

Reinaldo J. Michelena, PhD

SUMMARY OF QUALIFICATIONS

- Fifteen years dedicated to research, development, and application of innovative seismic methods to help reservoir delineation and characterization, from programming and testing of novel algorithms to integrated interpretation of field data results.
 - Demonstrated ability to plan, initiate, follow, participate actively, and complete successfully multidisciplinary, complex technical projects started from scratch.
 - Dynamic team builder, constantly trying new ways to promote integration and motivation toward success
 - Emphasis on achieving solutions that are added value from the business point of view rather than solutions that are perfect from the technical point of view.
 - Strong negotiation skills.
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EXPERIENCE

- 2001- 2003 PDVSA – Intevp, Research and Technological Support Center
Senior Scientist for Reservoir Delineation and Characterization
- Led a multidisciplinary team of geologists, geochemists, geophysicists, petrophysicists, reservoir engineers, and geostatisticians that included senior researchers, technicians, and administrative and human resources assistants (90 employees).
 - Responsible for the generation of a portfolio of all technical activities of the group, from long term research to technical services. I managed an annual budget of the order of \$ 10 MMUSD.
 - Designed a catalog of oil reservoirs for PDVSA that included not only geological aspects about them, but also recommendations of ways to study them depending on production stage, available data, and geological environment.
 - Liaison between PDVSA–Intevp and international organizations (CoreLabs, CGG, Geocenter, Stanford University) for the planning of co-sponsored projects. I also participated actively in some of these projects by proposing and implementing ideas about seismic attribute analysis with CoreLab and processing and interpretation of multicomponent data with Geocenter and CGG.
- 2000 CGG Americas Inc., Houston, TX
Visiting scientist (seven months).
- Developed a method to perform automatic correlations between PP and PS records. This method was tested successfully with 3C data from the Orinoco heavy Oil Belt.
- 1998 – 1999 PDVSA- Intevp, Research and Technological Support Center.
Project Leader: Acquisition and processing of seismic data in Lake Maracaibo (Budget \$800K USD/y)
- Headed a team of 10 researchers in the improvement of the data quality in various areas of the lake where complex, gassy and muddy sea bottom, gas chimneys, and strong attenuation and reverberations cause strong degradation of seismic signals. Activities emphasized the characterization of the lake bottom in terms of thickness, stratigraphical variations, seismic velocities, density, and attenuation.

1993 – 2000

PDVSA- Intevp, Research and Technological Support Center.

Project Leader: Seismic techniques for reservoir characterization (Budget \$1MM USD/y.)

- Involved in all stages of the work performed in the area of multicomponent surface seismic, from acquisition of land data to processing and interpretation. I applied successfully innovative ideas for the integrated interpretation of 3C data using structural, lithological, production, and fracture information. The areas of application where Maporal Field (south-western Venezuela) and La Paz field (western Venezuela).
- Developed new methods to estimate fracture orientation from 2D and 3D converted wave data. The results of these methods were compared successfully with results obtained from azimuthal AVO analysis of P-wave data in Maporal Field. Horizontal well trajectories were designed using these results.
- Developed the theory and participated in the implementation of an algorithm to perform post stack stratigraphic inversion of converted waves. The results of the inversion of PP and PS data are P-wave velocities, S-wave velocities and densities in the area of interest. The algorithm was tested successfully in the Zuata Field located in the Orinoco Heavy Oil Belt and helped in the identification of shales and sands with similar acoustic impedance but significantly different densities.
- Developed and successfully tested techniques for summarizing the information contained in many seismic attribute maps (similarity analysis). These methods are commonly used within PDVSA and were crucial in the discovery of a giant field (Ceuta-Tomoporo) in western Venezuela. I also developed techniques for facies recognition based on the estimation of fractal dimension and highest frequency content of seismic data.
- Developed and successfully tested a nonlinear method to estimate reservoir properties from multiple seismic attributes. The method is much faster than geostatistical estimations using seismic attributes and requires less well information. My method has been applied with success in various fields in western Venezuela to estimate sand content and volume of shale.
- Performed 3D azimuthal AVO to estimate fracture orientation from conventional P wave data. The emphasis of my work has been on the joint interpretation of azimuthal AVO results with information from break out orientation logs, structural trends, lithological variations, production information, and local stress variations. As I said before, I have compared successfully fracture orientations obtained from 3D azimuthal AVO with fracture orientations obtained from 2D multicomponent seismic data.
- Designed, developed and tested a prototype of an explosive source to generate shear waves. Analysis of field seismic data is still in progress.
- Represented PDVSA-Intevp in technology and business deals with the following companies: Paradigm Geophysical, Geocenter, CGG, and CoreLab. These deals resulted in long term cooperative agreements aimed to introduce new technologies from these companies to PDVSA and transfer Intevp's proprietary seismic technologies to PDVSA's operations.
- Chaired the Steering Committee of the Stanford Exploration Project (Stanford University) and also represented PDVSA-Intevp in the Reservoir Delineation Consortium of the Earth Resources Laboratory (Massachusetts Institute of Technology). Initiated and followed for three years the advances in the

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- Consortium for Research in Elastic Wave Exploration Seismology (University of Calgary).
- Industrial advisor of Intevep's master and PhD students in the following universities: Stanford University, Massachusetts Institute of Technology, University of Illinois at Urbana-Champaign, University of Texas at Austin, Texas A&M, and University of Houston.
- 1995 – 2000 PDVSA - Intevep, Research and Technological Support Center.
Skill coordinator in the area of multicomponent seismic:
- Mentoring of junior professionals (6).
 - Responsible for career planning and training. During this period, 5 professionals were sent to universities in the US and Canada to complete masters and PhDs in 3C seismic.
 - Responsible for coordinating business needs with research activities in the area of 3C seismic.
- 1995 - 1999 PDVSA - Intevep, Research and Technological Support Center.
Project Advisor: Estimation of elastic constants in anisotropic media:
- Proposed ellipsoidal approximations of phase and group velocities to estimate elastic parameters in orthorhombic media (as an extension of the PhD work). These approximations were used in the implementation of tomographic methods to estimate seismic velocities VSP multicomponent data.
- 1995 - 1996 PDVSA - Intevep, Research and Technological Support Center.
Chief Geophysicist
- Led a team of geophysicists, computer scientists, mathematicians, and physicists that included senior researchers, technicians, and administrative assistants (40 employees).
 - Responsible for the generation of a portfolio of all technical activities of the group, from long term research to technical services. I managed an annual budget of the order of \$ 5 MMUSD.
- 1991 Amoco Production Company, Tulsa, OK
Visiting Scientist in the Tulsa Research Laboratory
- Developed of a code to do kinematic ray tracing in transversely isotropic media. The results of my code were compared successfully with traveltimes computed using finite difference solutions of the elastic wave equation.
- 1985 - 1988 Intevep, S.A.
Staff Geophysicist
- Involved in exploration activities of hydrocarbons using electrical methods.
 - Responsible for the first magnetotelluric profile performed in the country aimed to estimate the thickness of sediments in the Eastern Venezuelan Basin. The results confirmed an increase in the depth of the basement towards the North, which opened new frontiers for exploratory activities in the area.
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EDUCATION

- Universidad Simón Bolívar, Caracas, Venezuela. Bachelor of Science in Physics, 1984.
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- Stanford University, Master of Science in Geophysics, 1990.
 - Stanford University, Doctor of Philosophy in Geophysics, 1993.
Dissertation: "*Anisotropic Traveltime Tomography*".
Member of the Seismic Tomography Project and the Stanford Exploration Project.
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PUBLICATIONS

- Principal author or coauthor of over fifty papers published in internationally recognized journals and proceedings of national and international congresses. A publication list is available upon request.
 - Principal author or coauthor of numerous technical reports at PDVSA Intevep. A list of Technical Reports is available upon request.
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ACADEMIC ACTIVITIES

- Advisor of undergraduate and graduate students in physics and geophysics in Venezuelan Universities.
 - Member of two PhD defense committee at Universidad Simon Bolivar and Massachusetts Institute of Technology.
 - Lecturer of the course "Multicomponent seismic for exploration and production of hydrocarbons," a 40 hour training program that teaches basic theory, acquisition, processing, and interpretation of shear waves with emphasis on converted waves. Students learn basic concepts after completing a large variety of exercises.
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PROFESSIONAL ACTIVITIES

Member of the Society of Exploration Geophysicists (SEG).

As an active member, activities have included:

- Technical Program Cochairman of the SEG Summer Research Workshop "Estimation of uncertainty in seismically derived reservoir parameters" Galveston, Texas, U.S.A., 2003.
- Co-organizer of the SEG convention workshop "Estimation of elastic properties from vector data," San Antonio, TX, 2001.
- Co-editor of a special issue of The Leading Edge in shear wave technologies. September, 2001.
- Technical Program Cochairman of the joint SEG/EAGE Summer Research Workshop: "Recent advances in shear wave technology for reservoir characterization: a new beginning". Boise, Idaho, U.S.A., 2000.
- Technical Program Cochairman of the Sixth International Congress of the Brazilian Society of Geophysics, Rio of Janeiro, Brazil, 1999.
- Member of the SEG Research Committee (1995 – Present) Member of the Technical Program Committee of the SEG Development and Production Summer Workshop (1996).
- Member of the SEG Development and Production Committee (1994– Present).

Member of the Society of Venezuelan Geophysicists (SOVG)

- Vice-president of SOVG (1997–1998)
- Technical Program Chairman of the VIII Congress of the SOVG (1996).

Member of the American Association of Petroleum Geologists

- Session chairman at the 2001 AAPG Convention, Houston, Texas

Member of the Society of Petroleum Engineers

- Discussion leader of the Forum Series in South America and Caribbean- "*Seismic for Reservoir Management*," Aruba, 2002

HONORS AND AWARDS

- SEG: Associate Editor of the journal *Geophysics* in the area of seismic inversion, 1994 – 2001
- PDVSA-Intevep: Jury of the biannual *Technological Innovation at PDVSA* award for three consecutive editions (1997, 1999, and 2001).
- SOVG: Outstanding Professional Award, 1996.
- PDVSA-Intevep: Full Scholarship for doctoral studies at Stanford University, 1988 - 1993.

REFERENCES

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