



Laser Scanning and Geological Modeling: From Outcrop to Flow Simulation

John Howell
University of Bergen, Bergen, Norway

Note: AGS meetings will be at the BP Energy Center for 2009-2010.

Please check the website (www.alaskageology.org) and issues of the AGS newsletter for updates.

This newsletter promotes the December luncheon talk of the Alaska Geological Society, to be held Thursday, December 10th, at the BP Energy Center.

Outcrop analogues have long been used as a means to supplement the limited datasets that are available from subsurface reservoirs. As computer modeling of reservoirs developed through the mid-90s it was logical that outcrops would provide data for the conditioning of reservoir models and also be represented in the software. Initial studies concentrated on the collection of data through traditional means such as sedimentary logging, mapping and the collection of scaled drawings and photo panels.

Recent advances in surveying, especially the development of cm accurate dGPS and laser scanning (lidar) technology, have revolutionized the collection of geological field data. A ground based lidar system can scan a cliff, collecting "point clouds" of surveyed points at rates exceeding 10,000 per second. These points are used to generate extremely detailed and accurate surfaces on which high resolution digital surfaces can be draped producing a "Virtual Outcrop."

The virtual outcrop has a number of quantitative applications that extend beyond virtual fieldtrips. Large quantities of spatial and geometric data can be collected from the reservoir analogue. These include parameters such as bed thickness and bed geometry. Surfaces can be mapped and the data exported to reservoir modeling software where the geology is recreated in 3-D. Accurate representations of the geology can then be used to simulate fluid flow, providing an improved understanding of the impact that heterogeneities have on reservoir performance in the subsurface. The approach will be illustrated with two case studies from the western USA.

Joint Luncheon AGS / GSA

Date & Time: Thursday, Dec. 10th, 11:30 am – 1:00 pm

Program: Laser Scanning and Geological Modeling

Speaker: John Howell, University of Bergen

Place: BP Energy Center

Reservations: Please make your reservation before noon Tuesday, Dec. 8th, 2009.

Cost: Seminar only, no meal: Free
Reserve a box lunch: \$13
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The Panther Tongue and Ferron Sandstone include two well-exposed fluvial deltaic units deposited under contrasting base-level conditions. Virtual outcrops

were generated for both systems and a database of bed thickness changes was compiled, which illustrates the systematic thinning of delta front clinothems. The virtual outcrops were also used to build two reservoir models which were used to test the importance of clinoform draping shales upon simulated production.

In the second case study, two fluvial systems from the coal bearing coastal plain deposits of the Blackhawk Formation and the more arid, intra continental deposits of the Colton Formation were surveyed. Virtual outcrops of each were used to build close to deterministic models for the two successions, capturing up to seven- and five-channels bodies in the two cases, respectively. Analysis of the virtual outcrops included detailed mapping of intra channel architecture and led to the building of two, close to deterministic, geocellular models (2x2x0.05 km). These models have been flow simulated and used to test the role of crevasse splay and over bank deposits in providing connectivity between channel bodies.

The science of virtual outcrop geology is still in its infancy. The talk will conclude with a brief look into the future, including the application of ground based hyper spectral methods for the remote mapping of lithology and, oblique aerial lidar (helidar) which allows the very rapid collection of huge datasets from inaccessible cliff sections.

About the Author:

John Howell studied for his BSc (hons) at the University of Wales in Cardiff where he graduated in 1988. After a brief spell in industry he returned to academia to read for a PhD at the University of Birmingham. He completed his thesis on the sedimentology of the Rotliegend gas reservoirs in 1992 and moved to Liverpool University where he spent the next 10 years – four as a researcher and six as a faculty member.

While in Liverpool, he worked on a wide range of projects within the broad theme of sequence stratigraphy in areas as diverse as the North Sea, Utah, Namibia, Argentina, Chile and the Far-East. Publishing on the application of sequence stratigraphy in tectonically active basins in eolian, fluvial, tidal, and shoreface systems. As the sequence stratigraphic paradigm became more widely accepted, his research interests moved to the characterization and representation of geological outcrops in reservoir modeling software. In 1999 he spent a sabbatical in Saga Petroleum in Oslo (Norway) where he learned to build geocellular reservoir models.

Howell moved to Norway permanently in 2002 to take a Professorship at the University of Bergen. There he continues his interest in the reservoir modeling of

The Alaska Geological Society

LUNCHEON SCHEDULE 2009 - 2010

**Updates on the web at:
<http://www.alaskageology.org>**

September 2009	Thurs., Sept. 17 th , Paul O'Sullivan, Apatite to Zircon, Inc., Timing of Brooks Range Uplift and Denudation: A Summary of Fission Track Results Over the Last 25 Years.
October 2009	Thursday, Oct. 15 th , Steve Wright, Chevron, Cook Inlet Gas Shortage: Fact of Fiction?
November 2009	Thursday, Nov. 19 th , Stephen Hubbard, University of Calgary, High Relief Clinoform Development
December 2009	Thursday, Dec. 10 th , John Howell, University of Bergen, Laser Scanning and Geological Modeling.
January 2010	Thursday, Jan. 21 st , William Morris / Mark Scheihing, ConocoPhillips Alaska, Inc., Karoo Basin Sedimentology
February 2010	Thursday, Feb. 18 th , Mark Myers, DNR, AGIA
March 2010	Thursday, March 18 th , Pat Druckenmiller, UAF, Mesozoic Marine Reptiles
April 2010	Wednesday, April 15 TH , Don Gautier, USGS, Circum-Pacific Resource Assess.
May 2010	Thursday, May 20 th , Brigitte Martini, Ormat, Geothermal Prospects of Mt. Spurr

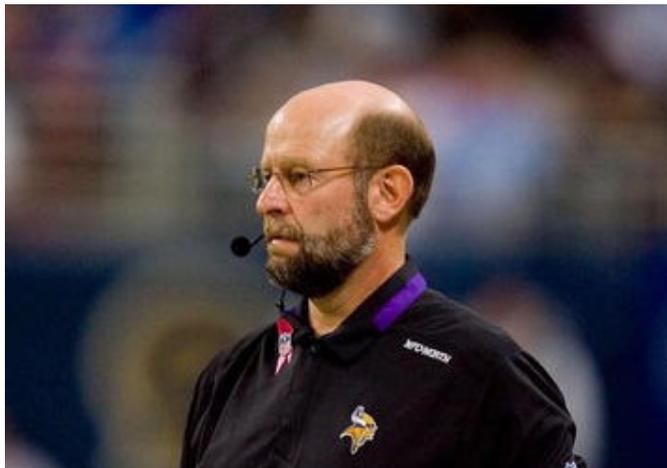
outcrops and works to develop new methods for the capture, analysis and utilization of digital outcrop data. His most recent work includes the utilization of ground-based and oblique aerial lidar and, the development of ground-based hyper spectral scanning. He has supervised 22 research students and published over 75 scientific articles.

In 2004, in conjunction with another Professor at Bergen University, he started an oil company called Rocksource. The company was founded on the belief that the correct application of technology improves exploration success and hydrocarbon recovery. Rocksource is listed on the Norwegian stock exchange and now employs 60 people. The company has production onshore Texas and 260 million bbls of risked reserves in its portfolio.

Howell divides his time between the University and Rocksource and generally wishes there were more hours in the day and days in the week.

From the President's Desk

Tom was away at this writing. In the space normally reserved for his column, I pose the question: Does anyone think Tom bears more than a passing resemblance to Minnesota Vikings coach Brad Childress?



The Alaska Geological Society is proud to offer several scholarships annually to undergraduate and graduate students conducting geoscience research projects in Alaska. These scholarships include AGS scholarships and the Don Richter Memorial Scholarship. The goal of the AGS scholarship program is to foster and support interest in Alaskan geology, and to increase geologic knowledge of our state. Detailed information about the scholarships, and applications for the scholarships, can be obtained from our website.

As of July 2009, the Alaska Geological Society has official 501c3 nonprofit status with the IRS. It is now possible to make tax-deductible contributions to AGS to help us sponsor field trips, workshops, technical conferences, and scholarships. The AGS Board of Directors would like to establish self-sustaining scholarship fund accounts. To celebrate our new tax-deductible status, please consider making a contribution to one of our scholarship funds, or to our general fund, this year. If you work for an employer who matches charitable or educational contributions, your contribution can significantly help us to increase our scholarship fund accounts as well as the size of the grants that AGS can afford to award to students. It is easy to make secure donations on our website, and we also happily accept checks by mail.

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Local Meetings:

American Water Resources Association—Alaska Section

<http://www.awra.org/state/alaska/index.html>

Alaska Geological Society

<http://www.alaskageology.org>

Lunch meetings are held monthly September through May in Anchorage. For more information, contact Jim Clough, 451-5030.

Alaska Miners Association

<http://www.alaskaminers.org/>

The Anchorage branch of the AMA holds weekly meetings at 7 AM every Friday at the Denny's on Northern Lights and Denali. They hold regular luncheon meetings in association with SME. For more information, contact the AMA office at 563-9229.

American Institute of Professional Geologists

<http://www.aipg.org>

AIPG holds regular quarterly evening Section meetings in Anchorage and Fairbanks. For more information contact Mark Lockwood, President, at Shannon & Wilson, Inc., in Fairbanks, 907-458-3142.

Chugach Gem & Mineral Society

<http://www.chugachgms.org>

CG&MS holds all meetings at the First United Methodist Church on 9th Avenue. Contact their hotline at 566-3403 for information on regular monthly business meetings, monthly potlucks, and guidebook sales, including the new Alaska Rockhound Guidebook.

Geophysical Society of Alaska

<http://gsa.seq.org/>

Luncheon meetings are held monthly September through May at the ConocoPhillips Tower. For more information, contact Phil Rorison, 265-6321

Society of Petroleum Engineers

<http://alaska.spe.org/>

For more information, contact Jack Hartz at 375-8239.

UAS Environmental Science Program

<http://www.uas.alaska.edu/envs>

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The Alaska Geological Society is an organization which seeks to promote interest in and understanding of Geology and the related Earth Sciences, and to provide a common organization for those individuals interested in geology and the related Earth Sciences.

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MEMBERSHIP INFORMATION

AGS annual memberships expire November 1. The annual membership fee is \$15/year. You may download a membership application from the AGS website and return it at a luncheon meeting, or mail it to the address above.

Contact membership coordinator Mark Olson with changes or updates (e-mail: gregory.c.wilson@conocophillips.com; phone: 907-263-4690)

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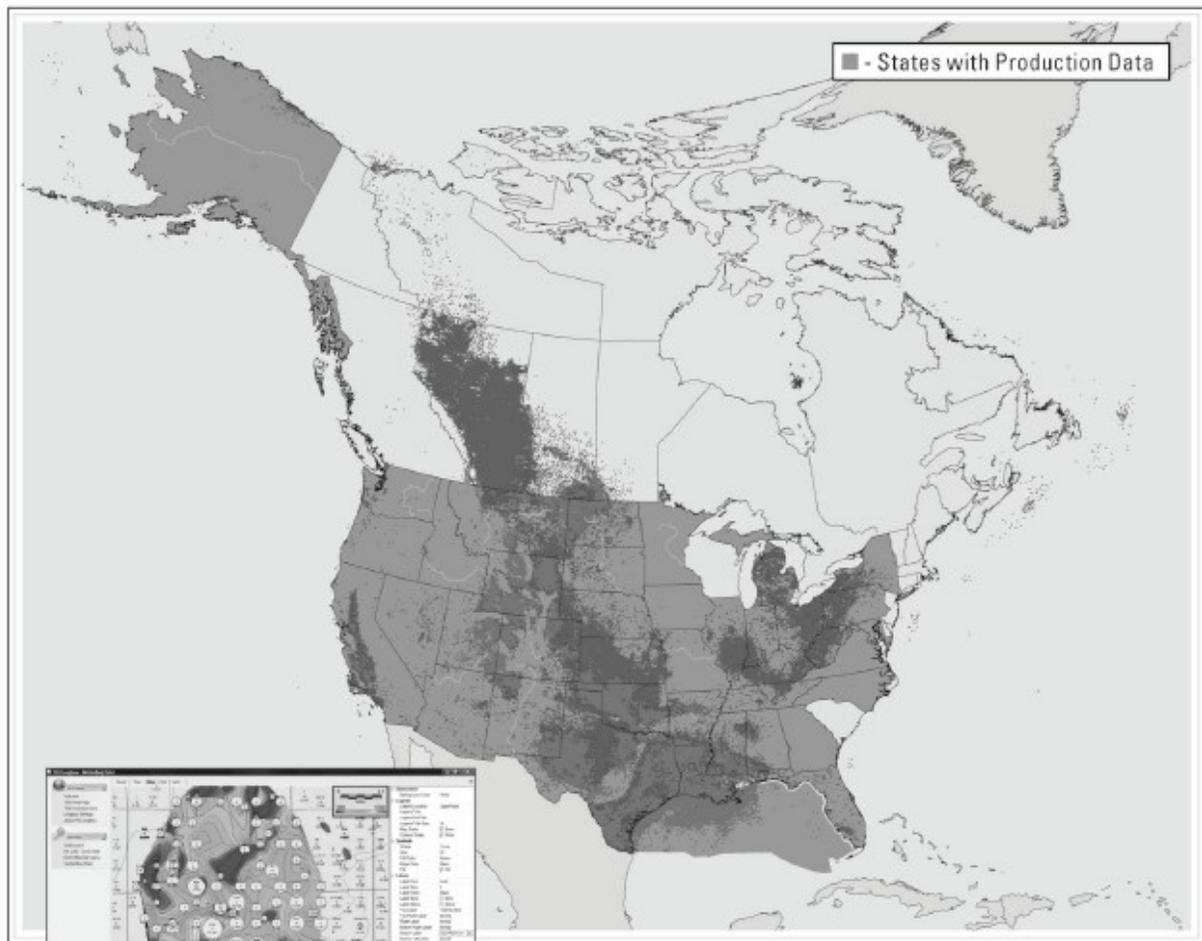
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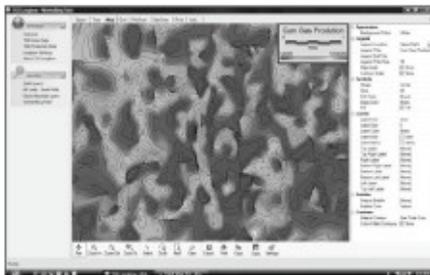
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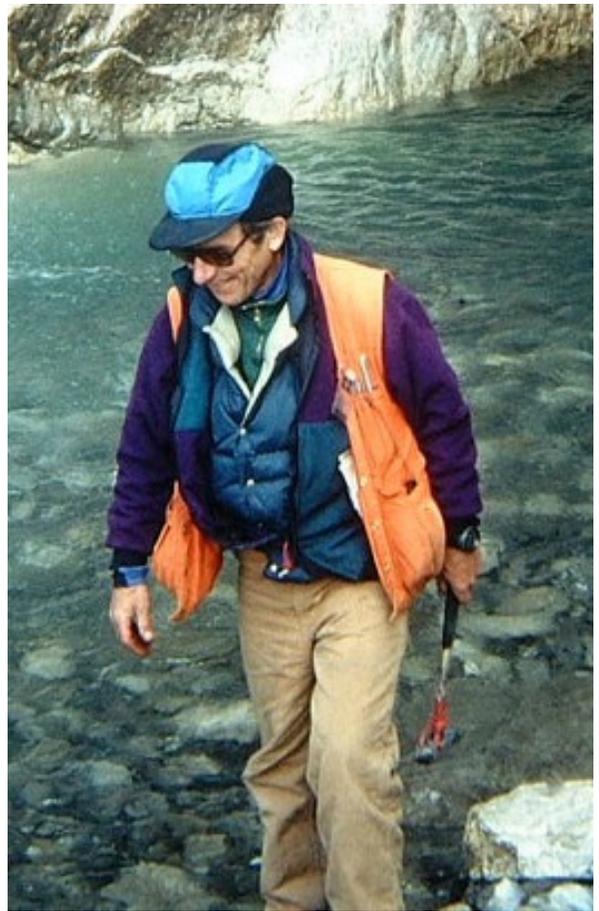


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After nearly 27 years of service to the State of Alaska, Rocky Reifentuhl recently retired from the Alaska Division of Geological and Geophysical Surveys (DGGGS). Rocky's geologic pursuits (as well as his adventuresome spirit) took him to nearly every corner of the state, many times on a bike or walking. Rocky's publication record is impressive, and if one were to conduct a quick search of the DGGGS online publications catalog, 94 publications with him as either first author or a contributing author would be returned. This is testimony to a very productive career! Over the next few months Rocky plans to revise a report on the Kemik Sandstone, originally prepared for another governmental agency more than a decade ago, for publication as a DGGGS report. So the number of reports with his name on them will soon jump to 95. Rocky and his spouse, Gail, plan to remain in the Fairbanks area to enjoy the new home they recently completed. Congratulations Rocky for a long and productive career of service to the Alaskan geological community!



Shared below are some words from his longtime co-worker and friend, Gil Mull:

Rocky Reifentuhl has retired from DGGGS!! Wow! The organization will never be quite the same! Field parties will not only miss his contributions to reconnaissance mapping projects, but will also miss the opportunity to follow his wilderness exploits, both in the line of field work, and also in his recreational exploits. Over the years that I worked with Rocky in the Brooks Range and on the North Slope, it was great working with him because if there was a long hard foot traverse that needed to be made, we always knew that we could count on Rocky could do it, safely. None of the rest of us would even have begun to think about attempting some of the lengthy traverses that Rocky would routinely make both in rough terrain or over the tundra tussocks, while carrying a 50 pound pack full of cold weather gear and rock samples, and a pistol in a shoulder holster for bear protection (which he had to use at least once). He covered ground like a caribou, but managed to do those traverses, working rapidly on his field sheets or air photos and also taking voluminous notes, often using colored pencils to highlight diagrams of the stratigraphy and structure. At our field camps, in the morning while the rest of us were eating breakfast and drinking coffee to wake up, Rocky would be out running, warming up for the day's traverses. And at the end of long days of field traverses, while the rest of us were relaxing in camp with happy hour drinks and rehashing the day---where was Rocky?? Out punishing his mountain bike on long rides on whatever surface was available. On at least one occasion, that surface turned out to be along the top of the TransAlaska pipeline---a challenge that for him was too good to pass up. On another occasion at the end of the day, our helicopter dropped him and his bicycle on the top of Slope Mountain, near the Dalton Highway, to ride back to our tent camp. We beat him to camp---but not by a lot.

So, what did Rocky do for fun when not in the field? For starters, on a number of occasions at the end of our field seasons, while the rest of us hopped a plane to fly back to Fairbanks, Rocky took off with his Leica camera and light bivouac gear for multi-day treks through the Brooks Range back to the Dalton Highway or to Anaktuvuk Pass, frequently covering over 30 miles in a day. In rough mountain country and over tussocks, that's a lot! These trips were sometimes solo and sometimes with his brother Steve or his wife Gail---both of whom are in as superb physical condition as Rocky is. On more than one of these treks, getting to the highway entailed swimming the Sagavanirktok River.

It was always fun to follow his exploits with brother Steve in the Alaska Wilderness Classic races through the Alaska Range or Wrangell Mountains---several of which they won, beating some competitors who were half their age. In the winter, it was---and I'm sure will continue to be---more bicycle time. While the rest of us struggled to keep our cars operational in the often way below sub-zero temperatures of Fairbanks winters, Rocky typically rode his bicycle to work, even at -40°---just to keep in shape and to save the hassle of dealing with frozen cars. For a number of years, he competed in---and on several occasions---won the Iditarbike or Iditarport races along the Iditarod Trail.

Rocky's publication record at DGGGS is ample testimony to his firm conviction that data needs to be made available to the public in a timely manner. He was acutely aware of the relevance of the field work---which was always more than just the compilation of a geologic map. At times and in places where I would worry and ponder an interpretation and want to delay until there was more data, Rocky would typically get his interpretation compiled onto the map. Some of us may at times have quarreled with some of his interpretations, but we could never deny the great value of having an interpretation on the map, there for everyone to see and work with, and shoot at if need be. Rocky is also an accomplished petrographer and often incorporated petrographic data into his reports, particularly with regard to the reservoir potential of prospective horizons.

Rocky's contributions as a field mapper will be missed by DGGGS, but I'm sure we'll continue to hear of his continued wilderness journeys on foot and by bicycle. Bon Voyage.

Cheers---

- Gil

2009 - 2010 Alaska Geological Society Board

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