HARROW & HILLINGDON GEOLOGICAL SOCIETY

A Local Group of the Geologists' Association *Founded 1973*

www.hhgs.org.uk Twitter @HHGeolSoc contact@hhgs.org.uk

2024 Geo-futures

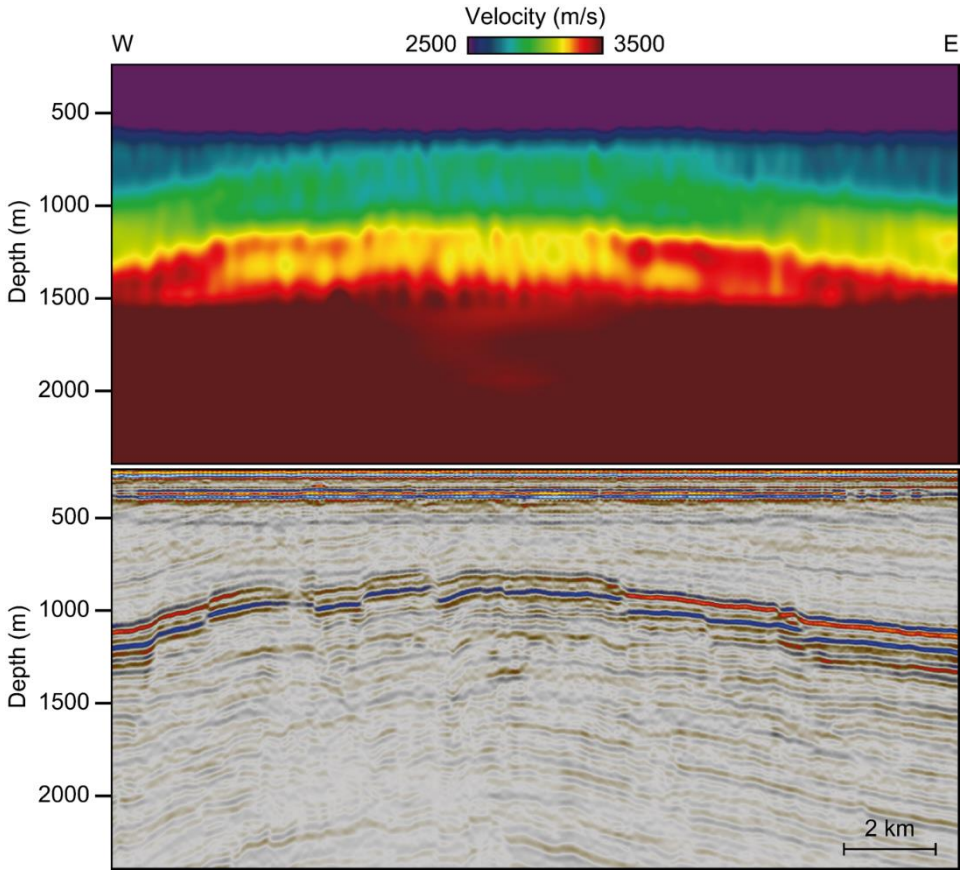
A series of talks showcasing advances in the research and practice of geology.

Wednesday 10th April 2024 at 8pm on Zoom

Through the Seismic Lens: Predicting Fault Zone Properties with FWI

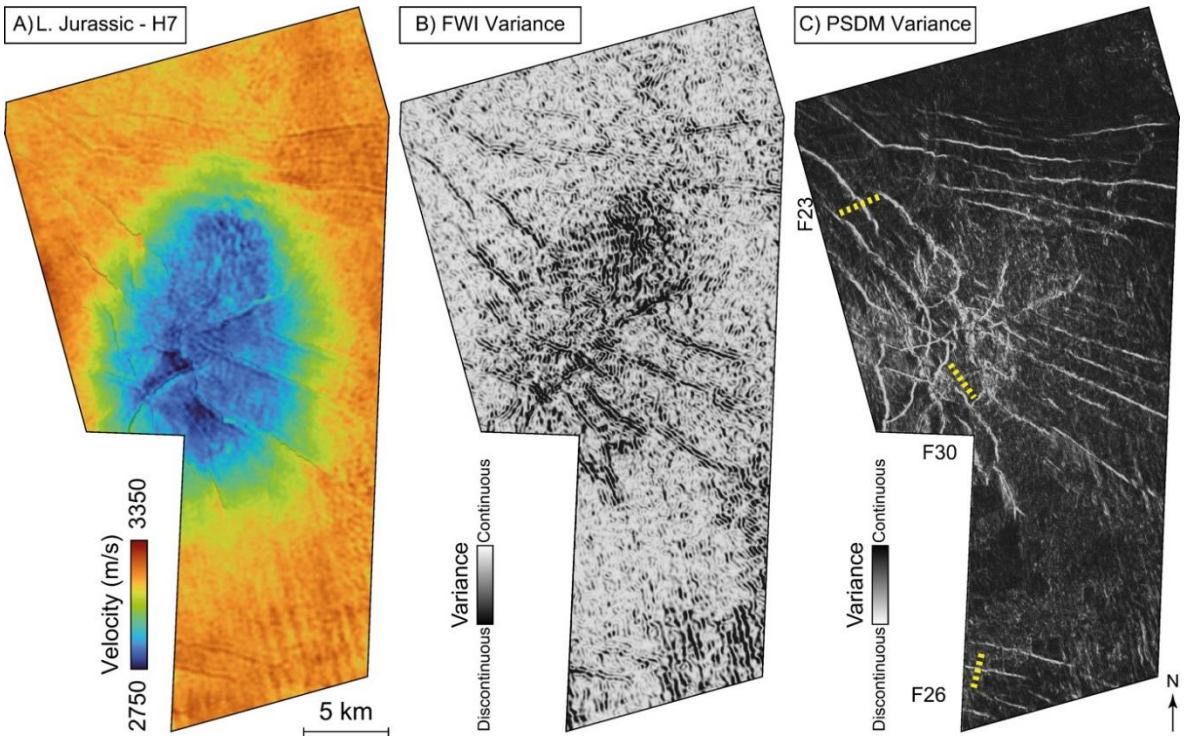
Ahmed Alghuraybi (Imperial College London)

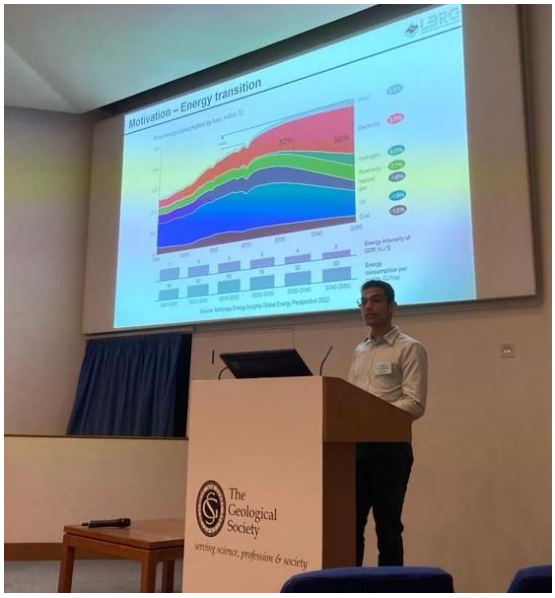
In an energy transition world, and to help our drive to find and implement net-zero solutions, we need an improved understanding of subsurface structures. Faults are major structures in the subsurface, and seismic reflection data have been widely used to image and study their geometry and growth history. However, it has long been recognised that mapping faults using seismic reflection data is a relatively subjective analysis, especially regarding fault geometries in map-view and displacement distribution across fault planes. Despite improvements in fault imaging, visualisation, and reduction in analysis time, predicting the physical properties of faults and fault zones in the subsurface remains challenging when using seismic reflection data.



Full-waveform inversion (FWI) is an advanced method of seismic imaging that aims to provide a high-resolution velocity model of the subsurface that utilises the full-waveform data (i.e., both reflection and refraction waves) from seismic surveys as opposed to the traditional velocity modelling workflows based on first-arrivals. The high-resolution capabilities of FWI can be used to highlight the velocity differences of geological structures in the subsurface (i.e., such as intrusions and fluid escape features, etc.). Theoretically, the physical properties of rock units (such as P-wave, S-wave velocities, and density) in the subsurface can influence the recorded seismic wavefield and, therefore, can be revealed by FWI models.

In this talk I will introduce the potential of using FWI as a tool to predict the sealing properties of fault zones using data from the Samson Dome, SW Barents Sea, offshore Norway. This could be a first step in the direction of improving our understanding of the physical properties of fault zones by combining seismic reflection and FWI velocity data. There are wider implications for planning carbon capture and geological storage, producing geothermal energy, designing radioactive waste disposal sites, locating water resources, and mitigating seismic hazards.





Dr Ahmed Alghuraybi
Imperial College London

Photo taken at the Geologists' Association Student Symposium (GASS2023) at which Ahmed was awarded the prize for best talk.