

Coal Seam Gas and a Warming World



A new broom has swept through the Australian political scene with the election of the Rudd Labor Government in November 2007. Part of the Rudd election strategy included a strong appeal to the green and concerned liberal vote. One of the new government's first acts was to sign the Kyoto Agreement, which deals with greenhouse gas emission targets. During the campaign, the previous government was portrayed (negatively) as climate change skeptics who were out of

touch with the concerns of ordinary Australians and still reeling from a long El Nino inspired drought. The new incumbents are now in a position where the electorate expects action on climate change.

Consequently, Australia's major emitters of greenhouse gases, including our #1 export earner, the coal industry, are currently dealing with the complex and potentially sobering prospect of a carbon tax. The government has drafted a proposal labeled "National Greenhouse and Energy Reporting Determination," that will force the miners to pay a penalty for the gas released during coal mining. This has spawned interest in better defining the volume of gas contained in the mine leases and the timing of the potential gas emissions. A credible expert is needed in this area to perform these assessments in an objective and scientific manner. This is where the Norwest Team comes in.

As a greenhouse gas, one tonne of methane has the same impact as 21 tonnes of carbon dioxide. Most of the gas in Australian coals is methane. Australian coal mining has been dealing with this gas as a safety hazard for years and has an excellent track record for

by Scott Thomson

degasification ahead of mining. In fact, degasification ahead of mining has been exported internationally and the global underground coal mine drilling and drainage scene looks more or less the same whether you are in an underground mine in Morgantown, WV, or in Wollongong, NSW, or Jincheng, China for that matter.

Of immediate consequence, is the fact that all methane gas released to render mines safe ends up in the atmosphere causing a major concern in the global battle to reduce greenhouse gas emissions. In addition, it is not enough for the underground coal miners to consider this question, even open cut mines are now being forced to understand and manage their gas emissions. In the latter case, usually very little gas sampling has been carried out. Again, this spells opportunity for those with technical expertise in this field.

The Norwest team out of Golden, Colorado and Newcastle, NSW has, for the past five years, been performing reservoir characterization and simulation for Xstrata Corp. at their Bulga site in the Hunter Valley, NSW, Australia. To the best of our knowledge, the Bulga project was the first project in the world that a true petroleum engineering approach had been applied to solving a coal mine gas drainage problem.

A dynamic model of the coal seam gas resource was developed and Norwest has had an ongoing role as senior consultants to

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Safety & Risk Management in Canada

by John Pilgrim

With the 2005 implementation and continuing maintenance of the Canadian Certificate of Recognition (COR) certification, Norwest has established a strong basic safety program. This program is enshrined in Norwest's Health Safety and Environmental Management Plan (HSE Plan). Effective measures are in place to ensure that the program continues to evolve and assist Norwest personnel in making safety a core component of day to day operations.

These measures, apart from ensuring legal compliance and the overall protection of personnel, are designed to at least meet the minimum expectations of most Norwest clients. Through its wide distribution, the HSE Plan is used to ensure that all contractors are made aware of and abide by the Norwest requirements.

However, safety in itself, is only one component

of a successful risk management program. The combination of good risk management practices linked to a strong safety program meets a number of needs:

- Reduce work related risks to personnel, property and the environment
- Help prevent violations of legislation
- Position Norwest as a superior performer in its chosen area of operations
- Increase productivity and reduce the costs of both incidents and inefficient work practices
- Meet all client HSE expectations
- Provide a significant marketing tool for future work and personnel recruitment
- Control insurance costs
- Significantly reduce the potential for legal liabilities arising out of personnel injury
- Control operational expenses by limiting downtime resulting from work place incidents, equipment repair or replacement, lost production and lost productivity

- Optimize corporate profitability

How effective has the implementation of our HSE Plan been? Norwest has been involved in the management and execution of field programs in Alberta's oil sands sector for the past seven years. These field programs are conducted during the winter months (December - March) in the severe climate of northern Alberta. Although Norwest's work scope has expanded over the years from the provision of field geology services to include overall program management (planning, development, drilling, field construction, and operational support services), we have seen a continued improvement in both the safety and overall program performance as our HSE Plan implementation has progressed. We will provide more specifics updates in future editions of the Norwester.

(below) Former Transcript Building and the newly renovated Annex (right).



Strong Growth for Norwest's Golden, CO PC Drives Expansion

Norwest's Golden office recently expanded its work space to support the company's aggressive growth. "The expansion gives us a greater opportunity to grow," said John Wright, President of Norwest's Oil and Gas Services. An Annex building adjacent to the main office (1010 10th St.) was entirely remodeled to accommodate an additional 6,000 square feet of new work space.

"Due to the growth of our professional staff, we were in obvious need of more work space," said John Campanella, Operations Manager at Norwest Golden. "The Annex went through an amazing transformation," added Campanella, referring to the makeover

of Golden's historic former Transcript Building. The Transcript Building is the previous home of the Golden Transcript, Golden's local newspaper.

The new Annex accommodates 5 private offices, 10+ cubicle work stations, 1 conference room, and a spacious backyard patio complete with a beer garden!

The official opening of the Annex was celebrated July 1, 2008 with a ribbon cutting ceremony officiated by the Greater Golden Chamber of Commerce.

The Golden office looks forward to new beginnings in the historic building.

Bike to Work Day: A wheel lot of fun!

In support of efforts to "go green," the State of Colorado has designated each June as Bike to Work Month. The highlight of the month was Bike to Work Day on June 25, 2008. About 15 Norwest (Golden) staffers saddled up for the two-heeled commute and left their gas guzzling cars in the garage. One employee, Kimber Founier, trekked in 12 miles from downtown Denver! As everyone arrived, a delicious pancake breakfast was awarded to all participants. After having such a good time with the ride and events of the day, several people pledged to ride or walk to work at least one day a week for the rest of the summer. Everyone had so much fun with the event that we are already thinking about how we will make next year even more cyclelicious.



Bike-to-worker: Tiffany Storrs

Tuff Views from a Hot Air Balloon



Launch of hot air balloon.

With a busy Fall season ahead of us, I hope everyone took a little time off this summer to relax at home or enjoy a vacation abroad. Personally, I had the opportunity to revel in the fascination of flight with a hot air balloon ride in the enchanting region of Cappadocia, Turkey.

The formation of Cappadocia's distinctive landscape began three million years ago with an eruption that covered the area in volcanic ash. Over time, the ash consolidated into thick layers of tuff. This soft rock is easily eroded by the elements, which has resulted in a magnificent vista of smoothly textured canyons and valleys.

In a number of areas, the tuff has been overlain with thin layers of basalt and other volcanic rock. This harder cap rock protects the soft tuff underneath from erosion, creating pinnacles and cones dubbed "fairy chimneys".

The region has hosted numerous civilizations over the years and it's easy to see why. Caves and dwellings have been carved from the rock slopes



Three views of the Fairy Chimneys

By Gordon Daniel

and fairy chimneys, many of which are still used today. In fact, our guesthouse room was hewn into the side of a small cliff.

Favorable winds and the breathtaking landscape have made Cappadocia a mecca for hot air balloon enthusiasts. Having signed up the day before, my wife and I were picked up before 5am and taken to the launch site. Crews were busy inflating the balloons and all around us these silent monsters were slowly coming to life. Once inside the basket, our pilot let off a few more blasts of flame into the cavernous balloon and suddenly we were airborne.

Our pilot's skill was nothing short of astounding. As the wind carried us over the surreal moonscape of ridges and valleys, he often navigated us within mere feet of the ground. The rising sun lit up the countryside as we drifted over dramatic rock formations and orchards of apricot and pistachio. After an hour and a half of the most spectacular bird's eye view imaginable, we touched down in a rough clearing and celebrated with a champagne toast. Another successful adventure!



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the mining company. Norwest assisted in the designing of a sampling program and pilot well tests which entailed history matching actual gas production versus forecasted results. The landmark achievements accomplished from this project were documented in a paper titled "A Petroleum Industry Approach to Coal Mine Gas Drainage" by Steve Hennings, Scott Thomson, and Xstrata client Jim Sandford. The Norwest paper received the prestigious Stefanko Best Paper Award for 2007 on behalf of the Society of Mining Engineers.

The association with Xstrata in Australia continues, and now the focus is on open cut emission assessment and reservoir characterization at the Bulga mine and at other Hunter Valley coal operations run by Xstrata. Norwest is also now assisting other mining companies in the Hunter Valley and considering marketing efforts, such as technical workshops, to expand their efforts to even more mines.

In Australia the greenhouse clock is ticking and those companies who cannot (or will not), accurately assess and report their actual gas emissions will be forced to pay a carbon tax penalty that may assume emissions that are far worse than the reality. Our role is to provide the technical expertise to undertake that assessment and ensure that companies comply with their legal requirements.

Local Australian newspapers are loaded with debate on this topic. Fueling the debate are the proposed legislative changes by the Rudd government, which are causing significant dissent. The Business Council of Australia has responded by stating that the proposed changes could force some companies out of business and render large swaths of Australian industry marginally economic. The Australian Prime Minister (alias, Tintin) recently spent the week in the Pacific Islands where it was suggested, our future might lie (see cartoon). Striking a balance between environmental and industry interests requires, at least in part, a better understanding of how much gas will be emitted during future coal mining operations. Norwest is involved in the early evaluation work and is in a good position to provide the required coal seam gas characterization work and technical guidance.

President's Message

by Craig Acott

This issue's feature article describes one of Norwest's international projects that entails the interaction between geologists and petroleum engineers. This project is representative of the type of project that we now conduct. As a mining guy, this type of project makes me think back to the "good old days", when typically the Norwest geologists would determine the volume and location of the ore body or coal seam and pass it on to the miners and processing guys who would develop a mine plan and ore processing flow sheet. It wasn't many years ago that Geoff Jordan (his recent retirement is covered elsewhere in this issue) told us in a planning meeting that if geologists were busy then the mining guys would be busy. Nowadays, things at Norwest look a lot different!

The geologists still conduct projects and feed them through to the mining and process engineers, but they are just as likely to be working with our petroleum engineering and/or hydrology groups on coal bed methane (CBM), coal mine methane (CMM), carbon sequestration and storage (CSS), and steam assisted gravity drainage (SAGD) projects, etc. It is also very likely that Norwest's safety, geotechnical, and environmental groups will also be intimately involved with these projects. This transition in the company from predominantly coal mining-based projects to conventional oil and gas, oil sands, oil shale and a number of other resource-based jobs over the past ten years has necessitated the development of the multi-faceted consulting company that Norwest has become today.

Pain is Just Weakness Leaving the Body

by Greg Gillian and James Sorenson

The day was beautiful as Van 2 pulled into Exchange 6. Over the next 20+ hours, The Norwesters – Miners, Not Whiners team took on the 183 mile run at the 2008 Wasatch Back Relay, June 21st -22nd. And despite sleep deprivation and sore muscles, there was no "whining" because "pain is just weakness leaving the body."

The twelve team members came from Norwest Vancouver, Golden, Denver, and Salt Lake City offices to run from Logan, UT up and over the Wasatch mountains and along the eastern slopes to Park City, UT.

Kirk Weber tackled his legs without complaint, which is no small feat when one of your legs is aptly named "You've Got to Be Kidding Me!"

To be honest, this transition was not something that Norwest management implemented as a result of a well thought-out, long-term strategic plan; at least part of our growth into other disciplines was in response to our client's demands. Many of our clients are looking for a "one-stop shop", and we have done our best to accommodate them. Furthermore, if there are given areas that we require expertise to complete a project, our clients often prefer that we sub-contract the expertise as opposed to having numerous contractors or consultants reporting directly to the client. As a result, we have developed strategic alliances with a number of companies that we work with on an ongoing basis and we either incorporate their personnel directly into our fee schedule or pass their invoices through as a disbursement, depending on the client's preference.

As a miner, it would be easy to think back and say "wouldn't it be simpler if...". Regardless of how hectic our work life has become, the transition that Norwest has undergone has made things very exciting. As a result, I am sure the employees at Norwest, me included, would certainly not be content with maintaining the status quo of the good old days. The opportunity to work on these complex projects with people from other disciplines within Norwest has become the norm as opposed to the exception, and everyone involved benefits from the change.

C. P. Acott

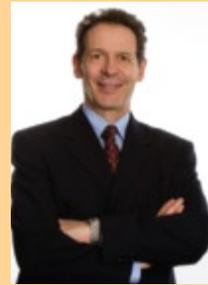
Helene Wieting, always the positive influence in the van, didn't let pain stop her as she shouted "I'm loving this" during her last leg.

The relay required each team member to run three times over the course of the event; each section was between three and eight miles long and included several challenging climbs and descents. Kirk Weber and James Sorenson tackled the steepest uphill portions, averaging over 7% uphill grades on gravel roads.

At the finish, the Norwesters completed the course in a very respectable time of 28 hrs, 50 mins, and 302 of 545 teams.

We look forward to more torture in 2009!

Sustaining our Success



Joe Aiello

by Joe Aiello

Norwest has changed considerably over the past five years. We've expanded our service offerings to include reservoir engineering and water management through

mergers with Questa Engineering and Applied Hydrology. We've grown from 80 employees to over 220 today. This kind of growth brings new challenges and opportunities.

To ensure Norwest continues to sustain its history of success, the Norwest Board of Directors decided to add the position of Managing Director, with overall responsibility for Norwest's operations. In broad terms, the Managing Director's duties include enhancing corporate integration, providing more focus on strategic initiatives, and meeting the challenges associated with our next phase of growth.

Joe Aiello, former president of Norwest's Canadian operations, was appointed Managing Director on June 1, 2008. The presidents of Norwest's four business units, Craig Acott (Calgary/Vancouver), Mike Day (Denver), John Wright (Golden) and Bob Evans (Salt Lake City) report to Joe and are the core team charged with operations management.

As part of our integration process, we are bringing all of our operations under the Norwest Corporation banner. While the names "Questa Engineering" and "Applied Hydrology" have been dropped from our promotional literature and logos, their history, and the knowledge and skills of the people they brought to Norwest remain a

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The Wasatch Relay Team

Norwest Short Course Schedule

Fall 2008

Register for short courses online at www.norwestcorp.com or call toll-free 866.277.1629

CO₂ Capture & Sequestration (CCS) 101 -What the General Public Should Know

- October 7, 2008 – 8am-5pm – Golden, CO
- \$625 USD
- Instructors: Eduardo Manrique(Ph.D) & Anibal Araya(M.S)

A short course designed for technical and non-technical people alike who seek a general awareness about CCS and its impact on the environment and our society. This 1-day course is a great opportunity to get up to speed on the challenges and issues that surround CCS.

CO₂ capture and sequestration represents one of several mitigation options used to manage CO₂ emissions coming from industrial sources, especially from coal-fired power plants. The basic four areas of CCS will be described:

- CO₂ capture from emission sources: How to trap and separate the CO₂ from flue gases?
- CO₂ compression and transportation to storage locations: Why compress and pipe CO₂?
- CO₂ injection into geologic formations: What is geologic storage? What options are available? Are there other options besides geological storage?
- CO₂ monitoring and storability prediction: Why is it important to keep track of the injected CO₂?
- Other topics include: International CO₂ projects, Environment and Safety, Economics and Carbon Trading.

Oil Field 101™ - Fundamental Aspects of the Oil & Gas Industry

- October 14-15, 2008 – 8am-5pm – Golden, CO
- \$575 USD
- Instructors: Jerry Bergeson(P.E) & Joe McHenry(M.S)

Do you know someone who is new to the industry or needs an overview of what the Oil Field is all about? Learn about industry terminologies, the technology, the tools, the processes, and the risks and rewards of our fascinating business. This 2-day course includes discussions on:

- History/Origins/Geology/Geophysics
- Oil/Gas/Land/Coalbed Methane
- Drilling/Reservoirs/Production
- Refining/Enhanced Oil Recovery
- Processing/Regulation/Marketing

CBM Overview

- October 17, 2008 – 8am-5pm – Golden, CO
- \$625 USD
- Instructors: Joe McHenry(M.S) & Steve Hennings(M.S)

Coalbed Methane (CBM) has become a significant portion of the North America gas supply. There are many differences between CBM and more conventional reservoirs but the basic laws of physics

still apply to both. There are five critical elements for a successful CBM development: resource, permeability, water management, completion effectiveness, and gas treatment/transport/sales. This 1-day course discusses these five elements and looks at how they impacted results in successful CBM basins. This course is valuable for managers, investors, engineers, geologists, and technicians wanting an overview of CBM essentials without concentrating too heavily in any one area. This course is a condensed version of our 2-day course. The course presents the essential aspects of CBM including differences from conventional gas, its history, and insight into its future. The seminar covers the following topics:

- Unconventional Nature • Reservoir • Geology Resource • Isotherm • Permeability • Pressure Testing • Water Management • North America Basins • Drilling • Completion • Operations Production Analysis • Artificial Lift • Water Management • Gas Facilities

SPE Workshop - Reservoir Engineering

- November 27th – 28th, 2008 - Brisbane, Australia
- \$1100 AUD
- Instructors: Joe McHenry(M.S) & Steve Hennings(M.S)

There are five critical elements to successful Coal Bed Methane (CBM) development: resource, permeability, water management, completion effectiveness, and gas treatment/transport/sales. This 2-day course analyzes the resource, permeability, and reservoir management issues.

This course is valuable for engineers, geologists, and technicians looking for evaluation ideas that will lead to improved development results and to engineers, managers, and investors involved in determining the financial value of CBM properties. This is a thorough discussion of CBM reservoir analysis from resource to simulation. The course presents the essential aspects of CBM including differences from conventional gas, CBM history, and insight into its future. The seminar covers the following topics:

- Unconventional Nature
- Geologic Aspects
- Coring & Logging
- Gas Contents & Isotherm
- Permeability
- Water Management, Reservoir Issues
- Simulation
- Well Completion Selection
- Production Forecasting
- North American and Australian Basins

To register for the SPE Workshop:

Phone: (+61) 2 9080 4307

Email: registration@informa.com.au

Sustaining our Success

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vital part of our organization today.

We expect that these changes will contribute to our ongoing efforts to improve all aspects of our client and supplier relationships by:

- broadening the scope of complementary services available in areas of value to our clients;
- increasing our capacity to serve clients through our strategy of attracting and retaining high quality people who bring a balanced combination of practical experience, technical excellence, innovation, and enthusiasm to our organization;
- providing a high quality product that is good value for the investment; and
- fostering personal relationships that are both enjoyable and rewarding.

We are looking forward to the next five years, replicating our successes of the past five, and contributing to the success of our clients and suppliers.



Colorado Energy Boom Fuels New Environmental Regulations

by Cindy Emmons

New and comprehensive oil and gas regulations proposed by the Colorado Oil and Gas Conservation Commission (COGCC) are expected to become effective in late 2008. These far-reaching rules address all aspects of exploration, drilling and production of oil and gas wells and include a new set of rules for coal bed methane development.

Norwest is currently assisting companies in evaluating the draft regulations, developing alternative language for the proposed rules, and providing expert testimony to the COGCC during regulatory proceedings. These changes to the oil and gas industry as a result of the new regulations will be significant both financially and operationally, and companies need to be prepared. A new short course will be added to Norwest's already popular list of course offerings this year to address the rapidly changing regulatory environment. This course will assist oil and gas E&P companies in educating and preparing their personnel about compliance with the new regulations. Contact Cindy Emmons (cemmons@norwestcorp.com) or Adam Bedard (abedard@norwestcorp.com) to learn more about the impacts of the new regulations on industries and to find out about course scheduling.

Mining Runs in the Norwest Family

by Rick Tiff

Some professions tend to run in families. Rick Tiff, Vice President of Geologic Services and General Manager of Norwest's Grand Junction, CO office is carrying on the mining tradition his maternal grandfather, Otho Graves began in the early 1900's. Otho was an early innovator in the crushed stone industry. After several years as a professor of civil engineering at the University of Pennsylvania and Lafayette College, he embarked upon a long and productive association with General Crushed Stone Co. Serving in such influential positions as director, vice president, president, and general manager Graves was responsible for the company's expansion and success for over 25 years.



Otho Graves
1882-1954

Three years later, he established a research laboratory for the Association. Consulting for the U.S. Bureau of Mines and serving on the National Industrial and Safety Councils were among his many other achievements.

In recognition of his many contributions, Otho Graves was inducted into The National Mining Hall of Fame in Leadville, CO in 1989. The federally-funded non-profit organization is a memorial to men and women who achieved great success in the mining and natural resource environment. Mining's colorful history is showcased throughout the facility and makes for an interesting look into the lives of those who impacted mining in such positive ways. Rick can be proud to follow in such impressive footsteps!

Recognized as an expert on seismographic testing in quarry blasting, Graves also influenced the National Crushed Stone Association, serving as its president. In 1925, Graves was pivotal in the creation of the Bureau of Engineering and the relocation of the Association's offices to Washington, DC.

Do you have a mining or energy legacy sprouting on your family tree? If you'd like to share your family ties to the industry, please contact Tiffany Storrs (tstorrs@norwestcorp.com). Visit www.mininghalloffame.org/hallfame.htm for more information on the National Mining Hall of Fame.

End of an Era - Geoff Jordan Retires

by Joe Aiello

After 29 years in the traces, the last of the original Norwest founders, Geoff Jordan, formally retired in April 2008. While Geoff has always felt that Norwest was more of a "family" than a business enterprise, he decided the time was right to slow down a bit and focus more on other important aspects of his life.

Geoff graduated from the University of New South Wales with a Bachelor of Science degree in Geology in 1970. Before emigrating to Canada in 1975, he worked for a consulting firm in Australia, exploring for various minerals including coal, base, and precious metals. Once in Canada, Geoff worked for Denison



Geoff Jordan

Coal on their north eastern BC coal prospects before setting out on his own with G.R. Jordan Consulting Services. It was from his base in the coal consulting sector that Geoff, along with Don

Symonds and Gerry Stephenson, developed the working and business relationship in 1979 that evolved into the Norwest of today.

As a founder, Geoff played a key role in Norwest's growth and development. He participated in, and managed resource projects around the world, bringing his extensive geological experience to our clients in coal, coal bed methane, oil sands, and heavy oil. He has been one of Norwest's QPs, signing off on resource and reserve reports to various securities commissions and has actively supported changes to the related regulatory process. Geoff was an Officer of the Corporation since its inception and Director until February 2008. Geoff and his wife Mitsuyo plan to remain in Calgary for the foreseeable future.

We have an ongoing working relationship with Geoff and plan to keep him involved, hopefully on a more relaxed schedule, with Norwest. Geoff, thank you for everything and our best wishes to you and Mitsuyo.

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