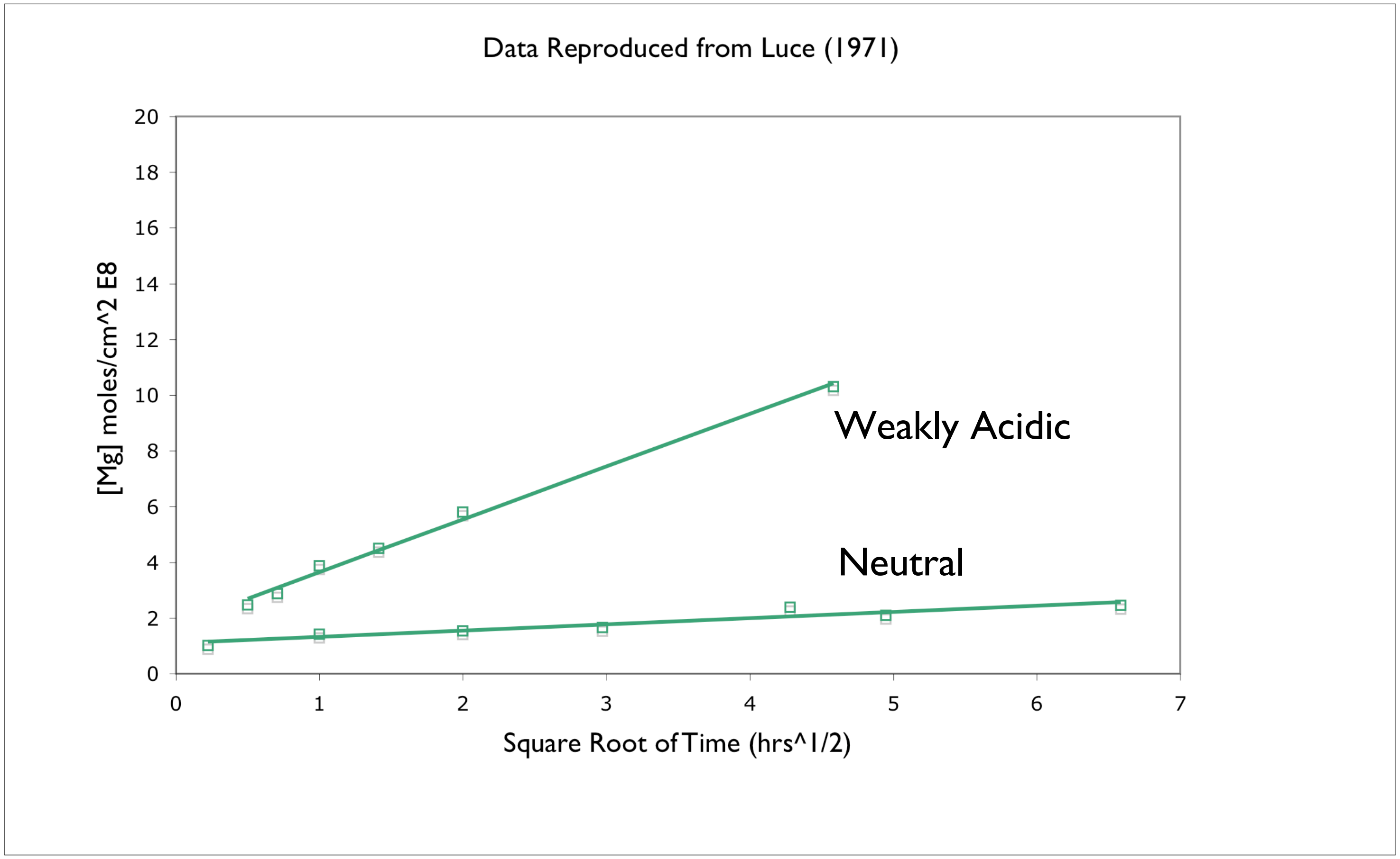
# Reaction

Past and current geochemical studies give us the tools by which to measure our progress



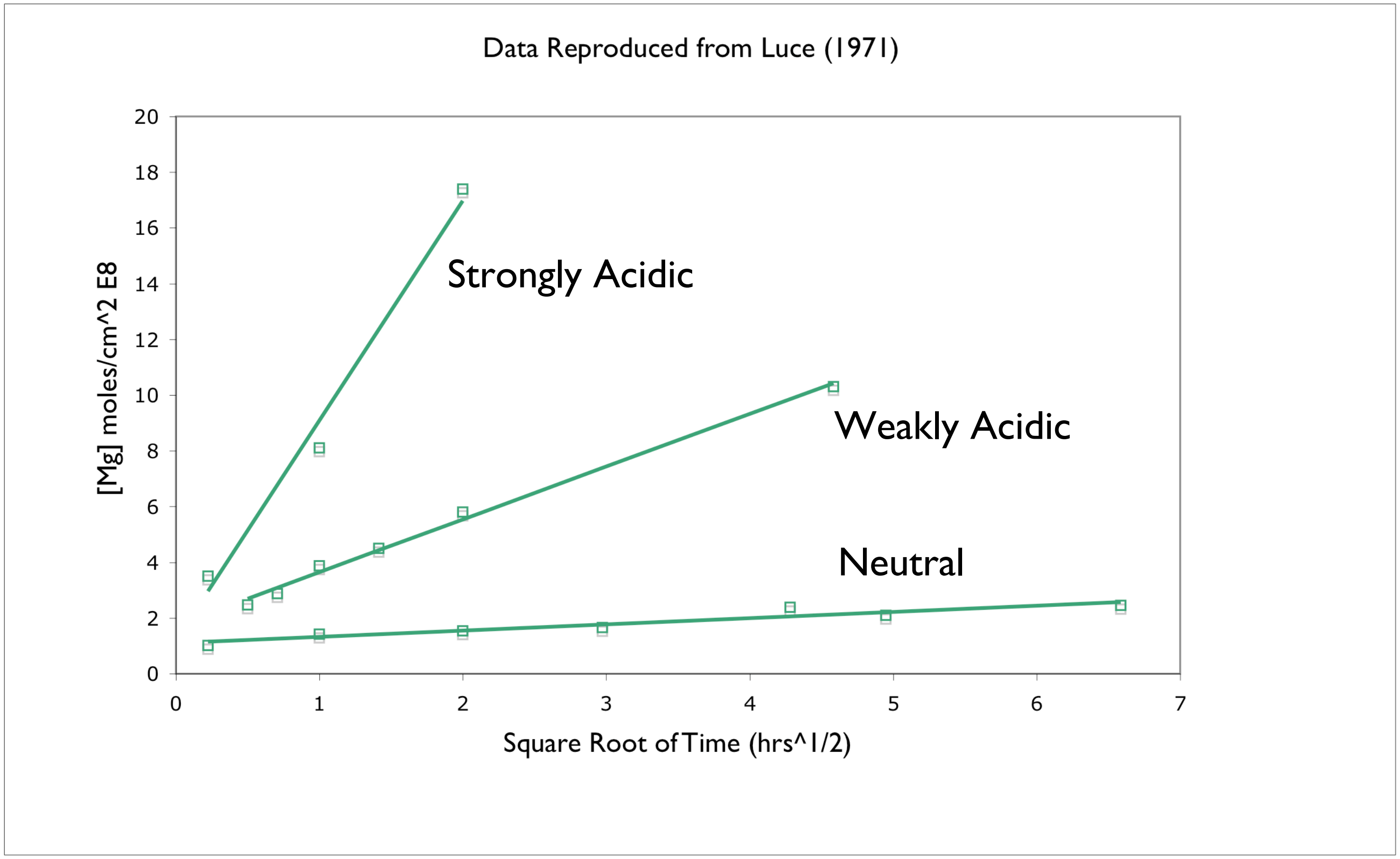
# Reaction

Using these tools, past and current geochemical studies give us clues as to which chemical pathways should be explored



# Reaction

Using these tools, past and current geochemical studies give us clues as to which chemical pathways should be explored



# Conclusions

•Benefits of mineral carbon sequestration make it too valuable of a technology to ignore

•Past and current experimental evidence suggests that a low cost chemical pathway is possible

•Mathematical tools allow us to be systematic in our experimental program

•There is a large parameter space for success

# References


1. O'Connor, W.K., Dahlin, D.C., Rush, G.E., Gerdemann, S.J., Penner, L.R., *Energy and Economic Evaluation of Ex-Situ Aqueous Mineral Carbonation* Albany Research Center, Office of Fossil Energy, US DOE
2. Newall, P.S., Clarke, S.J., haywood, H.M., Scholes, H., Clarke, N.R., King, P.A., Barley, R.W., 2000: *$CO_2$ Storage as carbonate minerals*, report PH3/17 for IEA Greenhouse Gas R&D Programme, CSMA Consultants Ltd, Cornwall, UK
3. Luce, R.W., R.W. Bartlett, G.A. Parks (1971) *Dissolution Kinetics of Magnesium Silicates* Geochim. et Cosmochim. Acta, 1972, Vol. 36. pp 35-50
4. Chizmeshya, A.V.G., M.J. McKelvy, R.W. Carpenter, D.A. Gormley (2003) *Enhancing the Atomic-Level Understanding of $CO_2$ Mineral Sequestration Mechanisms Via Advanced Computational Modeling* Technical Progress Report http://www.osti.gov/dublincore/ecd/servlets/purl/791496-ikGDY6/native/791496.pdf