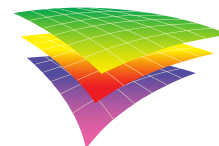




Virtual Field Trips for the Hydrocarbon Industry

Integrated Geoscience from Fieldwork,
Satellite and Sub-Surface Data



**Geospatial
Research
Limited**

☎ +44 (0)1913841759

🌐 geospatial-research.com

✉ susie@geospatial-research.com



Virtual Field Trips and Training

The GRL Difference

We offer the latest in digital outcrop geology to bring virtual fieldtrips to you – either to enhance your actual real-world fieldtrips, or as an alternative when a real trip is not a viable option.

Let's be totally clear: this is not an attempt to replace real fieldwork – quite the opposite in fact! Our experience to date is that virtual fieldtrips are a fantastic way for participants across the asset team to rapidly gain a shared understanding of the 3D geometry, scale, geological context, and hydrocarbon relevance of the outcrop, while at the same time emphasising the importance of studying real outcrops up close, in person.

Sceptical? ... Ask yourself this: how many times have you actually visited real outcrops in the last month? ... In the last year? ... In the total time since you graduated? Wouldn't you like to be able to visit many more (even if only virtually), without delay, whenever you wish?

Virtual fieldtrips allow people from different disciplines and with different levels of experience to quickly access the key geological content, and bring everyone up to a similar level of understanding. Key concepts are richly illustrated from our large catalogue of field examples, integrated with sub-surface data from areas of active exploration and production. All our trips include optional exercises to enhance the learning experience.

Our expert field-leaders will provide you with invaluable, first-hand experience of world-class outcrops that illustrate key aspects of the petroleum system, and leave you with new insight to apply to the sub-surface.

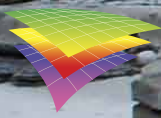
Delivery Options

You and your colleagues can participate in our virtual fieldtrips in these different ways:

1. A GRL geologist with expert knowledge of the specific field area will visit your office to guide the trip in person for your team. Participants will benefit directly from face-to-face interaction direct with the field expert. And when it's important for your team to develop a shared understanding of a hydrocarbon asset, there is no substitute for a skilled course leader acting as a catalyst to engender discussion and collaboration.
2. (Coming soon...) Remote participation options, including subscription-based access to all fieldtrips; each trip is available at any time as a self-guided tour, for anyone within your organisation. Here, the non-linear structure of each trip allows each participant to investigate different aspects of the data-rich material, which include in-depth interpretations applied to exploration and production. This option is also ideal for people who have already participated on an expert-led trip (real or virtual), and who wish to re-visit some or all field localities.



Discuss your needs
susie@geospatial-research.com



Virtual Field Trip Themes

Virtual Field Trips: Contents & Logistics

- Our field programme is highly flexible: we can design a virtual trip around your specific learning objectives.
- Active participation is promoted with hands-on exercises (individually and in small teams) that aid the learning and team building process.
- Our fieldtrip leaders are highly skilled in focusing on the aspects of outcrop geology most relevant to understanding the interpretation of subsurface geology.
- All our trips have applied learning objectives with direct relevance for hydrocarbon exploration and production.

Pricing Options

- Contact us for specific pricing information.

Tectonics & Structure for Exploration & Production

Our list of available virtual fieldtrips is constantly expanding – please contact us for an up-to-date overview or for further details on any of the following trips.

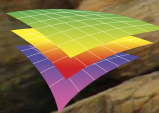
Bespoke Virtual Field Trips

We offer a specialised service to create custom virtual fieldtrips to specific locations that you've identified as relevant for your needs. We will interact closely with your in-house experts to capture insightful geological content and incorporate it into a dedicated virtual fieldtrip.

You can use this to capitalise on the wide experience of your geoscience staff, to enhance HSE and geoscience aspects of real fieldtrips, and to help ensure that as much as possible of the knowledge and field expertise of existing staff is preserved and remains easily accessible even when staff leave.

The cost of this service depends on the amount of data already available, and the size and complexity of the virtual fieldtrip required. Contact us to discuss your needs in more detail.

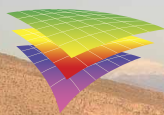
	Theme	Example Locations	Summary Learning Outcomes
1	Rift systems	Moab, USA; Apennines, Italy; Corinth & Evvia, Greece; Kilve, UK; Northumberland Basin, UK; Cleveland Basin	From the regional to the reservoir scale, understand deformation localisation patterns in active rifts and the control of structure on sedimentation and erosion. Appreciate the complexity and challenges of E&P in rift systems: including, but not limited to, trap geometries, flow pathways along or through segmented faults and rift geometries and play distributions.
2	Structural traps in fold and thrust settings	Zagros, Turkey-Iraq-Iran; Rockies, Canada; Assynt, UK; Jebel Hafeet, UAE; Semail Foreland, Oman; Bude, UK	Study a wide variety of trap geometries, and the range of factors that represent risk to trap integrity. Understand the relationship between mechanical stratigraphy and a stacked reservoir/seal sequence.
3	Oblique tectonics (transpression & transtension)	Zagros, Turkey-Iraq-Iran; Northumberland Basin, UK; Caledonides, UK; Spanish Pyrenees; Gulf of Evvia, Greece; Cyprus	Study the effect of oblique tectonics on the relationship between regional rift geometry, graben asymmetry, transfer zones, and the distribution of pre-rift, syn-rift and volcanism. Also study the control of oblique tectonics on modifying trap geometries and fracture properties in fold and thrust settings.
4	Extensional fault geometries	Apennines, Italy; Moab, USA; Kilve, UK; Malta; Corinth & Evvia, Greece; Northumberland Basin, UK; Cleveland Basin; Canyon Lands, USA	Investigate in detail the different geometries of extensional fault systems and how they can affect the flow of hydrocarbons in the subsurface. Includes along-strike segmentation, vertical segmentation, and interaction with mechanical layering, trap geometries, and reservoir segmentation.
5	Fault segmentation, linkage and relays	Kilve, UK; Malta; Moab, USA; Arkitsa, Greece; Apennines, Italy; Arches NP, USA; Table Lands, USA; Canyon Lands, USA; Northumberland Basin, UK	Understand the concepts of fault segmentation and linkage and their relevance to E&P. In particular, appreciate how segmentation and linkage evolve over time and how they control trap geometries, flow pathways, and sediment routing.
6	Faults and fault damage zones	Moab, USA; Ninety-Fathom Fault, UK; Arkitsa, Greece; Kilve, UK; Arches NP, USA; Zagros, Iraq; Carboneras Fault Zone, Spain; Caledonide basement, UK	Investigate the structure of fault damage zones in extensional and compressional settings. Understand the different flow properties of faults and damage zones and the implications for charge, traps and fault seal.



Virtual Field Trip Themes

Tectonics & Structure for Exploration & Production (continued)

	Theme	Example Locations	Summary Learning Outcomes
7	Fault seal	Moab, USA; Zagros, SE Turkey; Ras Al Khaimah, UAE; Arkitsa, Greece	Appreciate the complexity of fault architecture, fault zone damage, and shale smear, and how they can affect fault seal.
8	Fractured reservoirs - an overview	Wadi Bih, UAE; Zagros, Turkey-Iraq-Iran; Jebel Hafeet, UAE; Lewisian Basement, UK; Zechstein, UK	Understand the main factors effecting E&P in fractured reservoirs with examples from fracture, carbonates, shales, basement, and chalk.
9	Fractured carbonates	Zagros, Turkey-Iraq-Iran; Wadi Bih, UAE; Jebel Hafeet, UAE; Zechstein, UK; Carboniferous, UK; Northumberland Basin, UK; Kilve, UK; Evvia, Greece; Apennines, Italy	Understand in detail the challenges effecting E&P in fractured carbonates. Appreciate the multiscale nature of fracture systems and study direct analogues for producing reservoirs. Understand the uncertainty of measuring and modelling fractures in carbonates.
10	Fractured shales	Cleveland Basin, UK; Whitby, UK; Kilve, UK	Understand in detail the challenges effecting E&P in fractured shales. Appreciate the control of stratigraphy on both the natural and induced fracture systems. Understand the uncertainty of measuring and modelling fractures in shales.
11	Fractured basement	Lewisian Basement, UK; Orcadian Basin and basement, UK	Understand in detail the challenges effecting E&P in fractured basement. Understand the relevance of characterisation of fracture systems from regional to core-scale in relation to modelling of fractured reservoirs. Appreciate the importance of faults, fractures and fracture infill to reservoir permeability.
12	Fractured chalk	Flamborough Head, UK; Pegwell Bay, UK; SE England	Understand in detail the challenges effecting E&P in fractured chalk. Appreciate the multiscale nature of fracture systems and the role of mechanical stratigraphy.
13	Fracture systems - from measurements to modelling	Zagros, Turkey-Iraq-Iran; Wadi Bih, UAE; Carboniferous, UK; Zechstein, UK	Understand the uncertainty associated with sampling natural fracture networks and the limitations of upscaling and modelling reservoir scale fracture models. Appreciate the multiscale nature of fracture systems and how different fractures contribute to production.
14	Fractures and four-way closing anticlines	Zagros, Turkey-Iraq-Iran; Northumberland Basin, UK; Jebel Hafeet, UAE; Bude, UK	Investigate the fracture systems associated with four-way closing anticlines.
15	Deformation bands and reservoir compartmentalisation	Moab, USA; Azerbaijan; Ninety-Fathom Fault, UK; McKinleyville, USA	Understand the effect of deformation bands (granulation seams) on poroperm in high porosity sandstone reservoirs. Understand the control and geometries of deformation bands.
16	Mechanical stratigraphy, layering and fractures	Wadi Bih, UAE; Zagros, Turkey-Iraq-Iran; Jebel Hafeet, UAE; Zechstein, UK; Kilve, UK; Flamborough Head, UK	Investigate the concept of mechanical layering and its effect on fracture networks geometries to enable the creation of more geologically realistic DFN models.
17	Tectonic controls on sedimentation	Whitby, UK; Canyon Lands, USA; Zagros; Jebel Hafeet, UAE	Understand the role of structures in controlling sedimentation in extensional, compressional and strike-slip depositional settings.
18	Evaporite dissolution and collapse breccia plays	Zagros; Zechstein, UK	Understand the controls on evaporite dissolution and appreciate the impact of evaporite dissolution and collapse breccias on flow pathways.
19	Analogue outcrops for understanding your reservoir	Tailored to setting	Customised virtual field trips tailored to the specific characteristics of your reservoir. Contact us for further details.



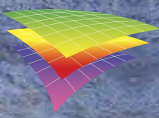
Virtual Field Trip Themes

Tectonics & Structure for Non-Geologist Working in Exploration & Production

	Theme	Example Locations	Summary Learning Outcomes
1	Petroleum systems for non-geologists	Zagros; Moab, USA; Kilve, UK; and others	Understand the components and key processes of the petroleum system, to enable effective communication with geoscientists in your organisation.
2	Unconventional petroleum systems for non-geologists	Cleveland Basin, UK; Lewisian Basement, UK; and others	Understand the components and processes of unconventional petroleum systems, to enable effective communication with geoscientists in your organisation.
3	Structure and tectonics in Exploration & Production	Zagros; Moab, USA; Jebel Hafeet, UAE; and others	Understand how structure and tectonics influence E&P across the world.
4	Geological uncertainty for non-geologists	Zagros; Zechstein, UK; Northumberland Basin, UK; Moab, USA; and others	Enable people to understand what is meant by geological uncertainty and to enable effective communication with geoscientists in your organisation.

Regional Structure, Tectonics & Geodynamics

	Location/Theme	Summary Learning Outcomes
1	Global geodynamics - the 'Big Picture'!	Think big-scale! Understand the importance of global geodynamics in the E&P workflow.
2	Cleveland Basin	Gain insight into fracturing in shales. Study background and fault-related fractures, and learn methods to constrain relative timing and range of key spatial properties. Understand the strengths and weaknesses in methods of characterisation of fractures.
3	Northumberland Basin	Understand the relevance of characterisation of fold and fracture systems from regional to core-scale for reservoir modelling. See the importance of faults, fractures and fracture infill to reservoir permeability. Understand the role and importance of structural reactivation and oblique tectonics.
4	Orcadian Basin	Understand the relevance of characterisation of fracture systems from regional to core-scale in relation to modelling of fractured reservoirs. See the importance of faults, fractures and fracture infill to reservoir permeability. Understand the role and importance of structural reactivation and basement-cover relationships.
5	West of Shetland Basin - onshore analogues	Understand the relevance of characterisation of fracture systems from regional to core-scale in relation to modelling of fractured reservoirs. See the importance of faults, fractures and fracture infill to reservoir permeability.
6	Zechstein petroleum systems	Understand the depositional sequences, diagenesis, faulting and fracturing affecting Zechstein (Z1 - Z3) carbonate reservoir facies in the Permian Basin of NW Europe. Appreciate the impact of evaporite dissolution and collapse breccias on flow pathways. Gain insights from an important global analogue for carbonate/evaporite systems.
7	Musandam Peninsula & Semail Foreland (UAE, Oman)	Understand the hydrocarbon geology of the Musandam Peninsula & Semail Foreland. Appreciate the relationship between four-way closing anticlines and fracture systems.
8	Zagros - Introduction to regional geodynamics	Understand the importance of continental-scale geodynamics that underpin the hydrocarbon geology of the Zagros.
9	Zagros - Introduction to petroleum systems in Kurdistan	Understand the components of the petroleum system within the Kurdistan sector of the Zagros fold and thrust belt.
10	Zagros - Introduction to petroleum systems in Iran	Understand the components of the petroleum system within the Iranian sector of the Zagros fold and thrust belt.
11	Zagros - Introduction to petroleum systems in SE Turkey	Understand the components of the petroleum system within the Turkish sector of the Zagros-Taurus fold and thrust belt.

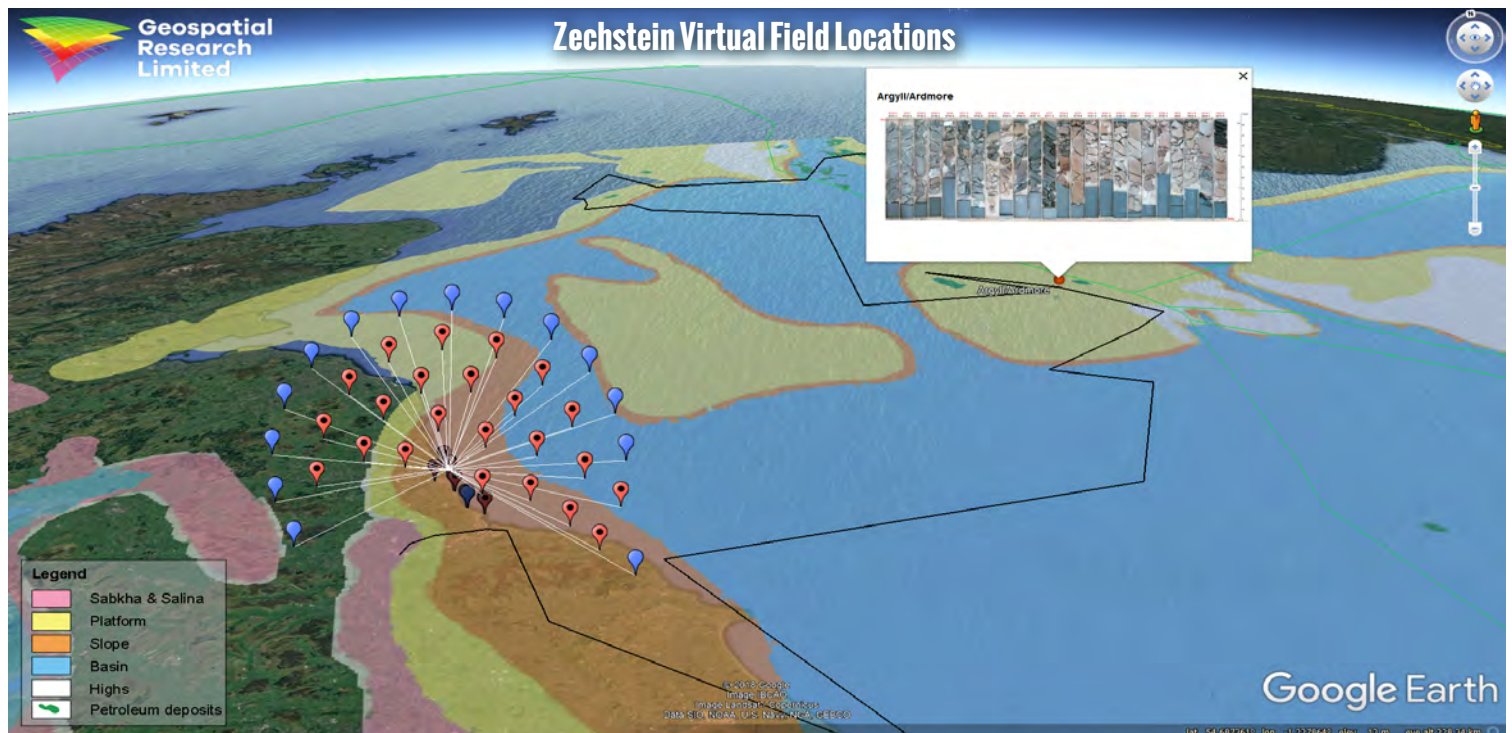


Virtual Field Trip Themes



Regional Structure, Tectonics & Geodynamics (continued)

	Location/Theme	Summary Learning Outcomes
12	Zagros - Trap geometries, trap integrity, breached traps	Study a wide variety of trap geometries within the Zagros fold and thrust belt, and the range of factors that represent risk to trap integrity. Understand the relationship between mechanical stratigraphy and the stacked reservoir/seal sequence.
13	Zagros - Fractured reservoirs	Understand in detail the challenges effecting E&P in fractured carbonates within the Zagros fold and thrust belt. Appreciate the multiscale nature of fracture systems and study direct analogues for producing reservoirs. Understand the uncertainty of measuring and modelling fractures in carbonates.
14	Zagros - Cenozoic type sections in Kurdistan	Visit Cenozoic type sections relevant for hydrocarbon exploitation.
15	Zagros - Cretaceous type sections in Kurdistan	Visit Cretaceous type sections relevant for hydrocarbon exploitation.
16	Zagros - Jurassic type sections in Kurdistan	Visit Jurassic type sections relevant for hydrocarbon exploitation.
17	Zagros - Triassic type sections in Kurdistan	Visit Triassic type sections relevant for hydrocarbon exploitation.
18	Moab, Utah, USA	Understand the relationship between fault relay geometry and fluid migration paths. See vertical and lateral variation in fault damage and fault zone geometry on a seismic scale. See the effect of deformation bands on poroperm in high porosity sandstone reservoirs. Gain insights into the effects of salt withdrawal on the overlying sequence.
19	Rocky Mountains - a structural transect	Understand the change in structural style across the Rockies and its relevance to hydrocarbon exploration.



Find out more
geospatial-research.com/vft

Discuss your needs
susie@geospatial-research.com