



Four Corners Geological Society Newsletter

January 2012



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JANUARY MEETING - CHARACTERIZING COAL FIRES

SPEAKER: Dr. Taku Ide, Stanford University
DATE/TIME: Thursday, January 19, 2012 Dinner at 6pm, Speaker at 7pm
LOCATION: Farmington Inn & Suites (formerly the Best Western Hotel), 700 Scott Avenue, Farmington, NM - see map on Page 2
COST: \$20 per person w/dinner (Students Free); \$2 per person for talk only
RSVP by 1/16 to: Dave Johnson, 505-324-6169 or David.Johnson@conocophillips.com

ABSTRACT: Underground coal fires pose environmental, social, health, and economic hazards. They can be significant sources of CO₂ emission, toxic fumes such as aromatics, carbon monoxide, and hydrogen sulfide, and cause surface subsidence as coal in the ground is consumed and the overburden collapses. These fires are world-wide occurrences, and they have been documented in the U.S., India, China, Indonesia, Australia, and South Africa, among other coal-bearing countries. Many coal fires burn persistently over time scales of many years to decades, despite efforts to control them.

In this project, results of field-based research at a subsurface coal fire, known as the North Coalbed Fire (NCF) near Durango, CO, on the Southern Ute Indian Reservation are used to delineate the life cycle of a natural coal fire. Field measurements include mapping of surface fissures that could act as oxygen influx points, delineation of combustion zone boundaries (subsurface temperature, surface snow melt, surface deformation, and magnetometer data), and measuring properties of the gases being emitted at the site (gas composition, d¹³C isotope signatures). One of the phenomena observed at the NCF - which is also commonly observed at other coal fires around the world - was the formation of fissures above the burning and previously burned areas. Numerical simulations were formulated and employed to describe the relationship between fissure locations and apertures and the magnitude of the collapse in the subsurface. Based on these measurements and simulations, detailed conceptual pictures of the NCF were created, and a CO₂ pilot injection test was designed and conducted at this site to determine

whether the combustion zone could be flooded by injecting CO₂ through wells that were drilled near the combustion zone.

Results of this pilot project demonstrated that (1) air required to support continued combustion flows through a zone of fractured rock that forms where coal has burned previously, (2) the primary driving force for air flow is the density-driven flow of hot combustion product gases through surface fissures that form as a result of subsidence as the coal burns, and (3) CO₂ injected into the air flow zone is drawn by the density-driven flow into the combustion zone, replacing a portion of the air flow that sustains combustion. The pilot test results suggest that a CO₂ injection scheme can be designed to control these fires if sufficient CO₂ (or other inert gas) is available to reduce the oxygen flow to the combustion zone below levels required to support continued combustion, and if the combustion region can be cooled sufficiently to prevent resumption of the air flow when injection ceases. Three independent methods provided consistent estimates of the rates of coal consumption, CO₂ emission, and the amount of air required to sustain subsurface combustion reactions. These estimates in turn, helped determine how much inert gas must be injected to overwhelm the combustion zone with the injected gas. The mass flow rate of inert gas required was approximately 100 kg/min. The duration of the injection period was estimated to be on the order of a year in order to cool the rocks so that the potential for reignition can be minimized. This result was derived using first-order calculations and a flow simulation model.

► What's New

- New CD of all 1952-1997 FCGS Publications now available for sale
- Thanks to all who renewed their membership!
- RMAG Job Bank now open (p. 3)
- WANTED: FCGS River Trip Committee Volunteers (p. 4)

SPEAKER'S BIOGRAPHY - Dr. Taku Ide

Taku Ide completed his Ph.D. in the Department of Petroleum Engineering (now Energy Resources and Engineering) at Stanford University. Prior to his current degree, he obtained both his M.S. (2006) and B.S. (2004) from Stanford, in Petroleum Engineering and Chemical Engineering, respectively.

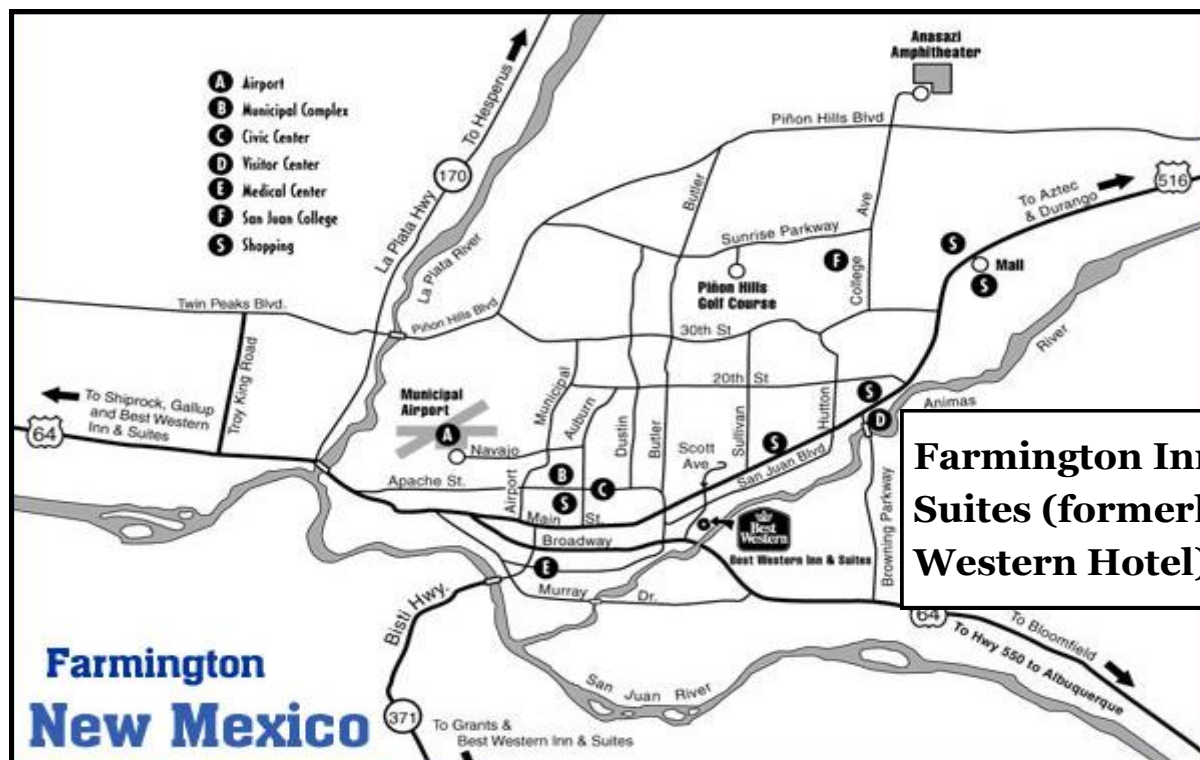
Taku studied underground coal fires in Colorado, U.S., for his Ph.D. project, and he specializes in integrating geology, geophysics measurements, geomechanic simulations, fluid-flow analysis, and coal combustion theory to characterized coal fires. During his program at Stanford, he applied his characterization methods at three separate

fires. He has received recognition from the international Society of Petroleum Engineers (SPE) and the Department of Energy Resources and Engineering at Stanford for his work on coal fires.

Upon graduating from Stanford, Taku launched a venture, Koveva, to apply his characterization techniques to coal fires around the world. He currently works closely with the state of Colorado as well as the Xinjiang Coal Institute in Urumqi, China.

Many thanks to Taku for offering to present this highly relevant talk to the FCGS membership.

► ► ► MONTHLY MEETING LOCATION MAP



Farmington Inn and Suites (formerly Best Western Hotel)

If there are any postings or announcements that you would like included in the FCGS Newsletter, please send the information to pleschak@blm.gov.

2011 – 2012 Future Meetings & Upcoming Events

January 19, 2012 Thursday
FCGS Monthly Meeting Farmington
Taku Ide, Characterizing Coal Fires

February 9, 2012 Thursday
FCGS Monthly Mtg, Durango, Vallecito Rm
Lynn Orr, Transforming Energy

March 15, 2012 Thursday
FCGS Monthly Mtg, Durango, Vallecito Rm
Bob Krantz, Fracture Modeling and
Permeability Prediction, Clair Field, UK

April 19, 2012 Thursday
FCGS Monthly Meeting Durango
Fort Lewis College Senior Theses

May 17, 2012 Thursday
FCGS Monthly Meeting Farmington
Speaker & Topic TBA

*NOTE: Monthly meetings will be held at
the normal locations (Fort Lewis College
Student Union or Best Western Hotel in
Farmington) unless otherwise specified.*



The RMAG Job Bank is now open!

*RMAG Members can post their company
job listings or search for employment
opportunities at [www.rmag.org/i4a/
pages/index.cfm?pageid=3332](http://www.rmag.org/i4a/pages/index.cfm?pageid=3332)*



"Prez Sez" by Zack Swaney

Hello All,

Happy New Year to all FCGS membership, friends, and family! We hope your holidays were happy, warm, and safe. The coming year is looking to be a great one for the society. We've had a great response to the membership renewal drive, our recent meetings have had great turnout, and we have more great speakers scheduled for the coming months. For January, we have Dr. Taku Ide coming to speak to us about his efforts in understanding and controlling the North Coalbed Fire near Durango. We look forward to hosting Dr. Ide.

A great thanks is owed to John Mercier of the BHP mine for his talk last month. Turnout was fantastic, in no small measure due to the many folks from BHP who came to see the talk. We hope we continue to see the level of turnout we've had over the last couple of meetings.

We would also like to put out a call for volunteers for a river trip planning committee. We think it's high-time we got the FCGS back on the river! If any of you are interested in participating in the planning of the river trip, please contact me at zack.a.swaney@conocophillips.com.

See you at this month's meeting! -- Zack



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2011-2012 Four Corners Geological Society Officers

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Editor: Pam Leschak, Bureau of Land Management
(970) 385-1342, pleschak@blm.gov

COLORADO-AIPG: Denver - Jan. 17, 2012 (Tuesday, Noon), Monthly Meeting - Dr. Jennifer Miskimins - "Hydraulic Fracturing 101: What is it? Why do we do it? And what work is going on at Mines?" (for info & RSVP contact Steve Sonnenberg, sasonnenbg@aol.com or 303-895-7663 by Jan. 13)

SME COLORADO SECTION: Denver - Jan. 19, 2012 (Thursday, Dinner), Monthly Meeting - Mr. Red Conger - "Production Growth Update at Freeport-McMoran Copper & Gold" (for info & RSVP contact Cathy Begej, CathyBegejSME@gmail.com, 720-889-6112 by Jan. 16).

RMAG-PTTC ONE DAY COURSE: Denver - Jan 23, 2012 (Monday), Dr. Nick Harris - "Source Rocks 101" (http://www.rmag.org/i4a/ams/amsstore/category.cfm?category_id=13).

ALBUQUERQUE PETROLEUM ASSOCIATION: Albuquerque, NM - Jan. 23, 2012 (Monday, Noon) Monthly Meeting - Carol Cochran & Bobby Stover - "Tax Planning Opportunities for the Independent Producer" (for more information & RSVP contact Katherine Smith, (505) 998-3401, ksmith@redw.com).

PASTE & THICKENED TAILINGS TRAINING COURSE: presented by Paterson & Cooke in Golden, CO - Jan. 31-Feb. 3, 2012 (http://www.patersoncooke.com/services/courses/PTT_Brochure2012.pdf).

ALBUQUERQUE GEOLOGICAL SOCIETY: Albuquerque, NM - Feb. 1, 2012 (Wednesday, Noon) Monthly Meeting - Wolf Elston & Eric Tegtmeier - "From submicroscopic to planetary: are micron-scale ZrO₂-ArSO₄ intergrowths the smoking gun evidence for mega-impact origin of the 2,055 Ma Bushveld Complex, South Africa, world's major source of platinum, chromium, and vanadium?" (RSVP/Info to William Turner, (505) 843-7643 or wturner@waterbank.com).

MINERAL & ENERGY ECONOMY IN COLORADO LEGISLATIVE RECEPTION: Denver - February 21, 2012 (Tuesday, 5pm) (www.aipgcolorado.com or contact Larry Cerrillo at 303-674-6484 or cerrillo1@mindspring.com).

ALBUQUERQUE PETROLEUM ASSOCIATION: Albuquerque, NM - Feb. 27, 2012 (Monday, Noon) Monthly Meeting (RSVP/Info to Katherine Smith, (505) 998-3401, ksmith@redw.com).

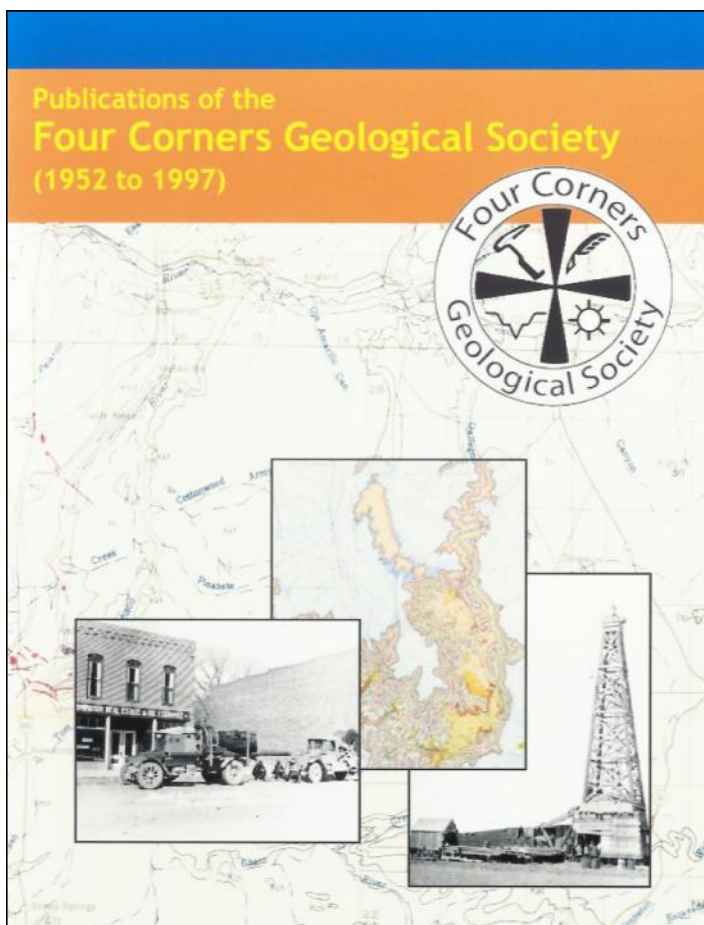
Advertising Rates for the FCGS Newsletter

Full Page (7.5" x 9.5")	\$100/month or \$1,000/yr
Half Page (7.5"x 4.5")	\$50/month or \$500/yr
Quarter Page (3.5" x 4.5")	\$25/month or \$250/yr
Business Card (3.5" x 2")	\$10/month or \$100/yr
Odd Sizes	\$3.50 per column inch per month (\$10 min.)

For more information, please contact the FCGS Treasurer, Tom Staatz at (505) 215-2908. Proceeds will go toward the further development of the Society (i.e. offset meeting costs, publication, etc.)

ATTENTION MEMBERS

- 2012 FCGS membership renewal applications were mailed to all members last month. Payment for 2012 is now past due. Be sure to renew your membership now and perhaps (???) avoid those pesky late payment fees!
- Volunteers are needed for the FCGS River Trip Committee! Contact Zack Swaney at zack.a.swaney@conocophillips.com or (505) 326-9727 if you can help out.



**NEW FCGS PUBLICATION!!
CD now available for all FCGS
publications from 1952-1997,
including all
OUT OF PRINT Volumes!!
Cost is only \$115
Order online from our website**

Publications of the
Four Corners Geological Society
(1952 to 1997)

This disc product contains the published works of the Four Corners Geological Society (FCGS) since 1952. The collection includes symposia, field trip guidebooks, and special topics. The emphasis of their publishing program is geology as it relates to the exploration of oil and natural gas: 20 publications in all, through 1997.

TABLE OF CONTENTS

1. Geological Symposium of the Four Corners Region (1952)
2. Geology of parts of Paradox, Black Mesa, & San Juan Basins, Four Corners field conference (1955)
3. Geology of southwestern San Juan Basin, second field conference (1957)
4. Isopachous relations and probable warping during Late Pennsylvanian time in the Aneth area, San Juan County, Utah: Bulletin No. 1 (1959)
5. Geology of the Paradox Basin fold and fault belt, third field conference (1960)
6. Shelf carbonates of the Paradox basin, fourth field conference (1963)
7. Durango-Silverton guidebook (1964)
8. Field trip road log: northeastern Paradox Basin salt anticline area (1967)
9. Geology and natural history of the Powell Centennial River Expedition [Grand Canyon], fifth field conference (1969)
10. Geology of Canyonlands and Cataract canyon, Cataract Canyon river expedition, sixth field conference (1971)
11. Cretaceous and Tertiary rocks of the southern Colorado Plateau: Memoir (1973)
12. Geology of the canyons of the San Juan River: A river runner's guide, seventh field conference (1973)
13. Canyonlands country, eighth field conference (1975)
14. Oil and gas fields of the Four Corners area, Volume 1 (1978)
15. Oil and gas fields of the Four Corners area, Volume 2 (1978)
16. Permian: A field symposium, ninth field conference (1979)
17. Oil and gas fields of the Four Corners area, Volume 3 (1983)
18. Paleotectonics — San Juan Mountain, Dolores Formation — Paleosols and depositional systems, Jurassic depositional systems -San Juan Basin, Quaternary deposits and soils — Durango area [field trip guidebook] (1984)



Four Corners Geological Society

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