Bay Area Geophysical Society Seminar Series

Björn Paulsson

CEO and President, Paulsson, Inc

May 22, 2019

4pm Rm 265 McCone Hall

UC Berkeley Campus

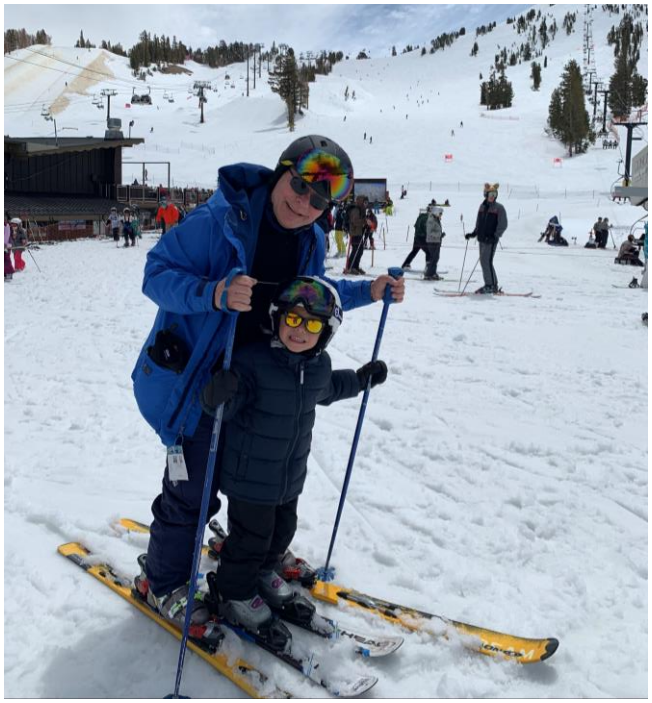
Development of a Borehole Seismic System

Abstract: The US Department of Energy is funding Paulsson, Inc. to develop a high temperature 3C borehole seismic source to be deployed in the same borehole as a large array of 3C Fiber Optic Vector Seismic Sensors. The combination of a clamped source and clamped receivers will create a borehole tool that can record single well seismic data. All components of the system have been designed to operate in a high temperature borehole environment suitable for geothermal applications. This is not just a borehole logging system, but a ***borehole seismic system*** able to image objects 100s and even 1,000s of feet from the surveyed borehole. Fiber Optic based multi sensor systems have been shown to operate efficiently and economically in boreholes recording data comparable to geophone based legacy systems at low frequencies and produce superior data at high frequencies. We have simultaneously operated Fiber Optic Seismic Vector Sensors (FOSVS), Distributed Acoustic Sensors (DAS), Distributed Temperature Sensors (DTS), and Distributed Strain Sensors (DSS) in the same borehole. Other fiber optic-based sensors are under development and will be combined with the current borehole sensor system. Fiber Optic Sensors can currently operate to

temperatures over 300°C. For instance, we have demonstrated in the laboratory that we can operate our fiber optic seismic vector sensors at 320°C for a week. If the silica-based core and cladding that make up the two inner layers of optical fiber are combined with an outer coating of gold rather than polyimide, operational temperatures up to 700°C can be achieved. If pure silica core fiber is used in the sensor system, then the system has a higher degree of hydrogen darkening immunity, allowing operations in reservoirs that have a presence of H2S. One major advantage with fiber sensors is that the sensors can be placed in boreholes while the recording instruments can be placed in a benign surface environment. Fiber optic-based sensors can thus be interrogated by lasers and instruments placed on the surface, eliminating the need to deploy fragile instruments in the high temperature borehole environment making the overall system much more robust.

Speaker Bio:

Björn Paulsson received a Ph.D. in Seismology and Rock Mechanics in 1983 from U.C. Berkeley working with Professors Neville Cook and Tom McEvilly. He currently holds 9 patents and has published over 50 papers. He led large research projects while at Chevron and while starting and managing small companies. Bjorn has developed new borehole seismic source and receiver technologies including the most powerful nondestructive downhole seismic source, the largest borehole seismic 3C receiver arrays deployed in the oil and gas industry and pioneered the time lapse monitoring of in situ rock masses.



Björn & Nils Skiing at Mammoth, CA

After the talk: We will gather at Matiki Island BBQ and Brew (no host) at 1828 Euclid St (300ft from North Gate entrance on Euclid)