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The British Geological Survey's Experience and Expertise in Supporting Projects such as the Sirte Depression Connection Project

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Does the SDCP need inputs from geology?

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First modern geological map William Smith (1815) - England

Purpose was:

- locating natural resources (coal, iron ore,limestone, building stone)
- advice for civil engineering works (canals, roads, railways)

The BGS was created in 1835 to continue these functions to the present day, in the UK and internationally

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What the SDCP needs from geology

- 3D geological models of project area – to understand engineering challenges, rock types and properties, permeability, local supply of construction materials, etc
- Hydrogeological issues – finding and sustaining consumption (potable) groundwater, impacts of project on aquifers, etc
- Geohazards – ground stability / collapse potential, seismic risks, corrosion risk from soil geochemistry, etc
- Coastal geology and oceanography, including changes to sedimentation rates, tidal regime, channel gouging, etc
- Geo-environmental issues, including salinification, pollution, etc
- Geo-information – visualisation and custodianship of project geo-data

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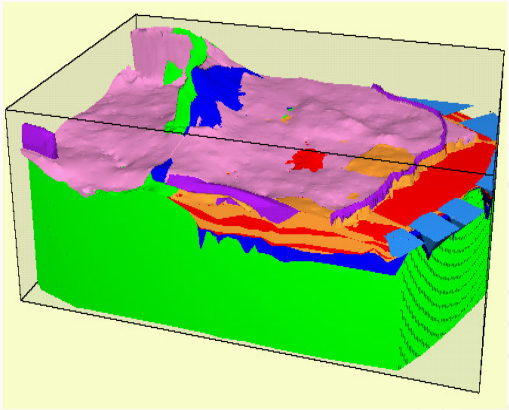
Building a 3D geological model of the project area



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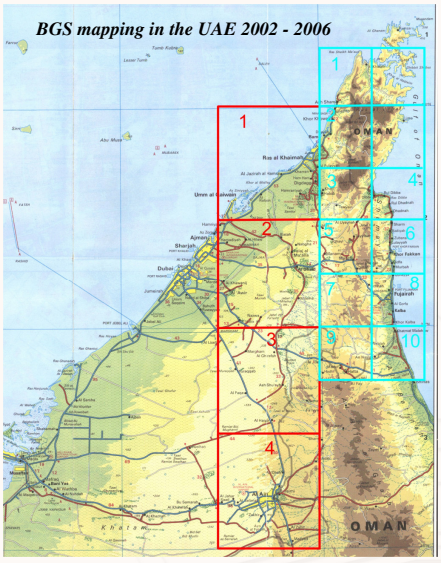
1. Update existing geological maps – digitise, edge match, convert to standard dictionaries, lithostratigraphy etc
2. Rapid revision mapping using remote sensing, airborne geophysics, geochemical surveys, geochronology, structural traverses etc
3. Acquire high resolution topographic data (maps, air photos, lidar, shuttle images etc)
4. Add existing or newly acquired sub-surface data from boreholes, well logs, shallow and deep seismic, ground resistivity etc
5. Build consistent databases and model into "walk in" visualisation software, to produce scale-independent views, attributed with physical & chemical properties, environmental & resource information



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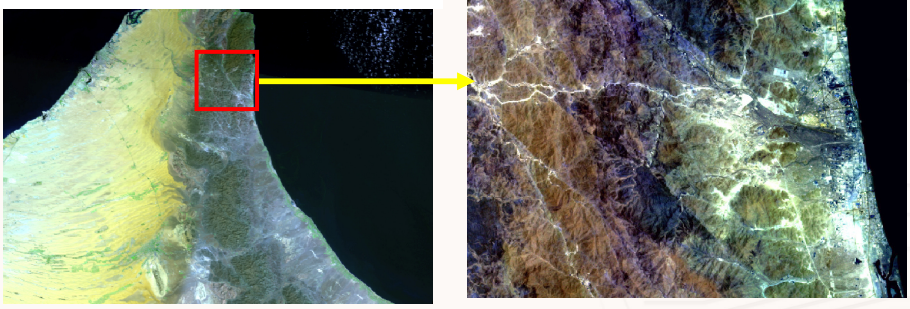
ASTER satellite bands in the short -wave infrared shows geology invisible on the ground



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Airborne geophysics

- Rapid acquisition of magnetic, gravity, radiometric, EM and topographic data

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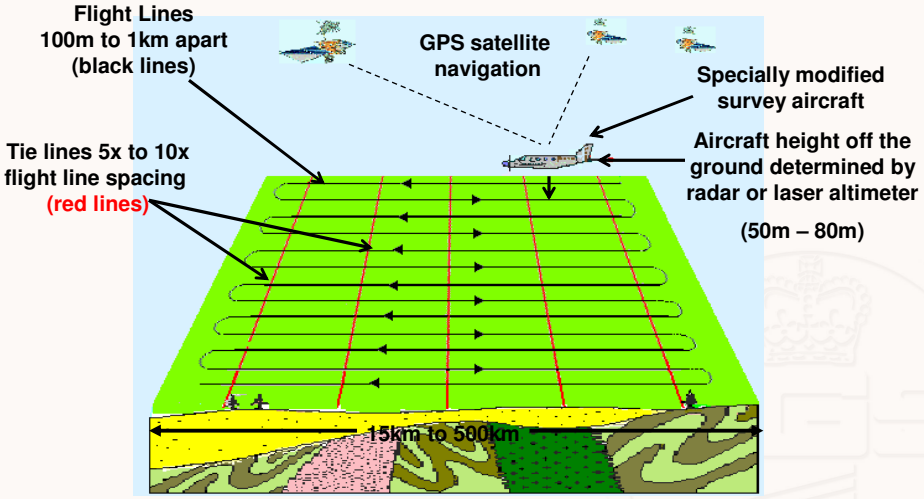

Slide c/o Fugro

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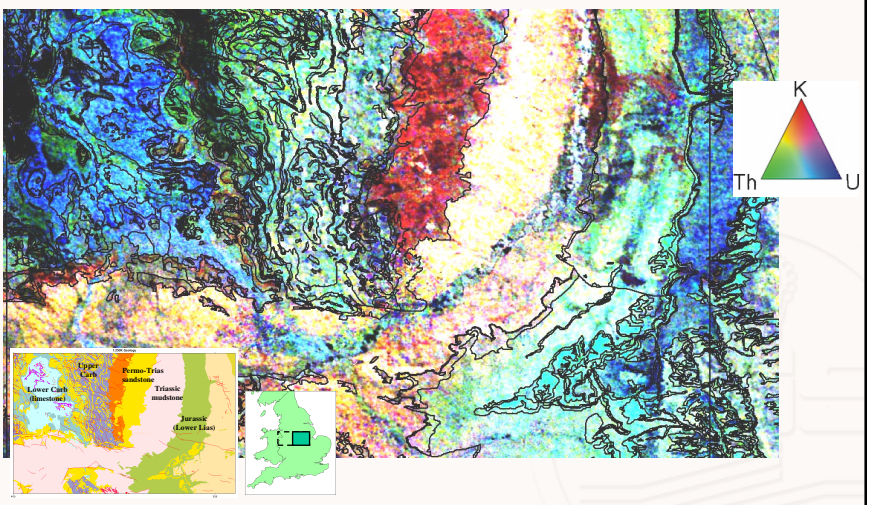
Radiometric maps of geology



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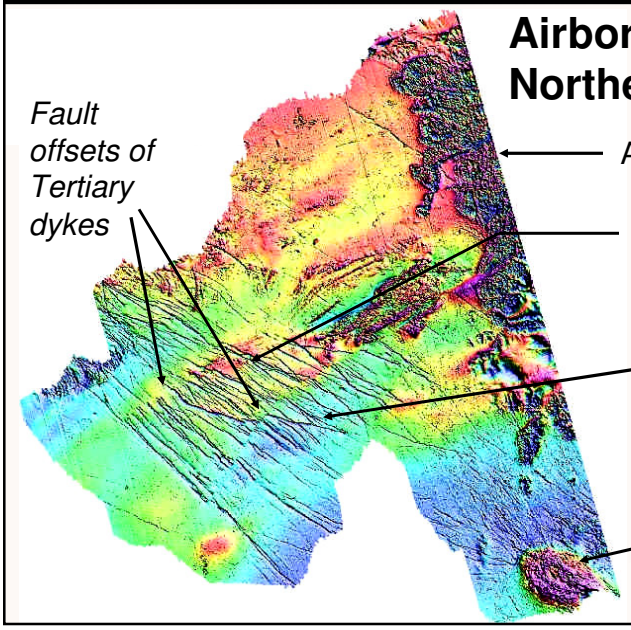
Airborne Geophysics Northern Ireland



Fault offsets of Tertiary dykes

Antrim Basalts

Caledonian structural trend

Cross-cutting Tertiary volcanic dykes

Slieve Gullion volcanic centre

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Visualising the geology

- Virtalis StereoWorks visualisation system
- 3D subsurface data models
  - tool for geoscience communications
  - for scientists, planners, decision makers and service operators

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Magnetic and Electromagnetic Surveys for Groundwater

Electromagnetics (conductivity related to salinity)

- identifies water bearing rocks
- determines water quality (fresh, brackish or saline)
- maps palaeo-channels (old river systems)

Magnetics

- identifies faults fractures and dykes that control groundwater flow in hardrock terrains;
- maps palaeo-channels (old river systems);

Digital Terrain

- Maps the topography that control surface water flow

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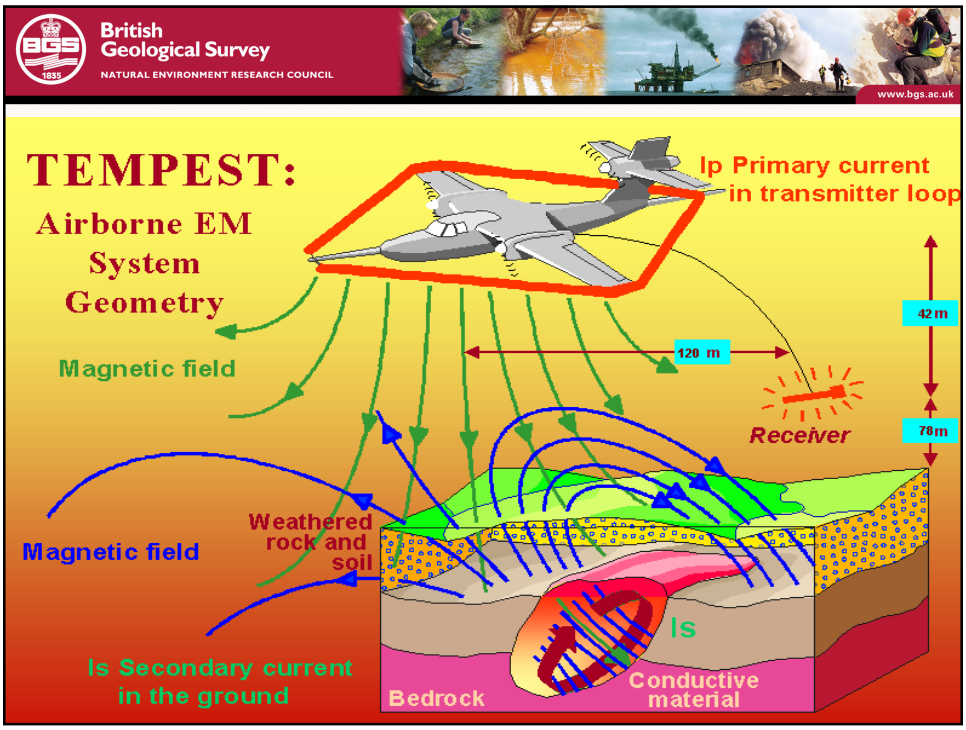

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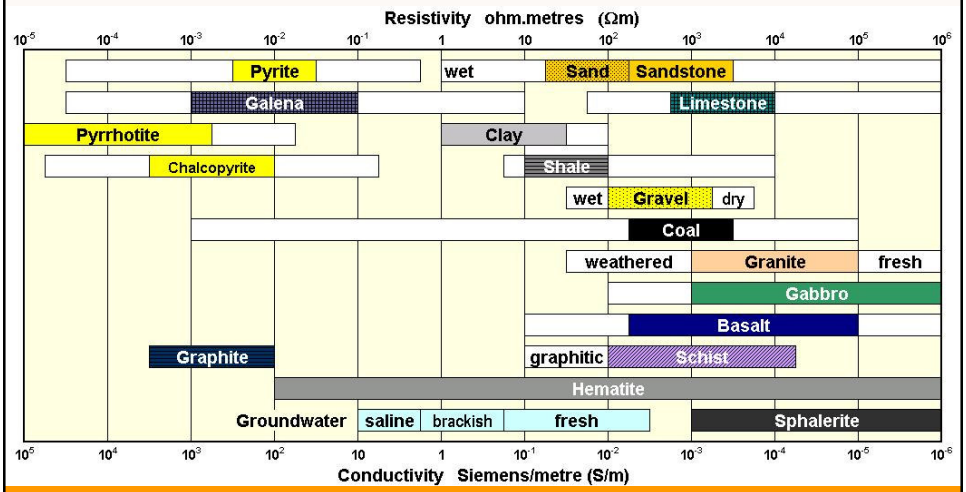

Conductivity / resistivity is most variable of all physical properties

Mainly controlled by water content, water quality, porosity, rock fracturing

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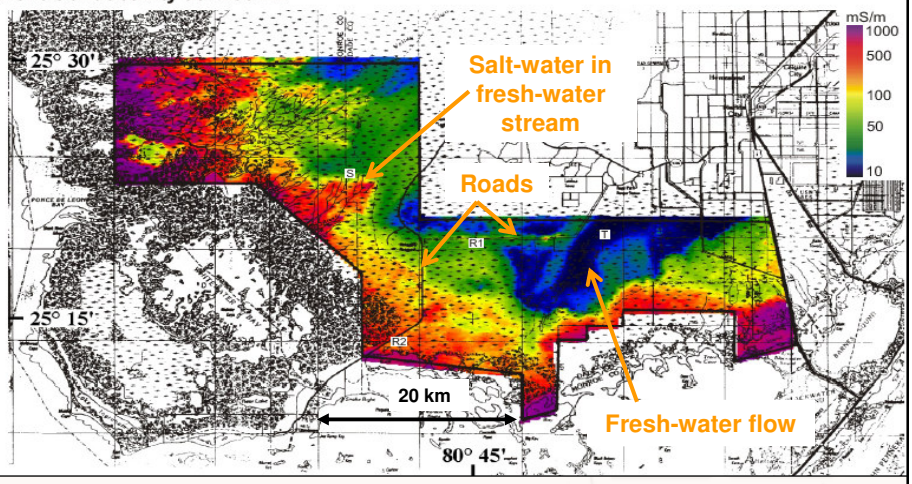
Apparent Conductivity at 7200 Hz



From Florida case study (slide by permission of Fugro)

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Geohazards – includes ground collapse potential, seismic risks, corrosion risk from soil geochemistry

- ground settling / slip
- solution cavities
- seismic damage

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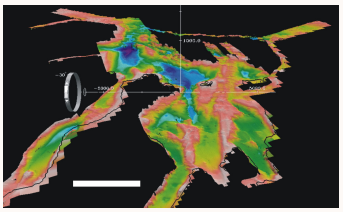
Coastal geology and oceanography

- Sea bed mapping, coring and morphology
- Current meter and tide gauge analysis
- Calculations of sedimentation / erosion rates and modelling consequences
- Climate change / sea level rise impact analysis



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and finally …….

- Large volumes of geoscience data will require large-scale, professionally designed and managed data bases and information systems

….to make the information available, in the right format, to those who need it

….and to preserve the data in the long term

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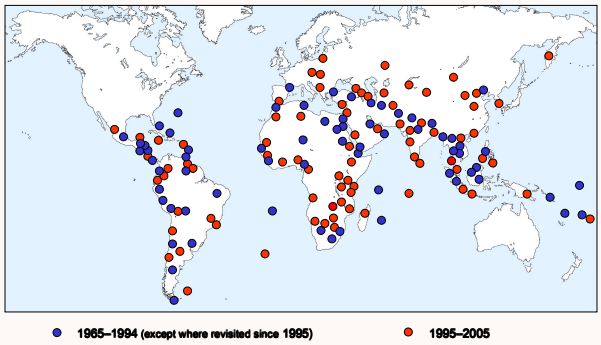

The BGS does integrated geological mapping projects in many parts of the world

Summary and Conclusions

A large scale engineering project like the SDCP will benefit from up-to-date geological understanding of

- 3D geology and its physical and chemical properties
- Groundwater and its protection
- Geological hazards
- Environmental and climate change impacts
- Coastal and marine geology
- Information dissemination and management

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Thank you for your kind attention

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