Hurricane Energy plc

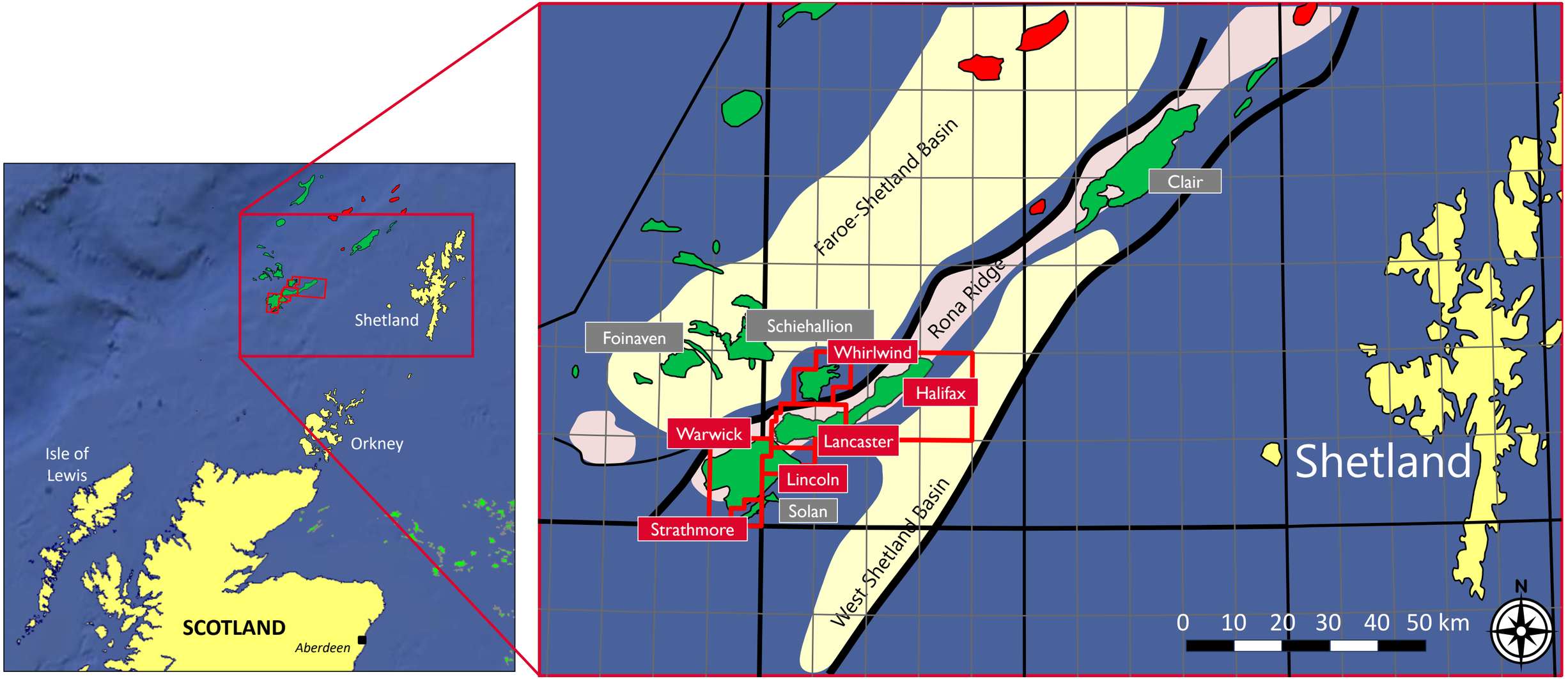
Rona Ridge Basement Play Update

March 5th 2019

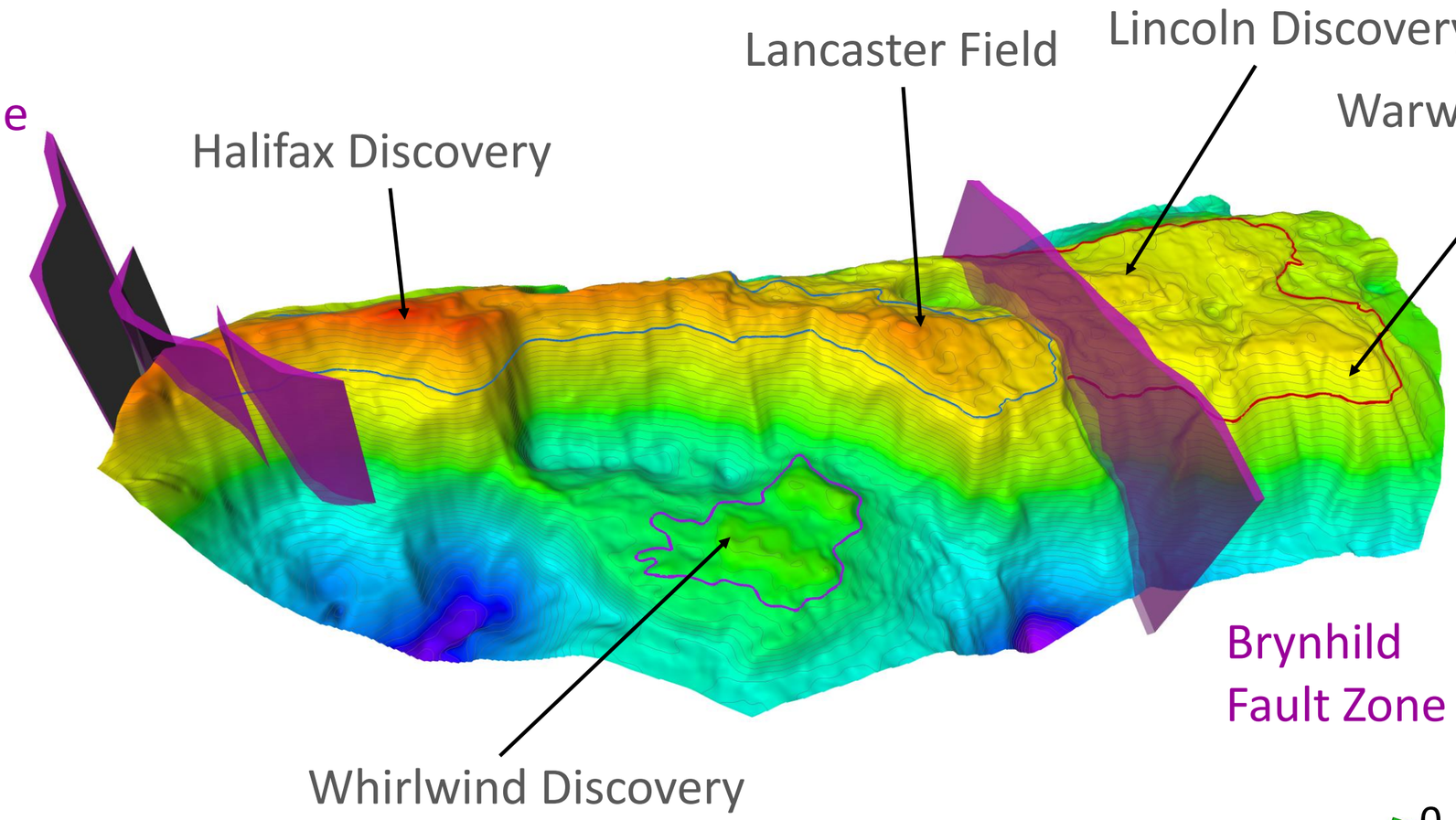
Agenda

- Hurricane’s basement assets
- Geological history of the Rona Ridge and associated fracture development
- Static and dynamic observations recorded to date
- Forward plans for the Rona Ridge

Hurricane's Assets West of Shetland



Rona Ridge Basement Assets



0 10 20 km

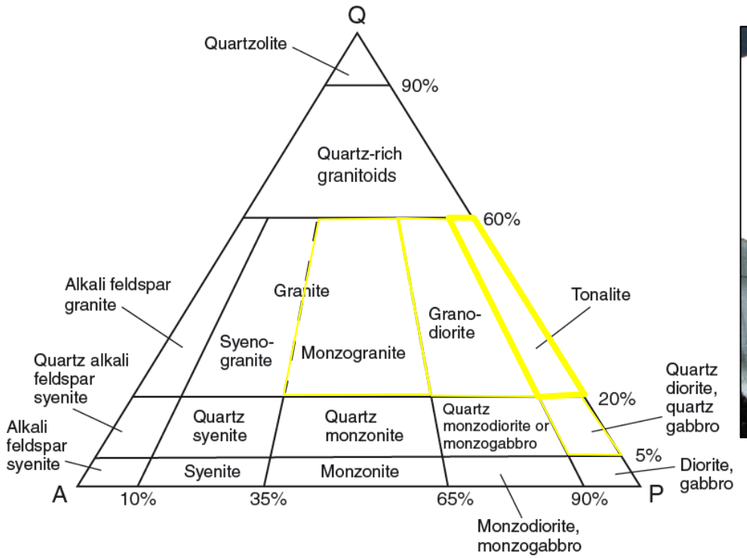
Top Basement depth structure
Contour increment 100m

Rona Ridge
Pluton Emplacement

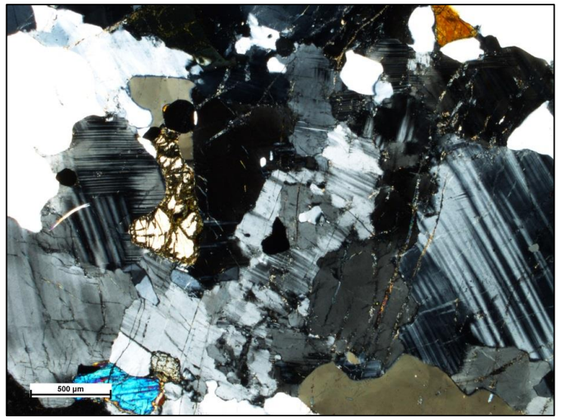
- Pluton emplacement at c. 2.74 Ga
  - Zircons dating from sidewall cores taken at Lincoln and Lancaster.
  - Dates fit with work completed by Kinny *et al*, 2019 (in press) on the Lewisian of NW Scotland
- Composition of pluton is predominantly tonalite (c. 95%) with minor granodiorite, quartz diorite and granite
  - Lithology has been defined from cuttings and core from numerous well penetrations including 8 wells drilled by Hurricane
  - Hurricane have acquired 241 sidewall cores in 5 wells
- Very early amphibolite facies metamorphism soon after intrusion
  - Apparent in thin section and from zircons
- Rocks are coarse grained and typically lack the foliation often associated with the Lewisian Complex. Ductile deformation is largely absent.

Tonalite SWC, 205/26b-12

Tonalite outcrop, Isle of Lewis



Plutonic igneous rock ternary diagram



Metamorphic fabric seen in thin section, 205/21a-7

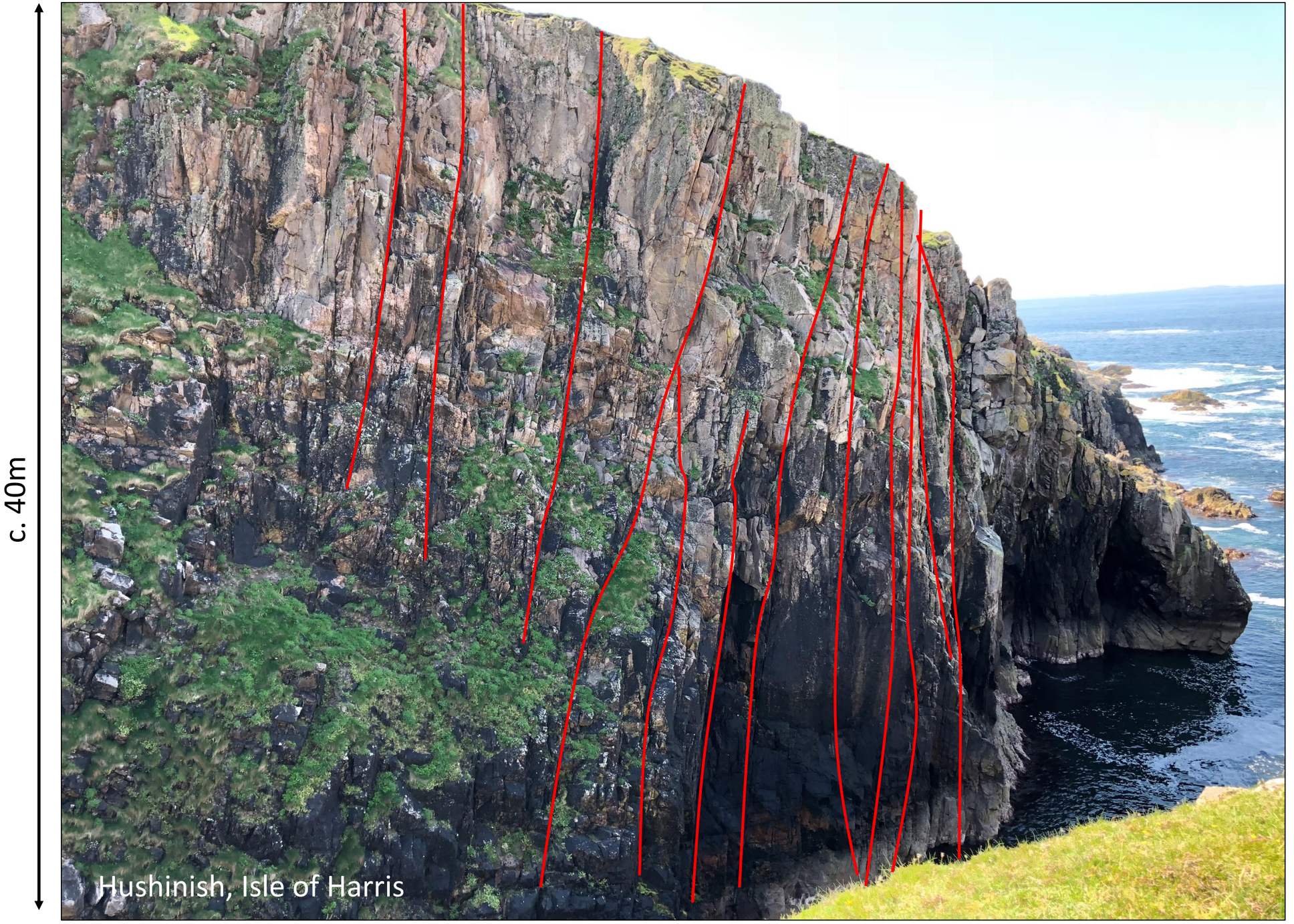
Rona Ridge Early Geological History

- Mafic intrusions (dolerite and basalt) dated at 2.4 Ga, consistent with age of the Scourie Dykes seen in outcrop in NW Scotland
- Outcrop and log data imply dykes cannot be mapped as linear features
- First brittle deformation in the Torridonian (c. 1.2 Ga) post-dates both tonalite and dolerite
  - A result of cooling of the pluton. Forms an extensive, non-strata bound joint network
  - Joints develop to significant depths, no reduction in jointing is seen with depth
  - Fracture development affects both lithologies

Dolerite SWC, 205/26b-12

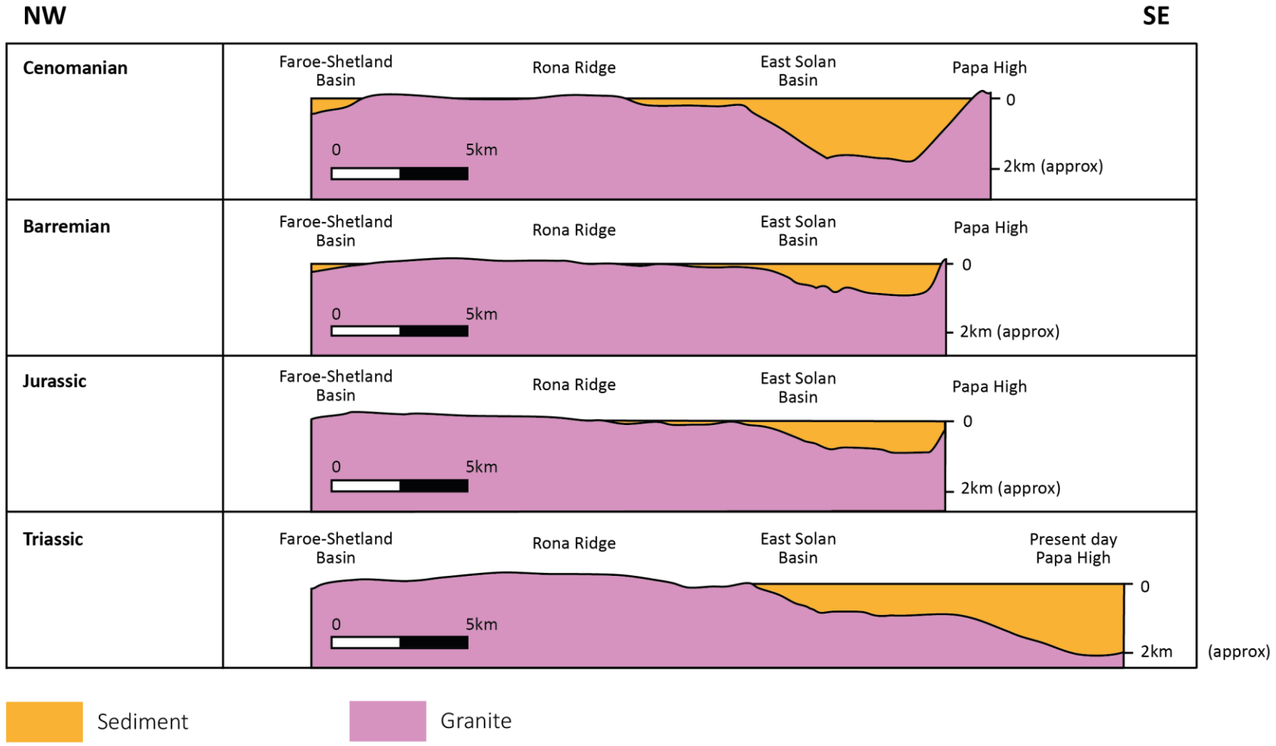
Complex deformation and migmatisation of mafic material, Isle of Harris

Outcrop Example of Extensive Jointing



Continued Deformation of the Rona Ridge

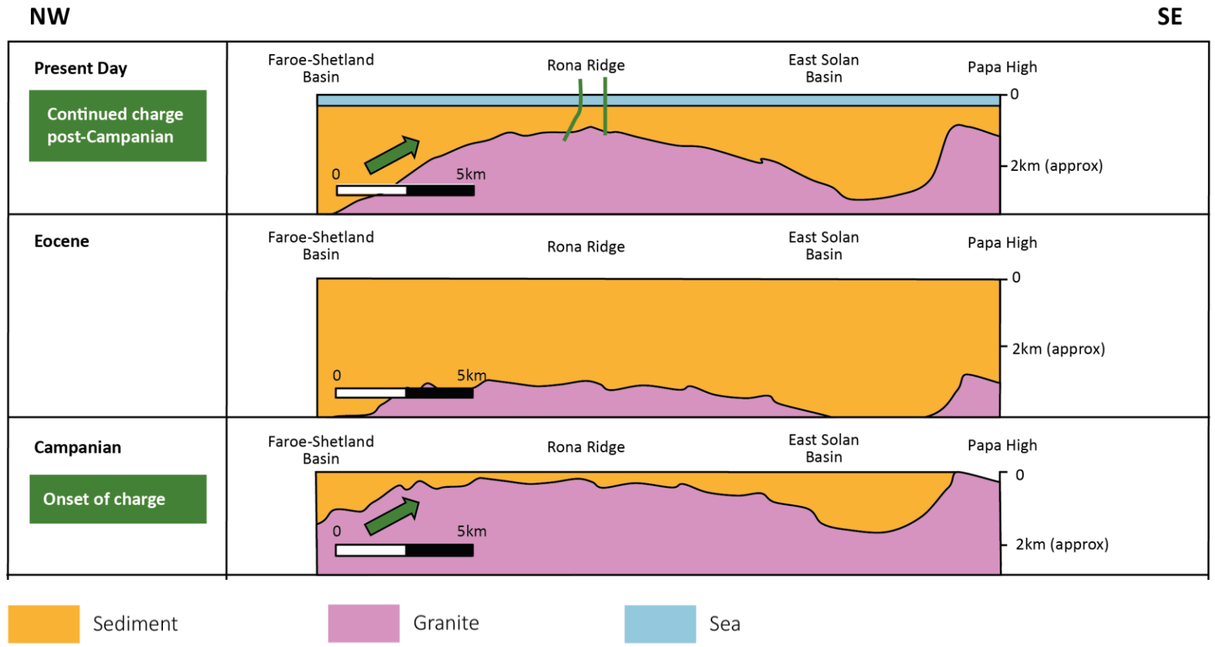
- Successive phases of deformation result in reactivation of the joint network, enhancing its connectivity by creating long, continuous features
- Regional thrusting following closure of the Iapetus Ocean during the Caledonian Orogeny (Ordovician)
- Variscan Orogeny (Late Carboniferous) uplifts the Rona Ridge, leading to unloading
- Mesozoic rifting in the Permo-Triassic (244 Ma), Jurassic (144 Ma) results in tensile fault/deep penetrating fissure generation
  - The Rona Ridge exists as a regional high from the Late Triassic onwards
  - Ongoing structural work suggests c. 1km of erosion of basement at Lancaster and Lincoln in the late Jurassic, with uplift of several km
  - Palaeocoastline present across Lincoln and Lancaster during rifting events



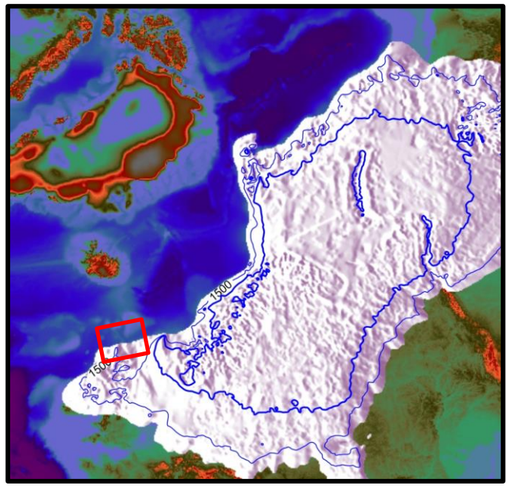
Rona Ridge over Lancaster during the Mesozoic (based on flattened seismic only, no forward modelling)

Hydrocarbon Charge & Recent Uplift

- Drowning in the Upper Cretaceous leads to burial of the Rona Ridge and maturation of the Kimmeridge Clay source
- Onset of charge in the Campanian, continues to present day
- Rona Ridge high acts as the focal point for charge
- Significant uplift and erosion (c. 900m) in the Oligo-Miocene along the Rona Ridge coeval with charge – fractures are opening as oil migrates into the fracture network
- Late Quaternary glacial cycles result in repeated loading and rebound of the West of Shetland region
  - Modelling work ongoing, however impact is fractures open up during periods of isostatic rebound



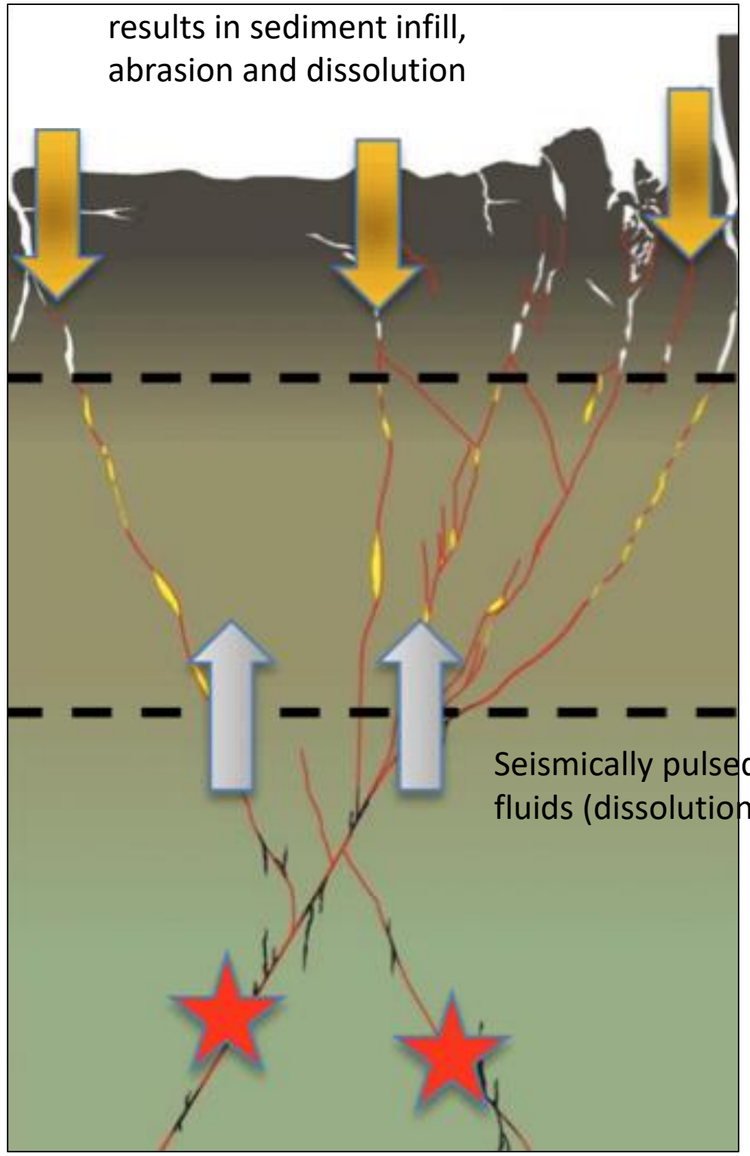
Rona Ridge over Lancaster from the onset of charge (based on flattened seismic only, no forward modelling)

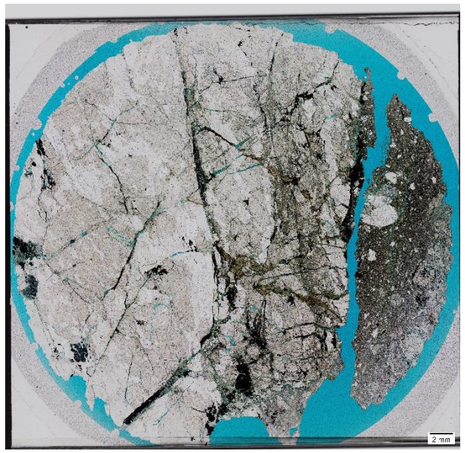


Late Quaternary ice sheet cover

Processes affecting fracture network

- Fracture network is impacted by:
  - Tectonic processes already described
  - Hydrothermal fluid ingress during rifting
  - Fissure development
  - Deep penetrating near surface processes including abrasion from coarse sediment & dissolution of minerals
- Mineralisation affecting the Rona Ridge is complex and multi-phase. Pre- and post-dates charge
  - Calcite dating currently being carried out on sidewall cores
- Weathering products e.g. haematite recorded to a minimum depth of 300m below the top basement surface
- Aptian limestone pebble found at depth (c. 400m) in basement at Lincoln during junk basket run
- Hydrothermal minerals e.g. epidote seen throughout all wells drilled to date





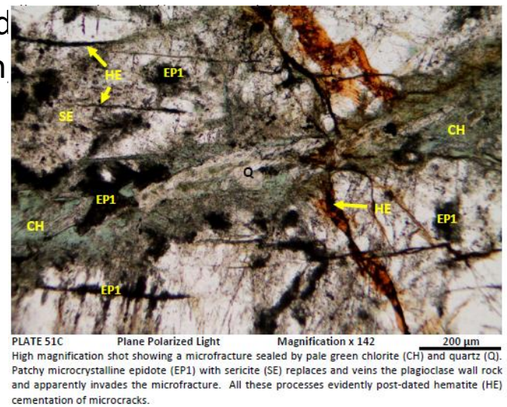
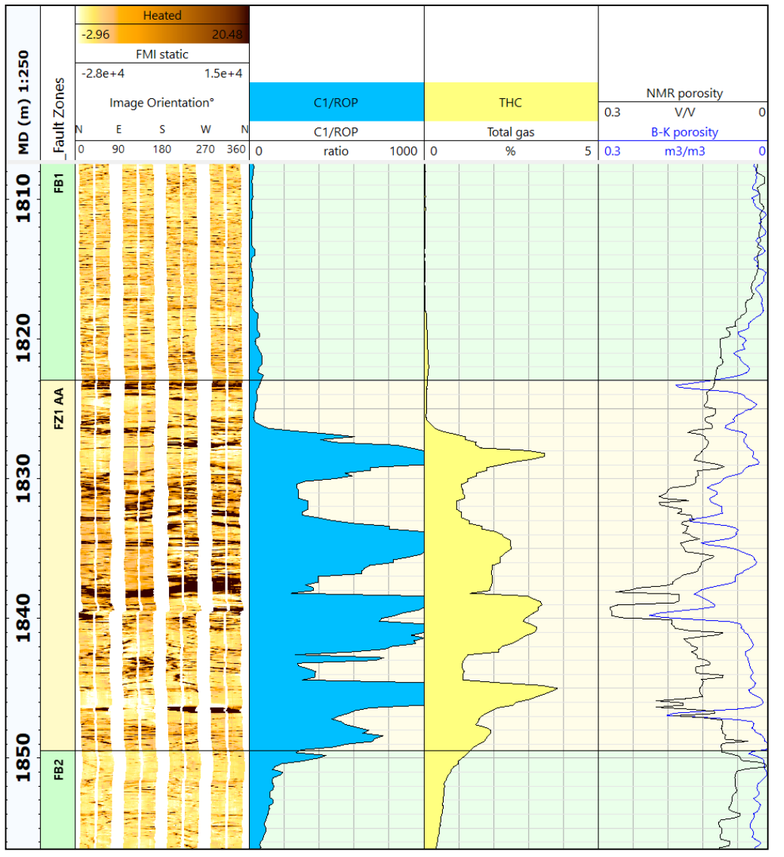


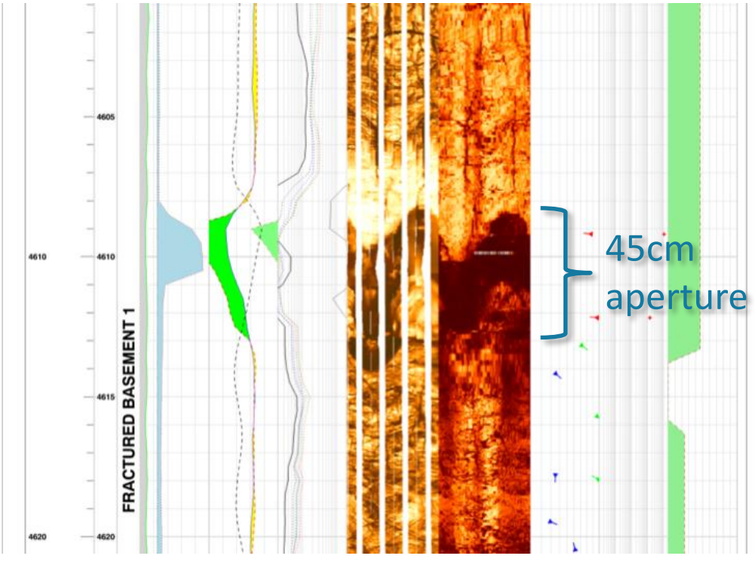
PLATE 51C Plane Polarized Light Magnification x 142 200 µm
High magnification shot showing a microfracture sealed by pale green chlorite (CH) and quartz (Q). Patchy microcrystalline epidote (EP1) with sericite (SE) replaces and veins the plagioclase wall rock and apparently invades the microfracture. All these processes evidently post-dated hematite (HE) cementation of microcracks.

Schematic of processes affecting the fracture network

Static observations from basement wells

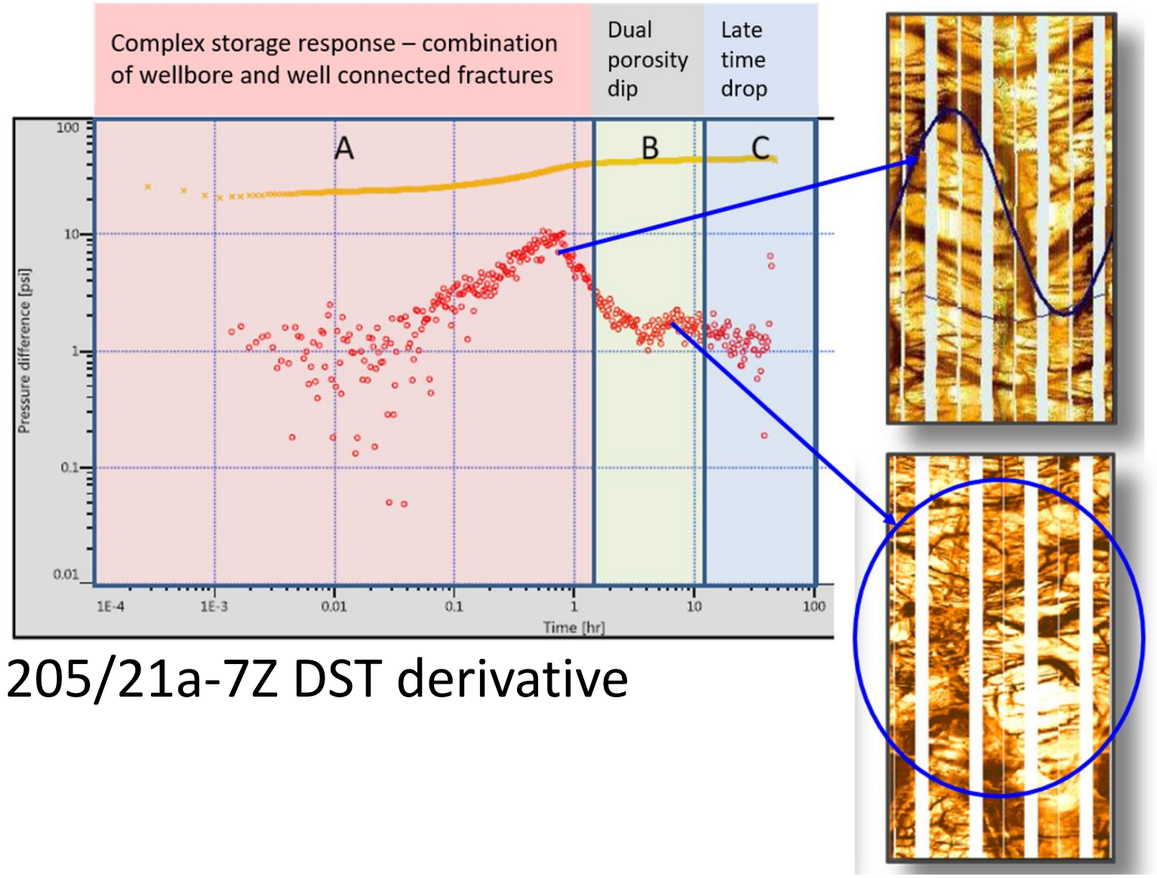
- No significant weathering of the rock fabric is present at the basement unconformity. Maximum of 14m recorded in 205/21a-7 (anomalous)
- Evidence of weathering processes in fissures to a depth of 300m vertically below top basement
- Average bulk porosity for the Rona Ridge is consistent across all of Hurricane's wells drilled to date at c. 4%
  - Comparable porosity ranges have been calculated using both NMR and neutron-density methods
  - Porosity peaks correlate with open fractures
  - Sidewall cores (which target tight rock) have measured porosities of up to 12% away from any weathered zone
- Fault Zones are present in all wells and are associated with elevated poroperm, however PLT data has demonstrated that flow comes from both inside and outside of Fault Zones
  - Fault Zones identified from log data can be correlated to faults identified from seismic interpretation
- A dominant NE-SW, high angle joint set is present in all wells, which may dominate flow during production
- Fracture apertures in excess of 60cm have been measured. Wide aperture joints (>2cm aperture) dominate early flow in DSTs





Dynamic observations from wells drilled to date

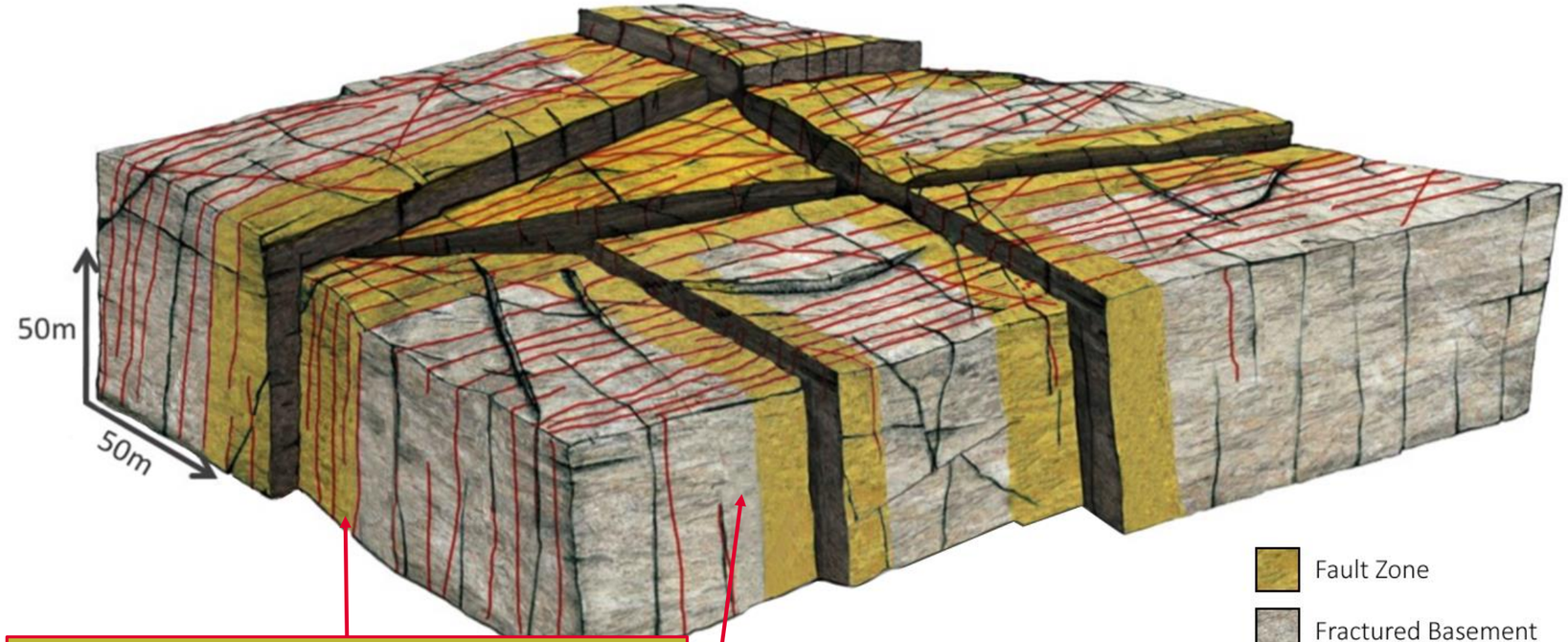
- No intra-basement barriers have been seen from dynamic data acquired during DSTs
- A dual porosity response has been seen on all DST data, attributed to wide aperture joints being supported by smaller scale fractures acting like a matrix
- Flow rates in excess of 10,000 bopd can be achieved with minimal drawdown
  - PI for Lancaster is excellent (over 140 stb/d/psi from 2 horizontal wells), which is inline with observations made about fracture development & geological history



205/21a-7Z DST derivative

Rona Ridge Conceptual Model

- Requires some updating following recent/ongoing work
- However, all well penetrations are broadly supportive of this model
- Fault Zones remain primary targets for well penetrations, but the whole reservoir is productive



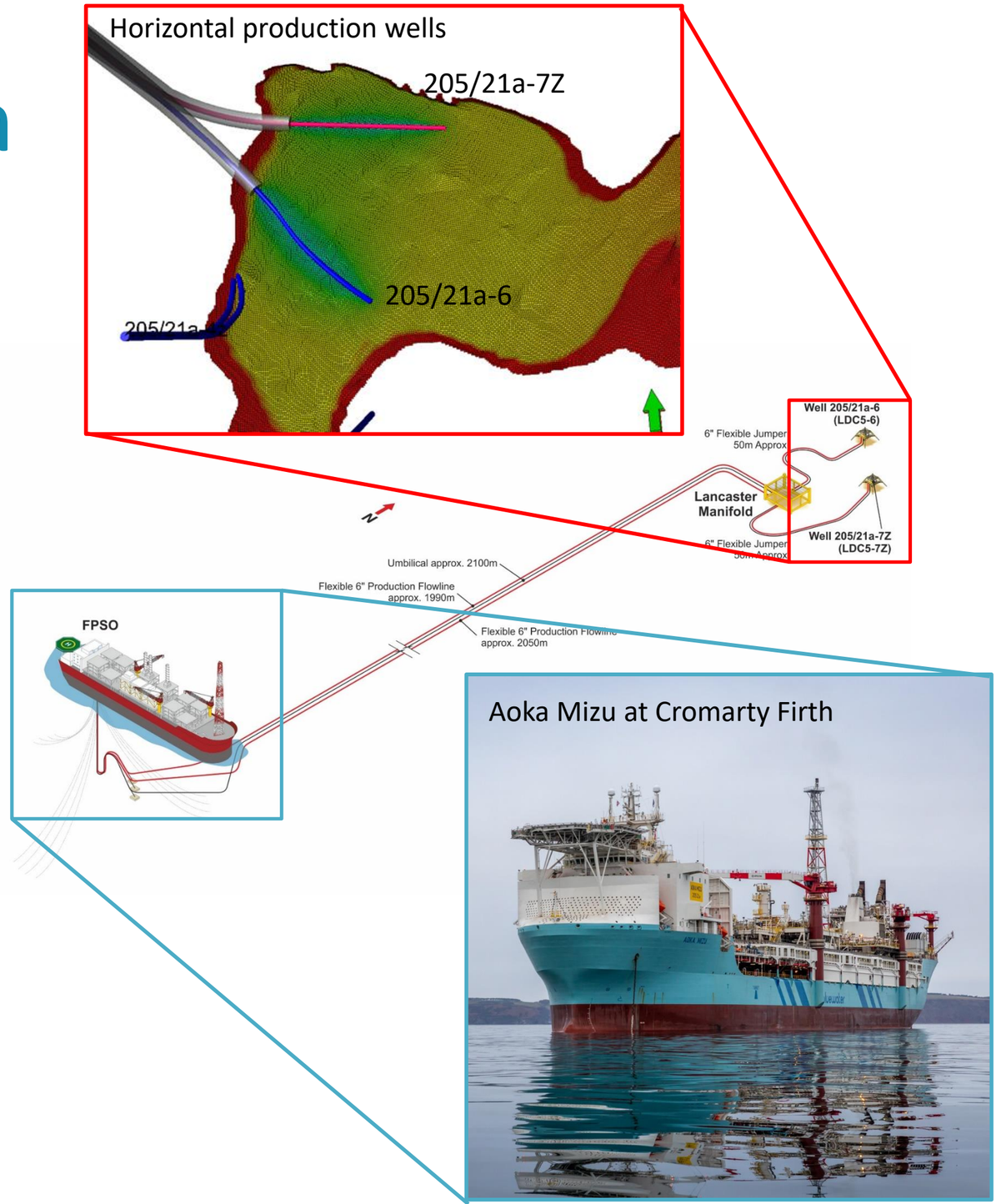
1. Fault Zone Facies
Preferentially higher poroperm characteristics
Seismically identifiable features
Widths based on log data

2. Fractured Basement Facies
Permeable, connected fractures present between Fault Zones
Contributes to flow

Forward Plans

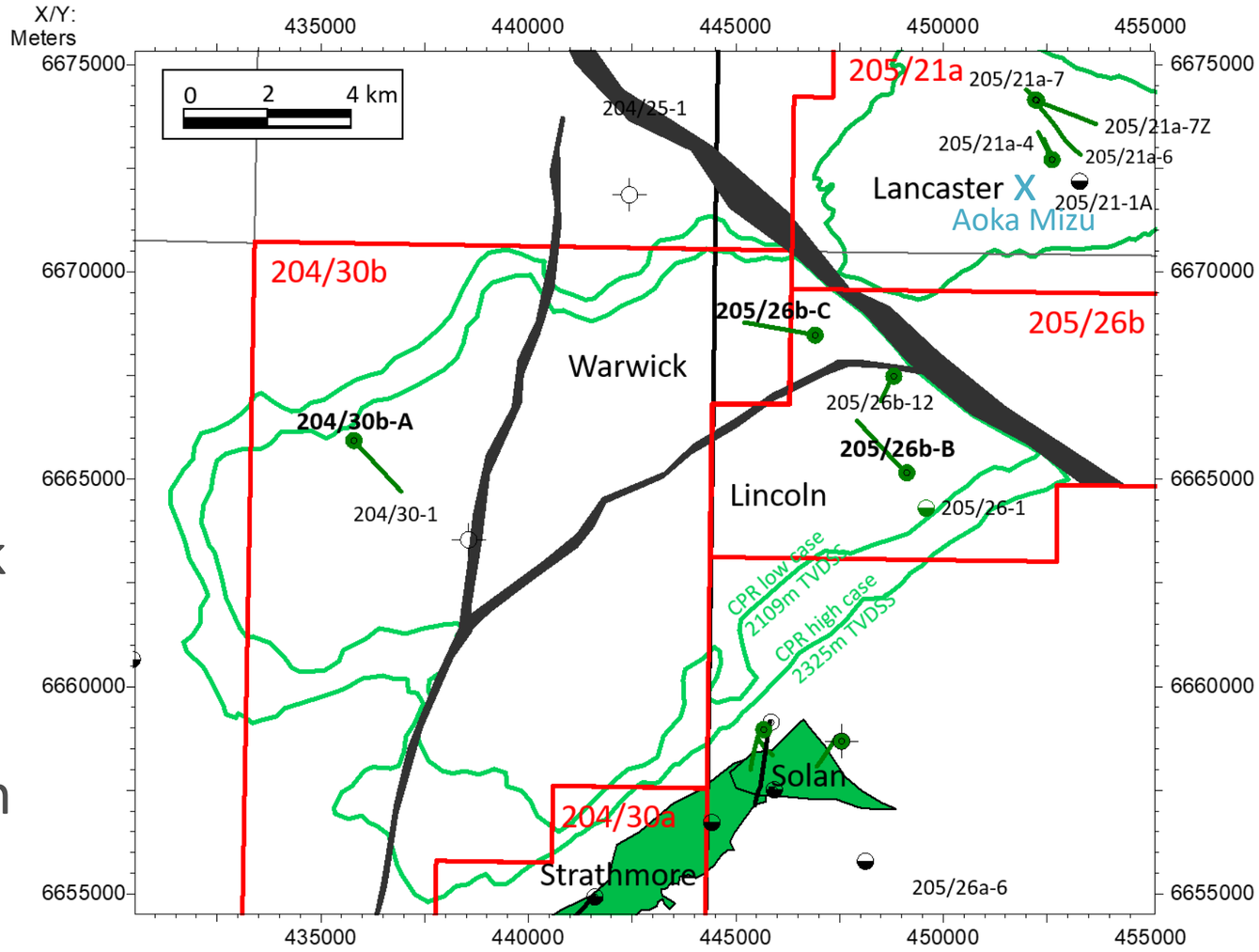
Lancaster Early Production System (EPS)

- Two well tieback to the Aoka Mizu FPSO to provide long term dynamic data that will inform full field development decisions
- Utilises 205/21a-6 and 205/21a-7Z which are both horizontal wells with a 1km basement section
- Designed to produce 20,000 bopd
- No water production anticipated, however the FPSO has water handling onboard
- Staggered start up of wells plus periodic shut ins of one well at a time will provide interference data to help understand any permeability anisotropy
- Aoka Mizu is currently in Cromarty Firth waiting for a weather window to attempt hook up



Greater Warwick Area (GWA) Drilling

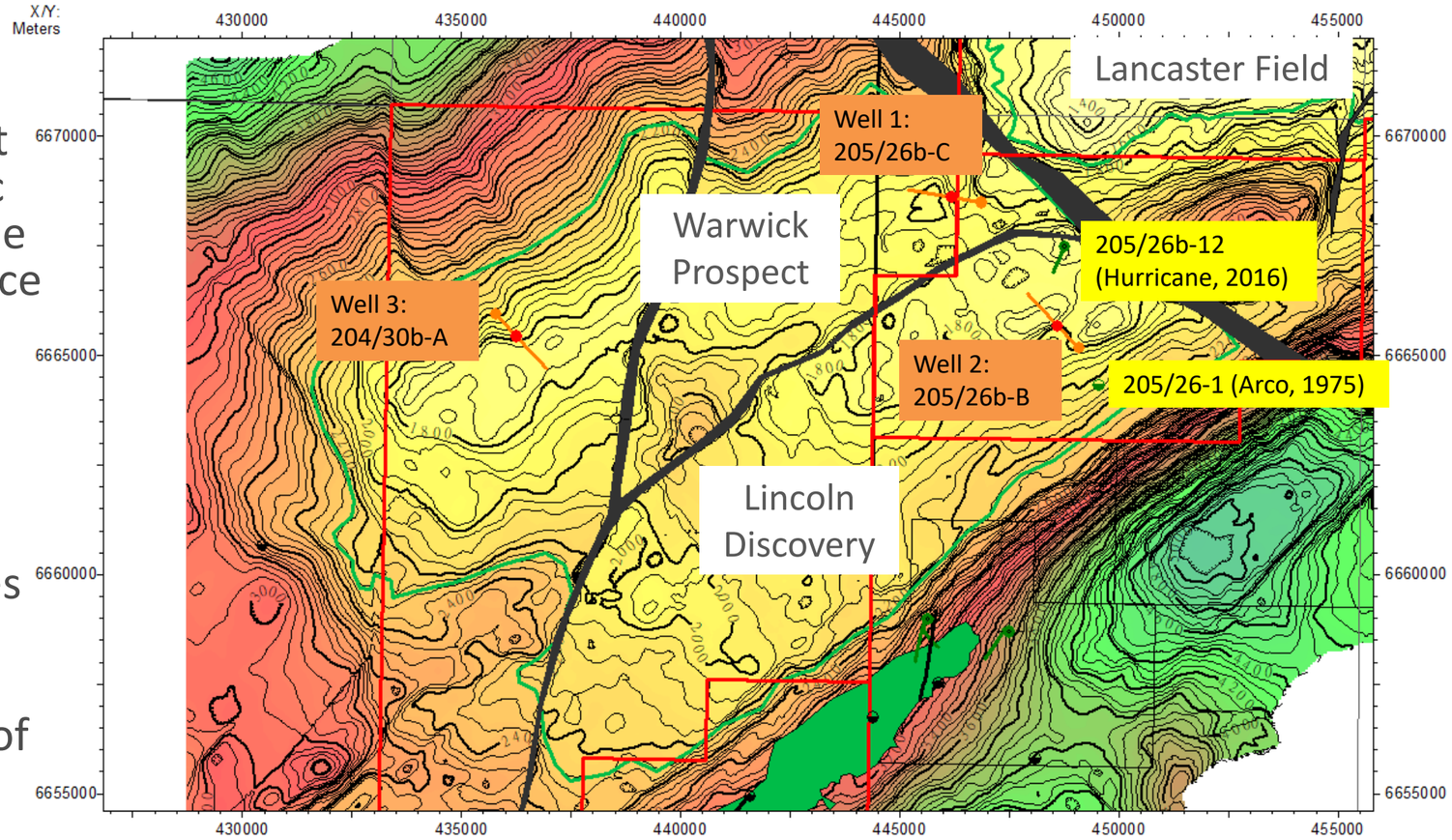
- Following results of exploration well 205/26b-12 on Lincoln, Spirit Energy farmed into the GWA (50% equity). Deal structure was to:
  - Drill 3 wells in 2019 and an additional 3 wells in 2020
  - One 2019 well will be tied back to the Aoka Mizu to provide early production data
- Transocean Leader due to come on hire to Hurricane end March 2019



Map showing planned 2019 well locations (205/26b-B, 205/26b-C & 204/30b-A) over the GWA

2019 wells overview

- Wells have been designed to:
  - Test that the GWA is a single accumulation with no intra-basement reservoir barriers. Downhole acoustic and memory gauges installed after the DST will provide long-term interference data
  - Provide an oil gradient for the GWA using DST pressure measurements combined with PVT data
  - DSTs will demonstrate reservoir productivity and allow fluid properties to be assessed
  - Refine static reservoir properties for the GWA through an additional 3km of basement penetration
- Each well is horizontal and has a 1km reservoir section planned



Basement depth map showing planned 2019 well locations and potential sealing faults identified by RPS

Conclusion

- Hurricane has already substantially de-risked the Rona Ridge basement play and has made significant advances in quantifying the basement reservoirs
- The Lancaster EPS aims to demonstrate that the basement can produce sustainable rates long-term in order to progress to full field development
- The 6 well programme and single well tieback on the GWA aims to demonstrate that the basement reservoir is a viable resource beyond the Lancaster Field
- Successful results in 2019 and beyond will contribute a potentially significant reserve base to the UKCS