

CURRICULUM VITAE

ROBERT JAMES JOHN HARDY

OVERVIEW:

I am currently working as a research consultant to the hydrocarbon industry. My research interests include multiple suppression, depth imaging, electronic learning, basin evolution and seismic oceanography. My services include seismic processing consultancy, seismic survey planning and geophysical research.

I currently teach training courses on seismic processing and reservoir geophysics and I have trained around 500 oil industry professionals in UK, US, Norway, India, Egypt, Libya and Canada and have received excellent reviews. The principal training course features a unique web-based seismic data analysis module and helps to teach interpreters advanced geophysical techniques. The course is available as a 5 day version but can be customized to suit client needs.

Throughout my career I have been service focused, results orientated, extremely industrious and shown innovation at all levels. I have been an influence within industry partnerships and academic research projects I have been involved with. A major strength has been the timely application of appropriate geophysical technology to solve interpretation problems. I have considerable experience in all aspects of the design, acquisition and processing of 2D and 3D seismic data and have worked on over 500 geophysical projects including survey design, multiple suppression, AVO, impedance inversion and prestack depth migration. My consultancy services are often requested by the oil industry and I am actively seeking involvement with "difficult" projects which may demand a more academic approach.

PERSONAL:

Born 4th April 1965, UK citizen.

Married and in good health. Based in Dublin, available to travel.

QUALIFICATIONS:

- 1986-1990 **Ph.D. Geophysics.** University of Cambridge.
Title "Imaging the crystalline crust in deep water using multi-channel seismics."
- 1983-1986 **B.Sc. Geology and Geophysics 1st Class.** University of Durham.
Awarded Geological sciences scholarship (1985)
Awarded Geophysics prize (1986).
Awarded Shell studentship in geophysics for Ph.D. study.
- 1981-1983 **GCE A levels.** Totton 6th Form College, Southampton.
Mathematics (B), Physics (B), Chemistry (A), Geography (B).
College chemistry prize. Grade 6 French Horn. Driving Licence.
- 1976-1981 **10 GCE O levels.** Noadswood Comprehensive School, Southampton.

EXPERIENCE:

- 2009- **Tonnta Energy Limited.**
I recently established a Dublin based seismic consultancy specializing in seismic survey design, modeling, research and "difficult" seismic processing projects. Recent projects include a research study of imaging beneath complex near surface (major independent), research into interpolation and seismic acquisition (major independent), project management of two 3D seismic surveys (small independent), re-processing of 2D land data (small independent), suppression of low frequency ground roll (contractor) and the investigation of water layer statics on seismic reflection data processing (research).
- 2004-2008 **Industrial Experience**
I developed an advanced seismic processing course aimed at seismic interpreters using web-based processing technology. My consultancy services in seismic processing and survey design were frequently requested by the hydrocarbon industry and I worked on several acquisition and processing projects in Poland and Ireland.

- 2003-2008 **Research Associate.**
I jointly formed a basin analysis group within the Geology Department of Trinity College Dublin and established an industry class seismic processing, modeling and interpretation system. I contributed to teaching geophysics and research programs in multiple suppression, imaging and attribute interpretation. I co-supervised five Ph.D. students and brought in over EU500k in research funds.
- 2002 **Geophysical Consultant.**
I left Hess to broaden my horizons and experience the technical geophysical challenges of either working with a contractor or as a consultant. After choosing a six month career break I set up a company and was based in London working on a four month contract for a small geophysical company based in Houston. During the contract I learnt, evaluated and made recommendations on a 3rd party tomographic software package, wrote training material and trained Houston based staff. I authored reports on the geophysical business in the UKCS in terms of marketing and recruitment strategy, software specifications and potential partnerships. I also presented at EAGE on company behalf. I was also interpreting 3D seismic surveys for velocity model building purposes. Several other smaller contracts were also completed during this period.
- 1990-2001 **Amerada Hess Limited, London.**
Over the eleven years at Amerada Hess I established and eventually ran the geophysical operations group in London which latterly included responsibility for digital data management. The department provided a service to international, exploration, production and development and reported to the research center in Houston. I have worked on the geophysical aspects of all Hess international acreage and exploration opportunities in the North Sea, West of Shetland, Faroes, Norway, Denmark, Algeria, Brasil, Gabon, Malaysia, Falklands, Thailand, Australia, Indonesia and Vietnam.
- 1999-2001 **Manager Geoscience Technology Northwest Europe and International.**
Expanded geophysics group to 6 staff and assumed additional responsibility for 6 digital data management staff under coordinated budget of £2M reporting to Houston. Project managed conversion of multi-site corporate database from Landmark to Geoquest, re-structured new data team of dedicated staff rather than contractors including new procedures and responsibilities. Involved in transition team for unsuccessful corporate merger. Planned and supervised several high quality 3D & 4D dedicated surveys on Hess development assets including 2 4D surveys for enhanced imaging of reservoir targets. Revamped corporation geoscience web content. Identified need for and established multidisciplinary team incorporating specialised seismic attributes for complex play in north sea resulting in improved appraisal strategy and successful drilling. Geophysical involvement with successful Malaysian exploration campaign and pioneered successful use of psdm in Vietnam acreage including technology presentations to international partners.
- 1997-1998 **Senior Staff Geophysicist.**
Continued existing responsibilities formalised to co-ordinate operations group (three permanent staff). Creation of operations web page, including reporting pages, software details and 3D survey database. Completed and presented web and Promax based processing course for interpreters. Planned and supervised 2D bottom cable dual-sensor and 4-component surveys (latter for imaging beneath gas clouds and lithology detection) and two-boat operations (sub-basalt imaging using refractions). Presentation of AH geophysical technology to international groups including Brasil. Ran several high profile multi- group 3D projects and was involved in equity determination.
- 1995-1996 **Staff Geophysicist.**
Supervised additional staff member and upgraded in-house center to IBM SP2 system. Developed velocity model building methodology and performed 10 post-stack depth migration projects, numerous in-house 2D reprocessing projects and 5 3D prestack depth migration projects dealing with complex salt swells, gas cloud problems and structural imaging.
- 1993-1994 **Senior Geophysicist.**
Designed parameters and supervised processing of 5 3D surveys including high-spec development 3D. Continued expansion of department by recruitment of additional staff and installed IBM RS6000 system. In conjunction with Horizon designed first onboard full fold 3D processing including onboard migration.
- 1991-1992 **Special Projects Geophysicist.**

Supervised processing of 6 3D surveys, several 2D surveys and 3D survey for Scott equity. Completion of over 100 in-house special projects in order to assist exploration teams, particularly for licensing rounds. In conjunction with Horizon commissioned first onboard 3D near trace cube processing including migration. Continued liaison with AHC research center and wrote interactive X-windows front-end for in-house software.

- 1990 **Geophysicist. Amerada Hess Limited.**
Geophysical software evaluation and installation. Supervised processing of five exploration 3D surveys and several 2D surveys. Established AHL in-house processing using Apollo DN10000 supercomputer and in-house AHC software. Several additional modules written to support local applications.

EXPERIENCE (pre 1990):

- 1989 **CGG London.** Two weeks processing BIRPS data with Dr. I.F. Jones.
1988 **BIRPS.** Participated as part of field crew for shear wave experiment, Durham.
1985 & 1986 **Shell UK Expro.** Palynology department developing new Eocene subdivision.

COMPUTING EXPERIENCE:

Systems	VMS, UNIX (all flavors, 12 years), DOS.
Hardware	VAX & Convex mainframes. SGI, SUN, IBM (RS & SP2), Apollo, Linux cluster.
Programming	Basic, Fortran, C, X-Windows, awk, shell scripts, HTML, Javascript.
Processing	Merlin SKS, CGG Geovecteur, Simon (AHC), Promax, Nutec Prima, Seismic Unix
Software	Sirius, AVO, Strata, GX2, 3D AIMS, Velit, LogM. Landmark, Geoquest (expert), Finder, CPS, standard windows applications.

PROFESSIONAL BODIES: Member of PESGB, EAGE and SEG.

OTHER: Research Associate, Dublin Institute of Advanced Studies
ICHEC Science Council Committee member, 2006-2008

SIGNIFICANT PUBLICATIONS:

- 2010 **Seismic imaging of variable water layer sound speed in Rockall Trough, NE Atlantic and implications for seismic surveying in deep water**, Jones, S.M., Sutton, C., Hardy, R. J. J., and Hardy, D., From: VINING, B. A. & PICKERING S. C. (eds) Petroleum Geology: From Mature Basins to New Frontiers – Proceedings of the 7th Petroleum Geology Conference, 1–10. DOI: 10.1144/0070000
- 2010 **New methods of improving seismic data to aid understanding of passive margin evolution: A series of case histories from offshore west of Ireland**, Hardy, R.J.J., Jones, S.M., Querendez, E., Biancotto, F., O'Sullivan, J., From: VINING, B. A. & PICKERING S. C. (eds) Petroleum Geology: From Mature Basins to New Frontiers – Proceedings of the 7th Petroleum Geology Conference, 1–10. DOI: 10.1144/0070000
- 2009 **Identifying and Quantifying the Effects of Water Column Velocity Variation on Surface Related Multiple Elimination**, Hardy, R., and Jones, S., 71st Mtg. Eur. Assn. Geosci. Eng.
- 2008 **The new synergy between seismic reflection imaging and oceanography**, Jones, S., Hardy, R., Hobbs, R.W., Hardy, D., First Break, 26, 51-57.
- 2008 **Imaging beneath igneous sills using reverse time depth migration**, Hardy, R., Bednar, B., Bednar, C., Fernandes, K., Jones, S., 70th Mtg. Eur. Assn. Geosci. Eng.

- 2007 **Assessing the Value of Seismic Re-Processing and Uncertainty of Seismic Processing**, Hardy, R., 69th Mtg. Eur. Assn. Geosci. Eng.
- 2007 **Imaging the water column using seismic reflection data**, Hardy, R., Jones, S.M., and Hobbs, R.W., 69th Mtg. Eur. Assn. Geosci. Eng.
- 2007 **Using seismic velocity to estimate denudation West of Ireland**, Hardy, R., and Hardy, D., 69th Mtg. Eur. Assn. Geosci. Eng.
- 2006 **Identification, interpretation and attenuation of interbed multiples from West Africa**, Hardy, R., and Mongan, J., 68th Mtg. Eur. Assn. Geosci. Eng.
- 2006 **An interpreters toolkit for multiple reflections**, Hardy, R., 68th Mtg. Eur. Assn. Geosci. Eng.
- 2005 **A strategy for multiple suppression**, Hardy R.J.J. & Hobbs, R.W., Multiple Attenuation – Geophysics reprint series No.23, Soc. Expl. Geophys (Eds. Weglein, A.B., and Dragoset, W.H).
- 2005 **Seismic model parameter estimation using least squares migration**, Miller, M., Kingsbury, N., Hobbs, R.W., & Hardy, R.J.J., 67th Mtg. EAGE, Expanded abstracts.
- 2004 **Case study of multiple identification using fast waveform modeling**, Hardy, R.J.J. & Hobbs, R.W., 74th Ann, Internat. Mtg.: Soc. Of Expl. Geophys., 448-451.
- 2003 **The technical challenges to exploration and development of the Kopervik Fairway, Outer Moray Firth, UK**, Argent, J., Blight, R., Cox, P., Hardy, R., Law, A., Smallwood, J., Walter, D., "Petroleum geology of North West Europe: Proceedings of the 6th Conference", Geol. Soc. London (Eds. A. Doré).
- 1997 **3D migration velocity analysis using a genetic algorithm**, Perrot, J., Singh, S.C., Begat, S.L. & Hardy, R.J.J., Soc. Expl. Geophys., 68th Ann. Internat. Mtg.
- 1994 **The changing role of onboard processing**, Hardy, R.J.J. & Haskey, P., 56th Mtg. EAEG, Expanded Abstracts, Paper B029.
- 1994 **Monitoring compaction and compressibility changes in offshore chalk reservoirs**, Dean, G., Hardy, R. & Eltvik, P., *SPE Formation Evaluation*, 73-76.
- 1991 **A strategy for multiple suppression**, Hardy R.J.J. & Hobbs, R.W., *First Break*, 9,(4) 139-144.
- 1990 **The reliability of multiple suppression**, Hardy R.J.J., Hobbs, R.W., Warner, M.R. & Jones, I.F., *First Break*, 8, (8) 297-304.
- 1990 **Imaging the lower crust in deep water**, Hardy, R.J.J., Warner, M.R. & The BIRPS Group, *Tectonophysics*, 173, 141-143.
- 1990 **The sea-floor multiple problem in multichannel seismic reflection data acquired on the Antarctic continental shelf: its causes and treatment**, Larter, R.D., Cunningham, A.P., & Hardy, R.J.J., *ANTOSTRAT, USGS Open File Report*, 90-309, 187-194.
- 1989 **Labeling long-period multiple reflections**, Hardy R.J.J., Warner, M.R., & Hobbs, R.W., *Geophysics*, 54, 122-126.

OTHER PUBLICATIONS

- 2008 **Mixing Oil and Water: a new synergy between seismic reflection imaging and oceanography**, Hardy, R., Jones, S., Hardy, D., Petex 2008
- 2008 **Novel uses of seismic data to reduce exploration uncertainty West of Ireland**, Hardy, R., Querendez, E., Jones, S., Fernandez, K., Hardy, D., Petex 2008
- 2006 **An interpreters toolkit for multiple reflections**, Hardy, R., Petex 2006

- 2006 **Case History: Addressing Seismic Data Quality West of Ireland**, Hardy, D., Querendez, E. & Hardy, R., Petex 2006
- 2004 **Positioning of faults on seismic data**, Hardy, R.J.J., Stewart, S.A., Hobbs, R.W., & White, N.J., Petex 2004.
- 2004 **Case history of seismic modelling using fast waveform modelling**. Hardy, R.J.J. & Hobbs, R.W., Petex 2004.
- 2003 **Case study of multiple identification using fast waveform modeling**, Hardy, R.J.J., Hobbs, R.W., & Fairhead, S.F., 65th Mtg.: Eur. Assn. Geosci. Eng.
- 2003 **Applications of 3D seismic modeling to hydrocarbon and mineral exploration**, Hobbs, R.W., Hardy, R.J.J., & Drummond, B.R., PESGB: geophysical technology – present and future capabilities.
- 1995 **Reducing risk using onboard 3D processing technology**, Euroforum conference, Aberdeen, “*Innovations in Cost effective Exploration and Development*”
- 1995 **Advanced processing techniques net further finds for Amerada Hess**, *Offshore*, April.
- 1994 **Comparison of 2D & 3D seismic data as an exploration/appraisal tool in the Mesozoic back basin play**, DTI sponsored West of Shetland and Tranche Symposium, “*Reducing risk in Frontier Areas*”.
- 1992 **Applications of real-time 3D processing**, PETEX 1992: “*3D Seismic - realising the value*”.
- 1992 **Workstation based interpretive processing**, Hardy, R.J.J & Cullen, E., NPF Conference, Kristiansand. “*Seismic Processing and Interpretation - the integrated approach*”.
- 1991 **Multiple suppression in deep water**, Hardy, R.J.J. & Hobbs, R.W., *AGU Geodynamics Series*, **22**, 383-390.