Luncheon Abstract

Joint Meeting
Alaska Geological Society (AGS)
Geophysical Society of Alaska (GSA)

Laser Scanning and Geological Modeling:
From Outcrop to Flow Simulation

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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 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.

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.

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	
Nonmember:	$15	
Reserve a hot lunch:	$20	
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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 were 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 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.