Anthony Gartrell (Ph.D)

SUMMARY

PETROLEUM GEOLOGIST

LOCATION: Australia (Perth)

TECHNICAL EXPERIENCE: 24 years

Shell, CSIRO, University of Western Australia and others

PROFILE

- Structural geologist with expertise in tectonics in a wide range of settings
- Sequence stratigraphy (especially in structurally active settings)
- Integrated Basin Studies, Play Based Exploration (PBE) and Petroleum Systems Analysis
- Play and prospect generation and evaluation

KEY SKILLS

- Geology, petroleum systems and plays in SE Asia and Australia
- Gross Depositional Environment (GDE) and play mapping
- 2D/3D seismic interpretation
- Structural restoration (2D/3D)
- Fault seal and trap integrity evaluation
- Integrated structural and charge history studies (fill/spill histories)
- Potential field data interpretation
- ArcGIS mapping

PROFESSIONAL EXPERIENCE

2013 – Present Principal Advisor Independent Consultant

Perth, WA

Geological consulting to a range of clients including: Shell Australia, Shell China, CGG, Rosneft, National Petroleum Company PNG, Petronas, Mubadala Petroleum.

Project leader for Regional Integrated Basin Study of Myanmar for Petronas (Nov. 2015 to June 2016). Managed 10 consultants and oversaw major technical program covering full range of discplines. Delivered significant insights into basin evolution and petroleum systems. Identified several new plays and prospects.

Provided expert structural geology, sequence stratigraphy and Play Based Exploration assessments in a range of basin and margins including Browse Basin, Bonaparte Basin, Carnarvon Basin, Pearl River Mouth Basin, Qiongdongnan Basin,Yinggehai Basin, Nam Con Son Basin, Papuan Foldbelt, Myanmar (offshore and onshore), Gulf of Thailand.

Identified and developed new plays in several of the above basins.

Develop SE Asia region-wide understanding of tectonics, basin architecture, evolution and depositional systems to analyse petroleum systems and identify and assess plays.

2015 – Present Senior Research Fellow The University of WA

Western Australia

Developed project proposal on Permo-Triassic Inversion Tectonics and Impacts on Sequence

Stratigraphic Architecture on the NW Shelf. Secured project funding from Inpex.

Principal researcher and co-supervisor of 3 Honours students working on the Inpex/UWA project.

2011 – 2013 Principal Regional Geologist Shell

Shell Australia, WA

Play Based Exploration expert and focal point for the whole of offshore Australia.

Lead North West Shelf margin-wide regional geology and Play Based Exploration prospectivity assessment.

Margin-wide identification and mapping of petroleum system and play elements for multiple play levels.

Provide geological input/constraints and worked closely with basin modelling specialist to construct regional basin model for hydrocarbon charge assessments.

Integrated PBE and basin modelling work to identify and developed several new plays in different basins on the margin (e.g. Carnarvon, Offshore Canning, Browse basins).

Provide regional geology and PBE support and products for new acreage and farm-in assessments.

Consultation to prospect evaluations on seismic interpretation, structural history, regional geology, trap development and integrity (e.g fault seal analysis) scenarios.

Knowledge holder for Australian offshore regional geology.

Mentor staff in areas of regional and structural geology.

2007 – 2011 Senior Explorationist Brunei Shell Petroleum

Brunei

Play Based Exploration/structural geology expert for BSP exploration department.

Co-lead Brunei Play Based Exploration project, recognised as best practice in Shell Group:

- Developed new tectono-stratigraphic framework and regional geological model for Brunei and NW Borneo.
- Construct petroleum systems model based on regional geology and hydrocarbon distribution.
- Regional seismic horizon mapping & integrated gravity data interpretation.
- Construction of gross depositional environment (GDE) maps linked to structural evolution (e.g. using regional 2D restorations).
- Construction of play risk maps.
- Identified and developed new plays and defined new leads and prospects (~30) in heavily explored and studied acreage.

Consultation to prospect evaluations on seismic interpretation, structural history, regional geology, trap development and integrity (e.g fault seal analysis) scenarios. Consult with team

members from various asset groups on structural issues.

2000 – 2007 Principal Research Scientist CSIRO

CSIRO Division of Petroleum Resources, Perth WA

Project lead for concept and startup phase of the Dynamic Fault Seal Behaviour in Petroleum Reservoirs consortium project.

Project lead for the Turbidite Research Initiative (TURI) Project. A multidisciplinary outcrop analogue project aimed at investigating fluid flow through faulted turbidite reservoir sequences in the Taranaki Basin, New Zealand.

Module leader for Computational Deformation and Fluid Flow module of the IPETS (Integrated Prediction and Evaluation of Traps and Seals) research consortium. Application and development of seismic and numerical modelling techniques to assess trap integrity issues fault reactivated settings.

Principal investigator for the Australian Petroleum Collaborative Research Centre (APCRC) Seals research consortium. Developed and applied new methodologies for integrating, 3D seismic interpretation, fault seal analysis, 3D structural restoration and fluid history techniques to assess fault seal and trap integrity issues in range of Australian basins.

Development and application of new methodologies for estimating palaeo-stress conditions from 3D seismic data.

Project leader for project involving physical analogue modelling of basin inversion processes in the Makassar Straits, offshore East Kalimantan. Investigated structural controls on petroleum systems and hydrocarbon distributions in the region.

2000 Structural Geologist NCP

National Centre for Petroleum, Adelaide SA

Performed a study of the structural geology and petroleum prospectivity of the offshore Clarence-Morton Basin (NSW)

Integrated seismic and aeromagnetic data (including spectral depth analysis) sets to develop interpretation

1995 - 1996 Structural Geologist / Interpreter WMC Resources

Perth WA

Performed a study on the structure of the Northern Carnarvon Basin (North West Shelf of Australia). Involved interpretation and integration of deep crustal seismic, aeromagnetic and gravity data from the region

Presented several new ideas for the structural evolution of the region and developed new play concepts

Consulted on specific structural problems encountered by other staff

Interpreted and mapped several key horizons in the greater Barrow Sub-basin for regional mapping and evaluation project

1993 - 1995 Research Officer The University of WA

Perth WA

Coordinated a collaborative research program between UWA and WMC Resources Petroleum Division investigating structural controls in the formation of the Barrow and Dampier Sub-basins

QUALIFICATIONS

1997-1999 Ph.D Geology & Geophysics

University of Western Australia

Project title - Extensional styles in rheologically stratified continental lithosphere: A study using examples from analogue models and field data from the North West Shelf, Australia

Developed new analogue modelling techniques.

Achieved significant new understandings of rifts, results published in 3 papers (Geology, Geological Society of America Memoir, Australian Journal of Earth Sciences)

1989-1993 Bachelor of Science (Hon) Geology & Geophysics

University of Western Australia

First Class Honours

Project title- Transfer structures in continental extension

COMPUTING / SOFTWARE SKILLS

Petrel, Kingdom, ArcGIS, 123DI, Traptester, 2D/3DMove, Geoquest (IESX, Charisma) seismic systems, Petrosys mapping system, grasp of basic UNIX system and commands

Used a wide range of PC and Macintosh software packages including Word, Excel, Mail, PowerPoint, Freehand, Corel Draw etc

TRAINING COURSES

Shell Exploration Leaders course, Tremp, Spain.

Applied Sequence Stratigraphy, Examples from the NW Shelf, Australia by Simon Sturrock.

Stratigraphic and Sedimentological Controls on Hydrocarbon Productivity: Core Examples from the NW Shelf of Australia by Simon Lang

Turbidite Systems & Their Response to Thrust and Fold Structures (Pyrenees, Spain) field course by Josep Munoz and Pau Arbues

Deltaic to Deep Water Depositional Systems of NW Borneo - Concepts & Models for Reservoir Prediction field course by Howard Johnson

Pore Pressure In the Subsurface course by Richard Swarbrick

Depositional Architecture Shell In-house course by Maarten Wiemer

ArcGIS Shell In-house course run by Ryan Brothers

Play Based Exploration Shell In-house course run by Larry Garmezy

123DI Classic Shell in-house course run by Dan Pescu

Traptester 5 training course by Dr Peter Bretan, Badleys (November 2002)

Fluid Flow & Ore Localisation in a Seismogenic Framework course by Prof. Rick Sibson, University of Otago, and Prof. Steve Cox, Australian National University (September 2002)

The Petroleum System - An Investigative Technique to Reduce Exploration Risk by Les Magoon, USGS, PESA Visiting Lecturer (November 2001)

Computer Aided Structural Balancing and Restoration with 3DMove and 2DMove by Midland Valley Exploration (November 2000)

Seismic Interpretation Using Charisma training course by Geoquest (June 2000)

Reservoir characterisation for E&P course, by Robert Sneider, ESSO Distinguished Lecturer (August 1997)

Section balancing course run by Dr Thomas Flottman, University of Adelaide (October 1997)

Extensional tectonics workshop, by Dr Matha Withjack, Mobil Research and Development Corporation (September 1996)

Geoquest (IESX) seismic interpretation software course by Schlumberger (January 1996)

Petrosys mapping course (February 1996)

Sequence stratigraphy short course, by John Sangree (August 1995)

SCHOLARSHIPS AND AWARDS

Australian Postgraduate Award (1997)

Minerals and Energy Research Institution of Western Australia Supplementary Scholarship Award (1997)

Australian Geological Survey Organisation Silver Jubilee Commemorative Award (1999)

Runner-up best paper for Australian Journal of Earth Sciences (2000)

PROFESSIONAL ORGANISATIONS

Member of the AAPG, EAGE and PESA societies.

JOURNAL PUBLICATIONS

Gartrell, A. P., 1997, Evolution of rift basins and low-angle detachments in multilayer analog models: Geology, v. 25, p. 615-618.

Gartrell, A. P., 2000, Rheological controls on extensional styles and the structural evolution of the Northern Carnarvon Basin, North West Shelf, Australia: Australian Journal of Earth Sciences, v. 47, p. 231-244.

Gartrell, A. P., 2001, Crustal rheology and its effect on rift basin styles. In Koyi, H. A. and Mancktelow, N. S. (eds): Geolocical Society of America Memoir, v. 193, p. 221-233.

Gartrell, A., Lisk, M., & Undershultz, J., 2002, Controls on the trap integrity of the Skua Oil Field, Timor Sea. In Keep, M. and Moss, S. J. The Sedimentary Basins of Western Australia 3: Proceedings of Petroleum Exploration Society of Australia. p. 390-407. Perth, Australia.

Gartrell, A. P., Zhang, Y., Lisk, M., & Dewhurst, D., 2003, Enhanced hydrocarbon leakage at fault intersections: an example from the Timor Sea, Northwest Shelf, Australia: Journal of Geochemical Exploration, v. 78-79, p. 361-365.

Gartrell, A., Zhang, Y., Lisk, M., & Dewhurst, D., 2004, Fault intersections as critical hydrocarbon leakage zones, Numerical modelling of an example from the Timor Sea, Australia: Marine and Petroleum Geology, v. 21, p. 1165-1179.

Johnson, L., Lisk, M., **Gartrell, A.**, & Boult, P., 2004, Calibration of charge and retention models for the Gidgealpa oilfield: implications for seal potential in the Eromanga Basin. In P. J. Boult, D. R. Johns, & S. C. Lang (Eds.): Eastern Australian Basins Symposium II. Petroleum Exploration Society of Australia, p. 461-471.

Gartrell, A., Hudson, C., & Evans, B., 2005, The influence of basement faults during extension oblique inversion of the Makassar Straits Rift System: Insights from analog models: AAPG Bulletin, v. 89, p. 495-506.

Gartrell, A., Bailey, W. R., & Brincat, M., 2005, Strain localisation and trap geometry as key controls on hydrocarbon preservation in the Laminaria High area. APPEA Journal, v. 45, p. 477-492.

Gartrell, A. P., & Lisk, M., 2005, Potential new method for palaeo-stress estimation by combining 3D fault restoration and fault slip Inversion techniques: First test on the Skua Field, Timor Sea. In Kaldi, J. K. & Boult, P. (eds), Evaluating Hydrocarbon Sealing Potential of Faults and Caprocks, AAPG Hedberg Series, v. 2, p. 23-36.

Brincat, M., **Gartrell, A.**, Bailey, W., Lisk, M., Johnson, L., & Dewhurst, D., 2006, An integrated evaluation of hydrocarbon charge and retention at the Griffin, Chinook and Scindian oil and gas fields, Barrow Sub-basin, North West Shelf, Australia: AAPG Bulletin, v. 90, p. 1359-1380.

Gartrell, A., & Bailey, W., 2006, A new model for assessing trap integrity and oil preservation risks associated with post-rift fault reactivation in the Timor Sea: AAPG Bulletin, v. 90, p. 1921-1944.

Zhang, Y., **Gartrell, A.**, Underschultz, J.R. & Dewhurst, D.N., 2009, Numerical modelling of strain localisation and fluid flow during extensional fault reactivation: Implications for hydrocarbon preservation. Journal of Structural Geology, v. 31, p. 315-327.

Langhi, L., Zhang, Y., **Gartrell, A.**, 2010, Evaluation of hydrocarbon trap integrity and fault-seal potential during fault reactivation using coupled deformation and fluid flow modelling and 3D seismic. AAPG Bulletin, v. 94, p. 567-591.

Zhang, Y.; Underschultz, J.R.; **Gartrell, A.**; Dewhurst, D.N.; Langhi, L., 2011, Effects of regional fluid pressure gradients on strain localisation and fluid flow during extensional fault reactivation. Journal of Structural Geology, v. 28, p. 1703-1713.

Langhi, L., Zhang, Y., **Gartrell, A.**, Underschultz, J. R., Dewhurst, D. N., Lisk, M. & Brincat, M., 2013 , Mechanism of up-fault seepage and seismic expression of discharge sites from the Timor Sea. In F. Aminzadeh, T.B. Berge, D.L. Connolly, Hydrocarbon Seepage: From Souce to Surface, Geophysical Developments Series, Society of Exploration Geophysicists and American Association of Petroleum Geologists, pp. 11-41.

Gartrell, A., Torres, J., Dixon, M., Keep, M., 2016, Mesozoic rift onset and its impact on the sequence stratigraphic architecture of the Northern Carnarvon Basin. APPEA Journal.

PRESENTATIONS / ABSTRACTS

Gartrell A.P., Harris L. B. & Dentith M. C., 1994, Sandbox analogue models of transfer zone formation above stepped listric detachment faults. SGTSG Conference Abstracts No. 36.

Gartrell A.P., Harris L. B. & Dentith M. C., 1994, Sandbox analogue models of transfer zone formation above stepped listric detachment faults. AGC Conference Abstracts No. 37.

Gartrell A.P., 1997, The Evolution of rift basins and low-angle detachments in multi-layer analog models. AAPG Annual Convention Abstracts, V. 6, Dallas.

Gartrell A.P., 1997, The Evolution of rift basins and low-angle detachments in multi-layer analog models. APPEA Conference Abstracts, V. 37, Melbourne.

Invited seminar for Australian Geological Survey (Canberra) on Rheological Controls on Extensional Styles: Application to the North West Shelf (August 1997).

Gartrell, A.P., 1998, Modes of extension, lower crustal flow and the evolution of the North West Shelf. The Specialist Group In Tectonics and Structural Geology Field Conference, Geological Society of Australia Abstracts Series, No. 53, Halls Gap.

Gartrell A.P., 1998, Lower crustal flow and its effect on extensional styles. Australian Geological Convention Abstracts No. 49, Townsville.

Gartrell, A.P., Numerical and Analogue Modelling of Extensional Basins: Applications in the Northern Carnarvon Basin, PESA (WA) Technical Luncheon Meeting (May 2000).

Gartrell, A., Lisk, M., & Undershultz, J., 2002, Controls on the trap integrity of the Skua Oil Field, Timor Sea. The Sedimentary Basins of Western Australia 3 Conference, Perth, Australia.

Lisk, M., Krieger, F., Gartrell, A., & George, S., 2002, My life before I was compressed: Fluid flow histories on the northern Australian convergent margin. In Deformation History, Fluid Flow Reconstruction and Reservoir Appraisal in Foreland Fold and Thrust Belts, AAPG Hedberg Conference, Palermo-Mondello, Italy.

Gartrell, A., & Lisk M., 2002, Stress history analysis from 3D restoration of faults: Initial results and implications for fault reactivation and hydrocarbon leakage in the Timor Sea region, Australia. In Evaluating the Hydrocarbon Sealing Potential of Faults and Caprocks, AAPG Hedberg Conference, Barossa Valley, South Australia.

Gartrell, A, & Lisk, M., 2003, Utilisation of 3D structural restoration technology to address fault seal issues in the Timor Sea. The Specialist Group in Tectonics and Structural Geology Field Conference, Kalbarri, p. 91.

Gartrell, A., Hudson, C., & Evans, B., 2004, Oblique Inversion of the Makassar Straits Rift System and the Role of Basement Faults: Insights from Analog Models: AAPG Annual Meeting, Dallas, 2004.

Gartrell, A., & Lisk, M., 2004, Changes in Late Tertiary Stress Conditions in the Timor Sea: Implications for Hydrocarbon Exploration. Tectonic Studies Group meeting, New Dynamics in Paleostress Analysis, London.

Underschultz, J, Gartrell, A., Johnson, L., Brincat, M., 2004, Oil-fill history of two reservoirs with an upper waste zone - Implications for Production: AAPG International Conference, Cancun.

Gartrell, A., Bailey, W. R., & Brincat, M., 2005, Strain localisation and trap geometry as key controls on hydrocarbon preservation in the Laminaria High area: APPEA Conference Abstracts. Perth.

Brincat, M, Gartrell, A., Bailey, W., Lisk, M., Johnson, L., & Dewhurst, D. 2005, Hydrocarbon remigration around the Griffin Area Fields, Barrow Sub-basin: Implications for future prospectivity. APPEA Conference Abstracts. Perth.

Lisk, M., Gartrell, A., Bailey, W., Underschultz, J., Brincat, M., & Johnson, L. 2005, Integrated structural and fluid-flow histories: A TEAM approach to addressing hydrocarbon charge and preservation. APPEA Conference Abstracts. Perth.

Johnson, L, Underschultz, J., Lisk, M., Gartrell, A., & Boult, P., 2005 Filling and leakage of a complex reservoir, an example from the Gidgealpa Field. APPEA Conference Abstracts. Perth.

Bailey, W. R., Gartrell, A., & Brincat, M., 2005, Oil preservation controlled by strain partitioning: new insights into trap integrity prediction in a reactivated setting, Laminaria High, Australian NW Shelf. AAPG Annual Convention, Calgary (2005).

Gartrell, A., Evans, B., Woodward, D., & Browne, 2006, Multidisciplinary examination of a deep-water turbidite reservoir outcrop analogue, Taranaki Basin, New Zealand. AAPG International Conference, Perth (2006).

Gartrell, A., Zhang, Y., Bailey, W., & Brincat, M., 2006, Fault reactivation and hydrocarbon preservation potential: (fault) Size does matter. AAPG International Conference, Perth (2006).

Lisk, M., Gartrell, A., Bailey, W., & Brincat, M., 2006, A holistic model to describe charge and retention history of the Northern Bonaparte Basin, Australia. AAPG International Conference, Perth (2006).

Gartrell, A., Clennell, B., and Zhang, Y., 2007, Changes In trap Integrity during the evolution of reactivated faults In the Timor Sea, North West Shelf, Australia. AAPG International Conference, Athens (2007).

Dyt, C. P., Strand, J., Gartrell, A. and Langhi, L., 2007, An automated approach to determining regional scale hydrocarbon loss/preservation due to fault reactivation. An example from the Timor Sea. AAPG International Conference, Athens (2007).

Langhi, L., Gartrell, A. and Strand, J., 2007, Fault kinematic analysis and 3D characterisation of re-migration seismic features: Two key elements to assess and predict fault seal integrity within reactivated areas. AAPG International Conference, Athens (2007).

Dewhurst, D., Clennell, B., Strand, J., Underschultz, J., Gartrell., A. and Bailey, W., 2007. Clay rich fault gouge in low clay content reservoirs: Implications for predictive fault seal evaluation. AAPG Hedberg Conference, The Hague, The Netherlands (2007).

Torres, J., Gartrell, A. and Hoggmascall, N., 2011, Redefining a sequence stratigraphic framework for the Miocene to present in Brunei Darussalam: Roles of local tectonics, eustacy and sediment supply. IPTC Conference, Bankok (2011)

Gartrell, A., Torres, J. and Hoggmascall, N., 2012. A regional approach to understanding basin evolution and play systematics in Brunei - Unearthing new opportunities in a mature basin (extended abstract). AAPG International Conference, Singapore (2012).

Connors, K., Barnadot, M-A, Harun, S.N. F., Gartrell, A., Romine, K., Jorand, C, Pryer, L., Insights on the Mesozoic to Cenozoic evolution Myanmar. SEAPEX 2017.

Gartrell, A., Torres, J., Dixon, M. Keep, M., 2016. Structural controls on sequence stratigraphic architecture with examples from the NW Shelf and NW Borneo. PESA Evening Talk, Perth (2016).

REFERENCES AVAILABLE ON REQUEST