

# ASEG PESA WORKSHOPS

## Sydney, August 2010

- Please note workshops have a minimum number of participants required to proceed and need to be booked no later than Friday July 17<sup>th</sup> 2010. Please also note the maximum numbers for each workshop. There are **seven** workshops on GEOLOGICAL MODELLING, EM & POTENTIAL FIELDS and **six** workshops on ENERGY, CARBON CAPTURE & ENGINEERING.

### GEOLOGICAL MODELLING, EM & POTENTIAL FIELDS WORKSHOPS

#### **G1: Tensor Processing: Gradient Processing**

Date: Saturday, 21 August 2010  
Time: 0830 – 1700 hours  
Venue: Crowne Plaza, Darling Harbour  
Cost: \$315.00  
Min No: 10      Max: 20

Presented by: Intrepid Geophysics Pty Ltd, Melbourne.

Intrepid Geophysics is at the forefront of developing techniques in the signal processing of full tensor and gradient data sets for both gravity and magnetics. We apply the underlying physical and mathematical properties of the tensor to correctly interpolate between tensor readings and achieve superior data processing results.

- Using Intrepid's Tensor Spherical Interpolation Technology, the eigenvalues together with the associated quaternion of the tensor can be used for the interpolation and filtering processes, correctly accounting for both the magnitudes and the angular variation of the tensor.
- This forms the basis for Quality Control of vector and full tensor surveys
- The approach is implemented in Levelling, Filtering, Terrain Corrections and Gridding Operations

This course provides participants with an introduction to a quality control, gridding and filtering of vector and full tensor datasets. You will learn to assess the quality of a tensor survey, interpret tensor data and optimise the signal content through linear differential de-noising [MITRE] and other methods. The course will cover aspects of the design of tensor instruments, and what signals can be recovered if potential gradients are measured. You will examine the five independent components of a tensor, and learn many ways to transform tensor data for examining the signal. Some actual gravity and magnetic tensor gradient data is used for training, so that the course enables you to study the real impact of noise in your signal.

A 30 day evaluation licence will be provided at the end of the course, allowing companies to further evaluate the application of Intrepid Tensor Processing on their own project datasets.

Attendees are required to bring their own laptop computer.

#### **G2: Advanced potential field data processing short course**

Date: Saturday, 21 August 2010  
Time: 0830 – 1700 hours  
Venue: Crowne Plaza, Darling Harbour  
Cost: \$500.00  
Min No: 15      Max: 20

Presented by: Gordon Cooper, Professor of Geophysics, University of Witwatersrand

This course will cover recent updates in potential field data processing. The course will begin with the standard filters then examine how they are related and look at modifications and extensions which have been introduced. The course will be approximately 50% lectures and 50% practical, with Matlab being used for the practical sessions. Attendees will need to bring their own laptop computers, and will be supplied with Matlab source code for all the filters demonstrated in the practical sessions. Knowledge of the Fourier transform will be assumed. The course syllabus may include — Horizontal derivatives in the space and frequency domains, in one and two dimensions; DOG and LOG filters; Sunshading. Measures of curvature; Vertical derivatives, including fractional order; Hilbert transforms; Analytic signals; Instantaneous phase and frequency; Laplaces' equation; Vertical continuation to flat and arbitrary surfaces; Pole reduction, including the low latitude and variable inclination/declination cases; Pseudogravity; Phase based data filtering; Depth estimation from power spectra; Matched filtering; A range of enhancement techniques such as the horizontal and vertical tilt angles, theta map, tilt-depth method, anisotropic diffusion, non-local means, AGC, and terracing will be discussed; GLCM textural analysis of potential field data.

Attendees are required to bring their own laptop computer.

### **G3: An overview of rapid geological and geophysical modelling in Gocad and Skua**

Date: Saturday, 21 August 2010

Time: 0830 – 1700 hours

Venue: Crowne Plaza, Darling Harbour

Cost: \$600.00

Min No: 15      Max: 20

Presented by: Peter Fullagar, Glenn Pears and Tim Chalke of Mira Geoscience Advanced Geophysical Interpretation Centre, Brisbane

This course is for geophysicists and geologists in exploration and mining roles who want to improve their knowledge or skill base for rapid geological modelling and geologically constrained gravity and magnetic inversions. The course will provide insight into Gocad modelling techniques and a new geological modelling technology called SKUA for rapid 3D model construction from observation data. These technologies allow for quick creation of complex starting models that are readily incorporated into constrained gravity and magnetics inversion.

The course is strongly focused on state-of-the-art technology and know how for integrating 3D geological and geophysical data into a single, consistent earth model. The course will include hands on model building using Gocad and SKUA, and updating models with UBC GIF and VPmg inversion software.

Attendees are required to bring their own laptop computer.

### **G4: Hands on workshop on processing and constrained inversion with prior information of AEM data with the Aarhus Workbench**

Date: Saturday, 21 August 2010

Time: 0830 – 1700 hours

Venue: Crowne Plaza, Darling Harbour

Cost: \$400.00

Min No: 10      Max: 20

Presented by: Dr. Andrea Viezzoli, Dr. Esben Auken, M.Sc. Camilla Soerensen, Aarhus Geophysics, Denmark.

Following up on the positive feedback from the varied people that attended our workshop held at AEG 2009 on general inversion methodologies for AEM data, we decide to offer for 2010 a more specific software-hands-on workshop. The aim is therefore to provide hands on tutorial on the main features of the Aarhus Workbench for processing and inversion of AEM data.

The Aarhus Workbench is a comprehensive, GIS based platform for processing, inversion and presentation of DC and EM data, both groundbased and airborne. A self contained program, it allows performing the whole process, with multiple datasets and data types, keeping track at all times of all the steps involved, in order to produce a well documented and convincing result, both for hydrogeological and exploration applications. Its extensive processing modules prepare the data for the layered full non linear spatially constrained inversions, which can be easily fed also with prior information, e.g., from borehole conductivity logs or layer surfaces. The GIS modules allow comprehensive visualization and QC of results (e.g., data residual or depth of investigation), and preparation of final report maps. Attendees will perform firsthand the whole process from data import to report maps, on different AEM data types.

Attendees are required to bring their own laptop computer.

#### **G5: Airborne Gravity 2010**

Date: Sunday, 22 August 2010

Time: 0830 – 1700 hours

Venue: Crowne Plaza, Darling Harbour

Cost: \$120.00

Min No: 80      Max: 200

Chaired by Bob Smith - Greenfields Geophysics, David Robson - Geological Survey of New South Wales, Richard Lane – Geoscience Australia and Mark Dransfield – Fugro Airborne Surveys.

The objective of this workshop is to review advances in airborne gravity since the Airborne Gravity Workshop 2004, also held in Sydney. The Airborne Gravity Workshop 2010 will follow four themes:

- Current operating airborne gravity and gravity gradiometry systems
- Developing airborne gravity and gravity gradiometry systems
- Advances in processing and interpretation software
- Review of complementary technologies

If you are interested in what is happening with airborne gravity, this workshop is a must. International and national presenters have been invited by the AG workshop committee as they are a world leader in an aspect of airborne gravity. The format of this one-day workshop will be succinct presentations followed by discussion forums throughout the day. A volume of Workshop Abstracts and accompanying DVD will be issued on arrival at the workshop.

#### **G6: Geomodeller: Building a 3D Geology Model – Reconciled with Gravity / Magnetic Tensor Data**

Date: Friday, 27 August 2010

Time: 0830 – 1700 hours

Venue: Crowne Plaza, Darling Harbour

Cost: \$300.00

Min No: 10      Max: 20

Presented by Intrepid Geophysics Pty Ltd, Melbourne.

This one day workshop will initially introduce the 3D GeoModeller approach to building a 3D geology model. Users will add new geology data, and revise their interpretive ideas, and will learn that geology models can be easily revised and improved. The workshop will then demonstrate the benefits of

computing forward model solutions for gravity and magnetics, including their vector and tensor components. This process effectively 'tests' the 3D geology model. The user can revise the model to achieve a 3D geology result which remains consistent with geology observations, and has improved consistency with geophysical datasets. In the afternoon session GeoModeller's geophysical inversion will be applied. This stochastic exploration process seeks 'alternative' geology models which are also consistent with the set of geology and geophysical constraints. It will be demonstrated that this inversion approach - using vector and tensor datasets - achieves further interpretive improvement and refinement of the 3D geological model.

New thin body modeling code will be show cased.

A 30 day evaluation licence will be provided at the end of the course, allowing companies to further evaluate the software on their own geological mapping problems.

Attendees are required to bring their own laptop computer.

### **G7: AEM System Definition and Qualitative Interpretation of 1D, 2D and 3D targets**

Date: Friday, 27 August 2010 – Saturday, 28 August 2010

Time: 0830 – 1700 hours

Venue: Crowne Plaza, Darling Harbour

Cost: \$1100.00

Min No: 15 Max: 30

Presented by James Macnae, Professor of Geophysics, RMIT University, Melbourne

Day 1 of this workshop will discuss and provide the methodology and software tools for geophysicists to determine statistically the true geometry/waveform of the AEM system they are using, and determine survey specifications. Calibration may tell for example that a "horizontal" transmitter is systematically tilted at 10°, resulting in target dip interpretations also out by 10°. Different calibration tools supplied can be applied to time- and frequency-domain AEM systems. Issues discussed include system noise levels and the effects on data of different bucking systems.

Day 2 will look at quantitative methods for AEM data interpretation. Participants will run commercial software on example data sets to perform a) fast 1D stitched CDI approximations, b) stitched 1D inversions. The results will be analysed and compared to the "truth". We will then look at the effects on AEM data of inhomogeneous conductive cover, and the responses of 2D and 3D structures. These have insidious effects on CDI sections, particularly in resistive areas where targets can vanish to unrealistic depths on the CDI. Participants will then run a fast 2D fitting code that aims to "migrate" the responses of localised targets within the CDI to their correct location and depth.

Attendees are required to bring their own laptop computer.

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## **ENERGY, CARBON CAPTURE & ENGINEERING WORKSHOPS**

### **E1: Seismic Facies Mapping within a Sequence Stratigraphic Framework**

Date: Monday, 16 August 2010 – Friday, 20 August 2010

(5 Days)

Time: 0830 – 1700 hours

Venue: Crowne Plaza, Darling Harbour

Cost: \$1300.00

Min No: 15 Max: 20

Presented by Rob Kirk, Director, Robkirkconsultants Pty Ltd, Nubeena, Tasmania.

This 5 day course is designed to give the attendee an understanding of seismic facies-what they are, how to map them, how to predict geology from them. A sequence stratigraphic framework is used to understand the geological cyclicity that we see in all basins and an emphasis on calibration with wells and outcrop will be given.

Common outputs from seismic facies studies, via palaeogeography maps, are the distribution of reservoirs and seals, and occasionally source rocks. You should be able to better risk the relevant parameters in the petroleum system.

This course may be considered as an analogue data base, referenced in an orderly manner to different geological environments-from the deep marine to fluvial-alluvial, including carbonates.

We will work on 20 or more seismic examples from around the world including North Slope Alaska, Gulf of Mexico, offshore West Africa, India, Vietnam, Malaysia, China and Exmouth, Canning, Great Australian Bight, Dampier and Barrow Basins.

Attendees are required to bring their own laptop computer.

### **E2: 3D Seismic survey design**

Date: Monday, 16 August 2010 – Friday, 20 August 2010  
(5 Days)

Time: 0830 – 1700 hours

Venue: Crowne Plaza, Darling Harbour

Cost: \$2100.00

Min No: 15      Max: 20

Presented by Gijs J.O. Vermeer, 3DSymSam - Geophysical Advice, The Netherlands.

The book "3-D seismic survey design" authored by the instructor and published by the Society of Exploration Geophysicists is used as a basis for this course. The main geometries used in 3D seismic data acquisition are orthogonal, parallel and areal geometry. The properties of these 3D acquisition geometries are analysed. Each geometry can be characterised by its basic subset. 3D symmetric sampling requires that the basic subset of each geometry is properly sampled, i.e., two of the four spatial coordinates are properly sampled. This approach maximizes spatial continuity (or: the absence of spatial discontinuities) ensuring optimal spatial filtering results including minimal migration artefacts. This theory is translated into practical guidelines for 3D seismic survey design. Case histories and modelling are used to illustrate the concepts and the relation between acquisition geometry and processing, in particular noise suppression and imaging.

The main subjects covered by the course are 2D seismic data acquisition, 3D acquisition geometries, relation between acquisition geometry and imaging, guidelines for 3D seismic survey design, implementation of nominal geometry, marine 3D acquisition (streamer acquisition and stationary receiver acquisition, time lapse), and converted-wave survey design.

This course gives a thorough theoretical background for practical 3D survey design without going into heavy mathematical detail, while not avoiding some practical, logistical aspects of survey design. It also provides the understanding of acquisition geometries which is necessary for optimal seismic processing. This course should be of interest for land and marine acquisition geophysicists and for processing geophysicists, both in research and in operations.

See <http://www.3dsymsam.nl/doku.php?id=courses> for brochure with a more detailed overview of this course.

Attendees are required to bring their own laptop computer.

### **E3: An Integrated Coalbed Methane Exploration Model: Defining Coal Seam Methane Sweetspots**

Date: Saturday, 21 August 2010

Time: 0830 – 1700 hours

Venue: Crowne Plaza, Darling Harbour

Cost: \$400.00  
Min No: 20 Max: 40

Presented by Andrew Scott, Altuda Energy Corporation, Texas.

This coalbed methane short course is valuable to geologists, hydrologists, geophysicists, and petroleum engineers, who want learn the basic fundamentals and/or review latest technologies that are applicable to coalbed methane exploration and resource development.

This one-day course is designed to review the basic fundamentals of coal seam methane for those new to the play, and to provide additional details about various aspects of coalbed methane exploration and development for those who are already familiar with coal seam methane. This course focuses on a geologic/hydrologic-centered approach to coal seam methane exploration and development of an integrated in a basin-scale coalbed methane exploration model.

The course will provide a “hands-on” overview of the fundamentals of coal seam methane including how coal reservoirs and coal seam methane production differs from conventional gas plays. A coalbed methane exploration model emphasizing key geologic and hydrologic controls on coal-gas production will be reviewed during the course. Each of the key factors affecting coal seam methane producibility will be reviewed in detail.. Additionally, the applicability of seismic data for predicting structural and stratigraphic attributes of coal seams and coal packages will be discussed

Several exercises will provide participants with practical hand-on experience. Topics covered in the short course include:

- Overview of the coalbed methane exploration model
- Coal Depositional Systems
- Tectonic and Structural Setting
- Seismic applications for CSM exploration
- Coal Rank and Gas Generation
- Gas Content Distribution
- Permeability and Hydrogeology

Attendees are required to bring their own laptop computer.

#### **E4: From Refraction Tomography to Refraction Attributed with the GRM & RCS**

Date: Friday, 27 August 2010  
Time: 0830 – 1700 hours  
Venue: Crowne Plaza, Darling Harbour  
Cost: \$500.00  
Min No: 12 Max: 20

Presented by Derecke Palmer, Senior Visiting Fellow in Geophysics, The University of New South Wales

Model and field case studies demonstrate that refraction tomograms are usually very similar to the starting models. Furthermore, refraction tomography does not recover features which are not present in the starting model, nor does it improve resolution. Therefore, it can be concluded that major effect of refraction tomography is largely cosmetic.

Detailed models of the regolith can be derived from refraction attributes computed from the head wave traveltimes and amplitudes with the GRM and from the RCS. A seismic attribute is any measure that helps to better visualize or quantify features of interest in seismic data.

In addition to seismic velocity, there are other attributes, which are useful measures of rock strength. The application of multivariate geostatistics to refraction attributes can facilitate more effective integration of geoscientific and engineering data for detailed geotechnical site characterization.

Refraction attributes can be included in joint inversion with other sets of geophysical data, such as land and airborne gravity data, and airborne electro-magnetic data. Relative density contrasts between the weathered and unweathered rock can be derived from the seismic velocities and the head wave amplitudes.

The RCS can image the region several hundred metres below the base of the weathering. Using regional seismic data recorded for Geoscience Australia, it will be shown that faults, which have no expression in the traveltimes data, can be recognized.

Attendees are required to bring their own laptop computer.

**E5: 2010 SEG / EAGE Distinguished Instructor Short Course – Geophysics under stress: Geomechanical Applications of Seismic and Borehole Acoustic Waves**

Date: Sunday, 22 August 2010  
Time: 0830 – 1700 hours  
Venue: Crowne Plaza, Darling Harbour  
Cost: \$210.00 SEG/EAEG member  
\$300.00 non member  
\$80.00 student  
Min No: 20 Max: 80

Presented by Colin Sayers, Schlumberger

The purpose of this course is to provide an overview of the sensitivity of elastic waves in the earth to the in-situ stress, pore pressure, and anisotropy of the rock fabric resulting from the depositional and stress history of the rock, and to introduce some of the applications of this sensitivity. The course will provide the basis for applying geophysics and rock physics solutions to geomechanical challenges in exploration, drilling and production. A variety of applications and real data examples will be presented, and particular emphasis will be placed on the rock physics basis underlying the use of geophysical data for solving geomechanical problems.

The following topics will be addressed:

- Introduction to the effects of stress in the earth.
- Sediment compaction and the state of stress in the earth.
- Pore pressure.
- Stress sensitivity of sandstones.
- Wellbore stability and wave velocities near a borehole.
- Reservoir geomechanics and 4D seismic monitoring.
- Fractured reservoirs.
- The seismic anisotropy of shales

The integrated nature of this course means that it is suitable for individuals from all subsurface disciplines including geophysics, geomechanics, rock physics, petrophysics, geology, geomodeling, and drilling, reservoir and petroleum engineering. The short-course presentation, limited to one-day, will provide an overview of the basic concepts and applications, and minimizes the use of mathematical developments. As a result, the course presentation does not require a theoretical background and can be attended by a broad section of working geoscientists and engineers interested in applying geophysical data to the solution of geomechanical problems. The course book will provide support for the course, and further extend some of the more technical considerations.

## **E6: Carbon Capture and Storage: Issues and Opportunities for the Petroleum Industry**

Date: Friday, 27 August 2010  
Time: 0830 – 1700 hours  
Venue: Crowne Plaza, Darling Harbour  
Cost: \$350.00  
Min No: 40      Max: 80

Presented by CCS experts from the Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) and its collaborating partners.

Burning fossil fuels for energy is a major source of CO<sub>2</sub> emissions to the atmosphere. Most anthropogenic CO<sub>2</sub> is emitted by coal fired power plants, though significant CO<sub>2</sub> is emitted through the production and separation of CO<sub>2</sub> – rich gas. The principle carbon management option of interest to the petroleum industry is carbon capture and storage (CCS). CCS involves the long-term storage of captured CO<sub>2</sub> emissions in subsurface geologic formations. CO<sub>2</sub> is captured at the source and transported from the source to the geologic storage site (typically via pipeline). The CO<sub>2</sub> is injected via conventional wells into the appropriate geologic reservoir. Migration of the geologically trapped CO<sub>2</sub> is carefully monitored and the quantity stored is regularly verified. Limited commercial-scale CCS already exists in a handful of projects around the world, some of these being for emission reduction, and others for enhanced oil recovery. However, to achieve the desired level of reductions in global emissions, the technology will need to be scaled-up and applied to a range of CO<sub>2</sub> sources and different geological storage formations. In addition, successful large-scale commercialization will have to include the technical aspects of CCS as well as issues of public acceptance, environmental, regulatory and liability constraints and the economics associated with carbon management. The petroleum sector has enormous opportunities to contribute to this emerging industry. This workshop briefly covers the basics of the CCS process and then explores in detail the challenges of the current technology of geological storage, including examples from working projects.