

**Control 1: Ancient and Active tectonic history.** The **multiple** deformation cycles that the tonalitic gneiss of the Lincoln prospect has undergone since its genesis over **3 billion years** ago has **repeatedly reactivated anisotropies**; faults, fractures, joints, metamorphic fabrics creating an interconnected permeable fracture network. Percolation of fluids has resulted in the dissolution of mineralisation in fractures, enhancing aperture width and increasing porosity and permeability.

**Control 2: Granitic composition of basement reservoir.** The Lincoln prospect basement is composed of granitic tonalitic gneiss. When put under stress granite is prone to **brittle failure** and therefore will produce a **3D interconnected fracture network**. **Granite is hydrophyllic** and therefore should naturally have a high recovery factor. Producing fractured basement reservoirs worldwide are predominantly granitic; Bach Ho-Vietnam, La Paz-Venezuela and Zeit Bay-Egypt. It seems that basement reservoir lithology is critical.

## Control 1: Ancient and active geological history

### Precambrian

#### Badcallian event @ 2.9 Ga

- TTG protolith emplacement
- NE-SW cooling joints
- Granulite facies metamorphism

#### Inverian event @ 2.49-2.4 Ga

- NW-SE ductile shear zones and foliated fabric
- Amphibolite facies metamorphism

#### Scourie dyke emplacement @ 2.4-1.8 Ga

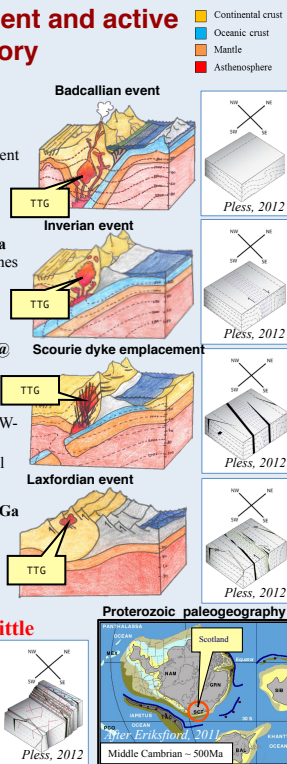
- Tholeiitic gabbros and basaltic dykes
- Dyke swarm trending NW-SE
- Associated hydrothermal fluids

#### Laxfordian event @ 1.8-1.4 Ga

- Reactivation of Inverian NW-SE shear zones
- Greenschist facies metamorphism

### Ductile regime to Brittle regime transition

#### Opening of the Iapetus Ocean @ 1400-542 Ma



### Mesozoic

#### Triassic extension

- W-E extensional faults
- Transpression and transtension caused opening of N-S oriented basins
- Hydrothermal fluids from associated magmatism

#### Opening of the Atlantic Ocean, Jurassic-Cretaceous

- Four phases of major rifting
- Deposition of seal rock

### Cenozoic

#### Paleocene North Atlantic Igneous Province

- Thermal uplift followed by thermal subsidence

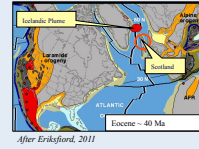
#### Quaternary retreat of ice sheets

- 1km of ice rapidly removed from paleohighs resulted in isostatic rebound
- Rupture along mineralised fractures and widening of already permeable fractures

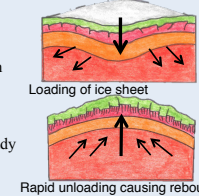
#### Carboniferous paleogeography



#### Paleogene paleogeography



#### Isostatic rebound



### Paleozoic

#### Metamorphosed Torridonian, Moinean and Dalradian sediments

#### Caledonian orogeny @ 490 Ma

- NW thrusting formed brittle SE dipping thrust faults
- Gravitational collapse facilitated by thrust faults

#### Unconformity

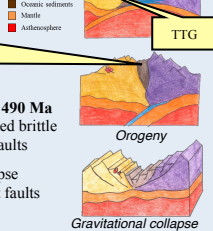
- Potential periodic exposure for 160 Ma between Devonian and Jurassic
- Percolation of connate/meteoric/hydrothermal fluids

- Visean transgression associated with melting of Gondwanan ice sheets may have formed caves analogous to those seen onshore Isle of Lewis

#### Variscan Orogeny @ 400-300 Ma

- Fault reactivation and inversion

#### Closure of the Iapetus Ocean



#### Caverns in tonalite on Isle of Lewis

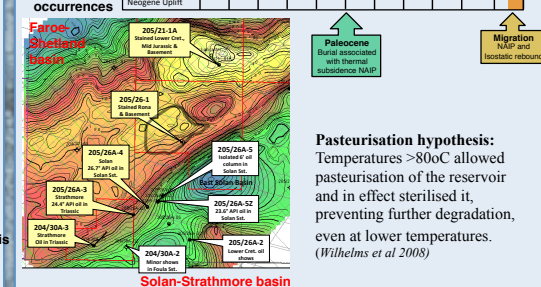


#### Middle Jurassic paleogeography



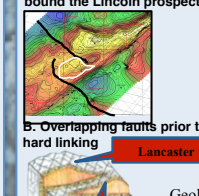
### Rona Ridge charging history

#### Hydrocarbon occurrences



## Control 2: Granitic composition of basement reservoir

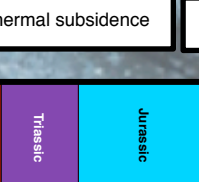
#### A. Overlapping faults that bound the Lincoln prospect



#### B. Overlapping faults prior to hard linking



#### C. Three geometries in which a relay zone may be breached



Granite has a high shear modulus therefore prone to hard linkage between overlapping fault tips. Faulting is likely to be highly connected in 3D.

Geological history and image log data implies that the fractures are permeable indicating the presence of an interconnected permeable fracture meshwork.

