SEG 2018 Honors and Awards citations

One of the most important functions of our Society is to honor those who have made momentous contributions to the profession and to the science. Our profession is made up of many different components including the science of geophysics; education about the field; collaboration between professionals; and the application of geophysical knowledge to find and develop natural resources, study the subsurface, and mitigate natural hazards. This year's honors and awards recipients have impacted all of these areas. They are role models and visionaries in our profession and SEG is proud to highlight their achievements.

MAURICE EWING MEDAL
Albert Tarantola (1949–2009)

Albert Tarantola is universally recognized as the principal contributor to the emerging field of full-waveform inversion. His writings on the subject have become legendary. He was also the first to recognize the close relationship between seismic migration and seismic inversion by proving that seismic migration is the first step in an iterative attempt to solve a full-waveform seismic inversion problem. His pioneering research in inverse problem theory, Bayesian probabilistic formulation, and uncertainty analyses has had a far-reaching impact not just in exploration geophysics, but also in global geophysics, medical imaging, and other branches of science and economics. He passed away 6 December 2009 in Paris at the age of 60, but his theory remains alive.

By Satish Singh

Albert Tarantola was one of the foremost theoretical geophysicists of his generation. He was a genius, full of energy and enthusiasm, which are rare traits among great theoreticians. His traits were extreme in every sense of the word, in his life as well as in his way of thinking. Albert left Spain at an early age for Paris, where he built a successful career. His first doctorate degree was in astrophysics. He became interested in the early development of global navigation satellite systems, subsequently in global positioning systems and geodesy. He used the relativity theory to apply corrections between different satellites and clocks, got interested in geophysics, and completed a second doctorate degree in geophysics.

Working with Bernard Velette at the Institut de Physique du Globe de Paris, he wrote two of the most important papers on inverse theory titled "Inverse problems: Quest for information" and "Generalised non-linear inverse problems solved using the least squares criterion." They were written in 1982 using a probabilistic approach, setting up the framework for discrete inverse problems. The papers were instantaneously recognized by the earth science community.

Albert extended this theory to seismic waveform inversion and wrote several papers, starting from acoustic to elastic. These papers formed the foundation of seismic full-waveform inversion. He established the concept of adjoint source and the crosscorrelation between modeled data and residual in order to compute the gradient for waveform inversion.

He also showed that the first iteration of seismic waveform inversion is migration. The industry recognized the importance of this work and funded a consortium where he started testing these ideas on synthetic and real data and where he trained brilliant students who took positions in the industry.

I joined the group in 1988. Coming from the analytical school, I had to fight my way in as Albert did not believe in approximations or working in transformed domains, such as frequency domain. Albert was a purist and believed in numerical methods. Recognizing the importance of computers in seismic waveform inversion, Albert established a national super-computing center at IPG Paris.

Identifying the limits of conversional waveform inversion, Albert moved his attention to important sampling using Monte-Carlo methods. He then published several papers with Klaus Mosegaard and established a whole new area of research. In his view, we should sample the whole model space and look at movies and images that most often appear to be the most probable solution, providing a posteriori probability distribution. In the later part of his life, he started working on the law of physics using his probabilistic approach and wrote a book on the *Elements for Physics*.

The last lunch I had with Albert was in June 2009 discussing a common project with Total. We also talked about his recent visit to Chile and Easter Island. After his return from Easter Island he had a stroke in Chile and was then repatriated to France. I saw him 3 December; he passed away 6 December 2009. His contribution to inverse problem theory will remain alive forever.

HONORARY MEMBERSHIP
Fred Aminzadeh

Fred Aminzadeh has made significant contributions to the field of exploration geophysics and seismic signal processing through his numerous books, patents, and publications, with a focus on technical advances in discipline boundaries applied geophysics, petroleum engineering, computer science, and electrical engineering. He has done pioneering work on seismic elastic modeling, seismic pattern recognition, artificial intelligence, reservoir monitoring, and induced seismicity. Aminzadeh has served SEG as president. He has also been on numerous SEG committees including chairing the Research Committee and Global Affairs Committee.

By M. Lee Bell

Fred Aminzadeh received his doctorate degree in electrical engineering, with a focus on seismic signal processing and elastic modeling, in 1979 at the University of Southern California in Los Angeles (USC). He started his career at Bell Laboratories with many innovations in signal processing and optimization, earning him the fellow of the Institute of Electrical and Electronics Engineers. His oil and gas career began when he joined Unocal (now part of Chevron) in 1983, staying until 1999. During his time at Unocal, he worked on a variety of endeavors, including introducing a new modeling and amplitude variation with offset

analysis based on elastic impedance; introducing a new method of pattern recognition and clustering of seismic data to identify hydrocarbon reservoirs; and pioneering a generalized Kalman filter used for reservoir simulation, seismic data analysis, and other fields. In addition, he did pioneering work on the use of neural networks and fuzzy logic in the oil and gas industry, patented reservoir image updating while drilling as a prelude to horizontal drilling, and geosteered many other innovations that spawned a large number of publications and several patents. He also led a team of professionals from oil companies and national laboratories to conduct an SEG/EAGE modeling project for salt and overthrust structures, for which he received the 1998 SEG Special Commendation Award. The models from this initiative were used in hundreds if not thousands of cases and paved the wave for the current SEG SEAM initiative. He also contributed to bringing down discipline boundaries in the oil and gas industry with his visionary paper, "Geo-engineering, the wave of the future."

In 1999, Fred established dGB-USA, expanding dGB's activities in America that provide services on reservoir characterization and OpendTect software to upstream energy companies. While at dGB, he made a significant contribution to the application of gas chimney technology in the oil industry, which won the Top Paper Award from AAPG in 2008 and led to the joint SEG and AAPG book *Hydrocarbon Seepage: From Source to Surface*. He served SEG on numerous committees including chairing the Research Committee. More significantly, he served as SEG vice president (2001–2002) and SEG president (2007–2008). During Fred's term of presidency, several significant milestones were achieved including the creation of Geoscientists *Without* Borders®, the opening of the SEG China office, the meeting of the General Assembly of Geophysicists, the launch of the Geo-Mentoring Initiative, SEG's participation in SPE's reserves evaluation, and the establishment of SEG SEAM.

Roel Snieder's remarks on Albert Tarantola, delivered 16 October 2018

Thank you for awarding Albert Tarantola the Maurice Ewing Medal, and thank you for asking me to receive this medal on his behalf. Albert's wife, Maria, is not able to be here, and I will make sure she receives Albert's Maurice Ewing Medal. Maria, we hold you in our thoughts tonight. You are with us in spirit for this moment as we celebrate the work of Albert.

I am truly humbled to be here in this role and feel like I am standing in shoes I cannot fill. Albert was a friend and colleague. He wrote two quotes in books that I would like to share with you because they shed light on Albert's character. When I worked with Albert in Paris, he discovered I had never studied general relativity. He muttered "c'est impossible," went over to his bookshelf, took the book of Weinberg, and gave it to me after he wrote in it: "Rend mois le meme poids en retour, mais en idées" — return the same weight to me, but as ideas. Albert was a man of ideas. In fact, he mostly cared about ideas, and the more fundamental they were, the more important they were for him. And in my copy of his book *Elements for Physics* he wrote "Pour Roel, En souvenir d'une longue complicité intellectuelle," for Roel, as a memory for a long intellectual complicity. This is what Albert loved, an intellectual complicity. It has been an honor for me to be part of Albert's intellectual world, which involved bold ideas and bold confrontations, all with the purpose of moving forward.

I will not attempt to give a laudation but instead will try to capture what I think Albert would have said tonight. Guessing what Albert would say is hazardous — he sometimes would change ideas at the spur of the moment — but this is my best guess of what Albert would say if he could accept the Maurice Ewing Medal in person.

He first would thank SEG and everybody who made this honor possible. Then he would thank Maria for her support over many years. Albert would recount how he started to work on what we now call full-waveform inversion in the 1980s as an outgrowth of his work on Bayesian statistics. He would tell us about starting the Equipe de Tomographie Géophysique in Paris, and what an exciting time it was with visitors who would come and go, and with gadgets like the connection machine — Albert loved gadgets. Albert would tell us that he realized in the 1990s that his dream of full-waveform inversion did not work, that he wanted to be honest, and that is why at the IUGG meeting in Vienna he had to get up in front of hundreds of people to tell them that he could not make his dream a reality. And then Albert would tell us about the amazing surprise that, around 2005, full-waveform inversion came back, that his vision became realized with the computers of that time, and how thrilled he was to see that happen. Albert would thank the people he worked with, the people he collaborated with and sparred with intellectually.

And then Albert would tell us that what he really wanted was to devise a theory that would change the world. Perhaps a theory where through the torsion of space-time one could explain the stability of the electron, or some bold theory like that.

There are a few things I want to tell you, Albert. You may not have changed our worldview in the way you wanted to, but without a doubt you have changed geophysics. And there is more I want to tell you, dear Albert. We love you. We love your brilliant mind. We love your lively and animated spirit. We love your unwavering courage to stand up for what you think is right. And we love the many moments of laughter that we have had with you.

— Roel Snieder
Colorado School of Mines