

Natural Resources Committee

4/30/08

7:30 a.m.

GFCC Conference Room

Attendance: Tom Bundtzen, chair; Cal Skaugstad; Gale Skaugstad; Paul Metz; Richard Hughes; Roger Burggraf; Bill Brophy; Jason Turner; Kathryn Arlen; Bud Fate; Joe Fields; Cassie Pinkel; Rick Solie; and Michelle Gibson.

1. Call to Order: Tom Bundtzen called the meeting to order at 7:30 a.m.
2. Roll call.
3. Approval of 4/16/08 Minutes: Motion to approve: Bill Brophy; second: Roger Burggraf; approved: yes.
4. Old Business
 - a. On this past Monday, the Board passed the Natural Resources Committee Resolution opposing the Anti-Mining ballot initiatives—it emphasized two initiatives of particular concern, and there are other initiatives out there.
5. Program: Permanent Carbon Dioxide Sequestration in Mafic Volcanic rocks by Paul Metz, Director Mineral Industry Research Laboratory UAF
 - a. Talk about methods by which we can mitigate the amount of carbon dioxide in the atmosphere, which is a geologic problem
 - b. What is Sequestration?
 - i. Removal of carbon dioxide emissions caused by the oxidation (burning) of carbon compounds from the atmosphere
 - ii. Climate change including global warming has been purported to be the result of the greenhouse gas effect caused primarily by anthropogenic CO₂ emissions
 - iii. Alternative methods of solving the perceived problem
 1. Largest source of carbon for combustion is coal—over half of us coal resources in Alaska.
 - c. Alternative methods of CO₂ emissions control
 - i. Stop or reduce the burning of carbon based fuels—major impact on transportation and power generating industries and the world economy
 - ii. Do nothing and let natural sequestration solve the issue—not politically correct.
 - iii. Temporarily store emissions from stationary power sources in subsurface reservoirs such as oil and gas fields
 - d. Review do nothing alternative
 - i. Case of the missing CO₂
 - ii. Current worldwide annual emissions of CO₂ are 8 billion metric tons but only 3 billion metric tons remains in the atmosphere – natural carbon cycle at least 100 billion tons annually.
 - iii. Natural sequestration in plants, ocean water, marine organisms, soils.
 - iv. Where else ???
 - v. General Circulation Models (GCM) only predict the natural sequestration of ½ of the anthropogenic CO₂ generated since the beginning of the industrial revolution – 1850.

e. Crustal Abundance of Major Elements

i.	Rank	Element	Symbol	Wt. %
ii.	1.	Oxygen	O	46.71
iii.	2.	Silicon	Si	27.69
iv.	3.	Aluminum	Al	8.07
v.	4.	Iron	Fe	5.05
vi.	5.	Calcium	Ca	3.65
vii.	6.	Sodium	Na	2.75
viii.	7.	Potassium	K	2.58
ix.	8.	Magnesium	Mg	2.08
x.	9.	Titanium	Ti	0.62
xi.	10.	Hydrogen	H	0.14
xii.	11.	Phosphorous	P	0.13
xiii.	12.	Carbon	C	0.094

f. Bowen's Reaction series show how rocks crystallize—this diagram indicates that a very large amount of material that forms the earth's crust at high temps and pressures, and chemistry of rocks change as magma cools down important in degradation of those rocks. Important with respect to buffering and controlling amount of in atmosphere

g. Geological reservoirs of carbon

- i. Petroleum and natural gas fields
- ii. Coal
- iii. Ocean water and marine organisms
- iv. Fresh water – surface and subsurface
- v. Soils – organic horizons
- vi. LIMESTONE – CaCO_3 12% by weight C
- vii. Other rocks containing the mineral calcite – CaCO_3 including other sedimentary rocks, igneous rocks, and metamorphic rocks.
- viii. More than 5/7 of the Earth crust is mafic volcanic rocks capable of storing trillions of tons of carbon as calcite.
- ix. In the process of storing CO_2 in mafic rocks we may also recover copper minerals from the basalts.

h. Distribution of Carbon in the Earth's Crust

- i. Independent estimation for the above average crustal abundance of carbon (0.094 wt.%).
- ii. Sedimentary rocks are approximately 5 percent of the mass of the crust.
- iii. Limestone constitutes approximately 22 percent of the sedimentary rock record.
- iv. Thus limestone constitutes 1.1 % of the mass o the crust.
- v. Limestone on is 12 wt. % carbon
- vi. Thus limestone accounts for most of the carbon in the Earth's crust.

i. Immediate need for sequestration – political and economic

- i. Decreasing domestic petroleum production – currently 8.5 million barrels per day and decreasing at 500,000 bpd per year.
- ii. Current consumption 22 + million barrels per day.
- iii. In a decade, U.S. nearly totally dependent on imported oil
- iv. Effect on international relations, defense, balance of payments, and value of the dollar.
- v. Alternatively U.S. has abundant coal supply.

- vi. If all energy consumption in U.S. could be converted to coal Alaska could supply U.S. total energy demand for at least 1000 YEARS (Alaska Resource Est. 5.5 trillion tons).
- vii. Conversion of coal to liquid fuels is currently technically feasible and the CO₂ production can be sequestered.
- j. Current Demonstration Projects
 - i. Big Sky Carbon Sequestration Regional Partnership Project – Columbia River Plateau Basalts
 - ii. National Thermal Power Corporation of India Project - Deccan Traps (NW India)
 - iii. Work over last decade funded by DOE looked at reaction of CO₂ with rocks like mafic volcanic rocks at the Pacific Northwest national lab—at high temperatures and high pressure, calcium and magnesium will react spontaneously in atmosphere and produce new minerals—better to design a system to mimic and use the natural process to sequester.
- k. Objectives and Significance
 - i. Evaluation of Basalt formation in India (Deccan Trap) for environmentally safe and irreversible long term storage of CO₂
- l. The Indian study will establish globally basalt formation as potential storage for CO₂ by leveraging study carried out in Columbia River basalt group under U. S. DOE
- m. Large amounts of basalt on the continent—
- n. Why are basalts an attractive proposition?
 - i. Storage potential in Basalts
 - 1. Indian Deccan Volcanic Province (DVP) is one of the largest terrestrial flood basalt formations covering nearly 500,000 sq. km
- o. CO₂ storage in formations
 - i. Injected in sedimentary rocks above its supercritical temperature and pressure
 - 1. Minimum Depth is 800 m
 - a. Hydrodynamic Trapping
 - b. Solubility Trapping
 - c. Mineralization
- p. In atmosphere process goes on slowly, and would disappear naturally over 100 years. Reaction rates are rapid with artificial sequestration.
- q. Alternative is developing chambers in volcanic rocks in which to inject CO₂ using the same concepts as storing natural gas. Storage volume level, the CO₂ and the entire gas stream could easily be injected into a larger volume, and react with rock in the chamber, and the rest of the compressed gas is available to turn a turbine at the surface. Gives off heat when it reacts with mafic volcanic rock—can recover heat in the process of utilizing pumped storage gas. Producing geothermal energy that we can recover from this reaction process.
- r. Joint UAF/MTU Proposed Site Investigations
 - i. Rampart Group Volcanics along Dalton Highway – Hess Creek to Yukon River.
 - ii. Nikolai Greenstone along Richardson Highway – Paxson to Copper River Basin.

- iii. Keweenaw Copper Belt – Copper Harbor to White Pine, Michigan (100 miles of strike length and past copper production of over eight billion pounds) Major underground workings near existing coal-fired power plant (see mine location map).

End of Meeting.

Respectfully submitted,

Michelle B. Gibson