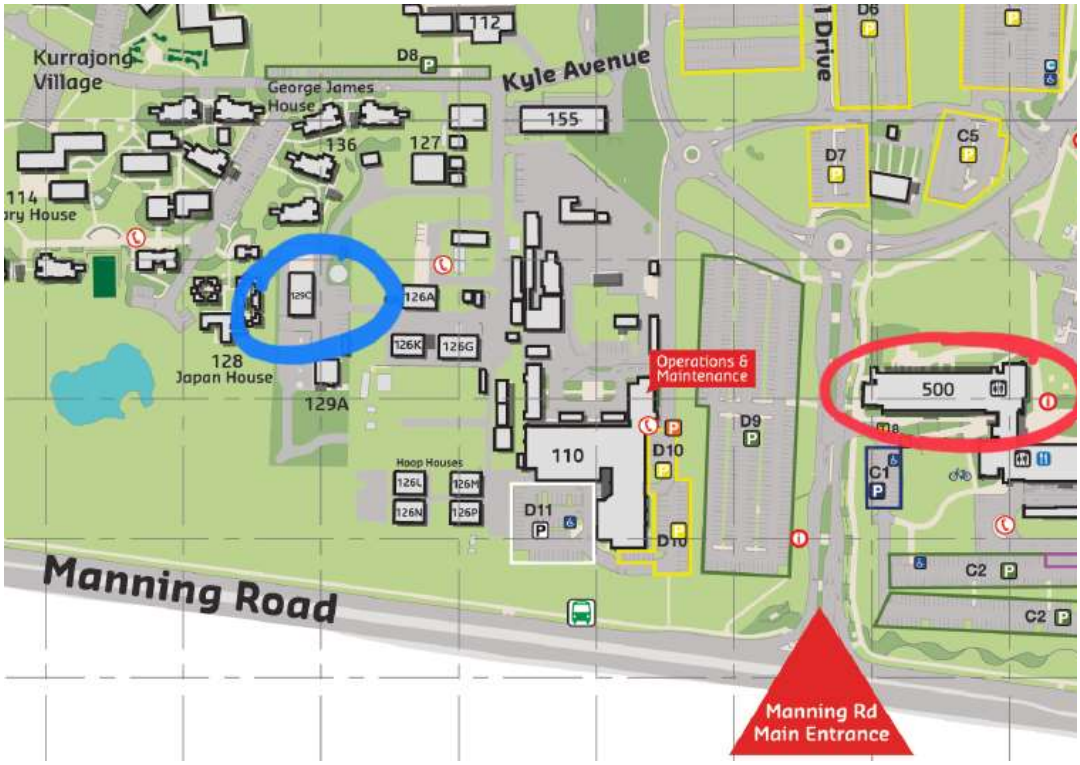
W27: Seismic for Everyone – an exploration with fibre optic cables

AEGC2019 Data to Discovery
Australasian Exploration Geoscience Conference
2-5 September 2019 • Perth, Western Australia
Incorporating the AIG, ASEG, PESA, and WABS

Coordinator(s)	Konstantin Tertyshnikov, Sinem Yavuz
Date(s)	Fri, Sep 06
Time	09:00 - 17:00
Location	Curtin University Building 500, room 1102 (Red Circle)



Summary Numerous recent developments in fibre optic sensing allow this approach to become a solid new technology for mining and oil and gas exploration. Presently fibre optics is applied in many aspects and stages of mineral and hydrocarbon studies. The workshop mainly focuses on the fibre optic technologies and advancements in application to borehole seismic for exploration and Earth imaging. The workshop also covers the improvements in the application of fibre optic sensing to surface seismic, innovations in processing and analysis of fibre optic seismic data, advances in the equipment and other fibre optic measurements for exploration. The live demonstration of several current fibre optic sensing systems will be held at the Curtin University research well facility during the second part of the workshop.

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* Schedule subject to change
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Schedule*

Time	Title	Speaker	Affiliation
8:30-9:00	Morning Tea		
9:00-9:25	*Distributed Fiber-optic Sensing - a versatile tool for seismic applications*	M. Karrenbach	OptaSense
9:25-9:50	*Loss tolerance - Subsea Borehole seismic applications*	M.Mondanos	Silixa
9:50-10:15	*Hybrid DAS and Geophones acquisition*	G. Palmer	Sercel/Fotech
10:15-10:40	*Structure and properties of ambient noise from long-term passive DAS acquisition in the Curtin/NGL research well*	E. Sidenko	Curtin University
10:40-10:55	Morning Break		
10:55-11:20	*Land seismic for mineral exploration with DAS - case studies*	A. Bona	Curtin University
11:20-11:50	*Application of distributed fibre-optic sensing to geothermal reservoir characterization and monitoring*	A.Chalari	Silixa
11:50-12:15	*Distributed temperature sensing for downhole operations surveillance*	L. Ricard	CSIRO
12:15-12:40	General discussion		
	Go to the demonstration site		

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12:50-13:30	Lunch (on site)
13:30-17:00	Demonstration of DAS interrogators. Vendors: Silixa, Sercel/Fotech, OptaSense, Febus-Optics

Presentation Abstracts

Distributed Fiber-optic Sensing - a versatile tool for seismic applications

M. Karrenbach *OptaSense*

Traditionally, distributed fiber-optic sensing has provided excellent results for borehole seismic applications. However, fiber-optic cables are ubiquitous in infrastructure installation for a variety of reasons. Besides simply carrying digital network data, they can be used for specific sensing purposes. In particular, seismic strain wave fields that are generated from either active or ambient noise sources, can be sensed effectively. While dedicated-fit-for-purpose fiber cable installations exhibit high data quality, the associated cost of installation limits wider use. Piggy-backing on existing infrastructure installations significantly lowers the cost for a desired data collection. We compare advantages and disadvantages of seismic data collected both on infrastructure and on dedicated-purpose borehole installation, where seismic wave fields are generated with actively controlled sources such as hammers and vibrators, and also with ambient noise and earthquake sources. These analyses demonstrate the versatility of using fiber-optic cables for sensing seismic wave fields, thus enabling many industrial, engineering and scientific applications.

Loss tolerance - Subsea Borehole seismic applications

M.Mondanos *Silixa*

Subsea installations have a particular challenge with extended range and excess losses through multiple connectors. Placing optoelectronics subsea is sub-optimal. Here we present the first results from the potential deployments of optical fibre cables to overcome 50 km of fibre losses.

Hybrid DAS and Geophones acquisition

G. Palmer *Sercel/Fotech*

DAS has evolved to the accepted and highly regarded technology for borehole seismic applications over the last decade. The approach has fundamental differences to the conventional geophones. A hybrid wireline is designed to utilise advantages of both types of sensors that complement each other during an acquisition.

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Structure and properties of ambient noise from long-term passive DAS acquisition in the Curtin/NGL research well

E. Sidenko *Curtin University*

Understanding of the ambient noise is important for various applications, particularly for the reservoirs and storages surveillance while monitoring natural and induced seismicity. Permanently installed DAS sensors in the Curtinn/NGL research well provide an excellent opportunity to study properties of different components of the noise and understand its structure.

Land seismic for mineral exploration with DAS - case studies

A. Bona *Curtin University*

Distributed acoustic sensing (DAS) technology proved its high potential in numerous applications. In hard rock environment however the use of this approach is quite challenging. There are certain areas such as a hyper-saline lakes, under which significant mineral reserves are found in Australia, where use of the conventional seismic systems is rather limited and usually experience hardware issues and equipment damage. In this case DAS seems an appropriate tool for such environments. A few case studies demonstrate the successful applications of land seismic acquisitions with fiber optics that potentially will replace geophones in certain areas of mineral exploration.

Application of distributed fibre-optic sensing to geothermal reservoir characterization and monitoring

A.Chalari *Silixa*

Enhanced Geothermal Systems (EGS) offer great potential for dramatically expanding the use of geothermal energy by allowing development of traditionally inaccessible thermal resources; thus, offering the possibility to significantly reduce carbon emissions to combat anthropogenically induced climate change. Continuous monitoring of the subsurface is of great importance especially in operations where the permeability is enhanced during hydro-shearing (expanding existing fractures) and hydraulic tensile fracturing (to create new fractures). Here we present highlights and example data from the deployment of distributed fiber systems at both hydrothermal and EGS sites including a field where a fault dominated reservoir supports a 22MWe power plant and a new research site that will serve as a focal point for development of EGS. At both sites distributed acoustic sensing and distributed temperature sensing were used.

Distributed temperature sensing for downhole operations surveillance

L. Ricard *CSIRO*

Distributed temperature sensing (DTS) is now commonly used as a key reservoir surveillance option. In this presentation, we highlight over 3 different case studies how DTS can be used to monitor downhole subsurface operations for completion installation, cement drilling, gas breakthrough and flow within a well. We discuss how different levels

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of interpretation can be achieved starting from overall qualitative analysis to local quantitative interpretation.

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