

## Earth observation for advanced geoscience modelling – the Tellus South West airborne high resolution geophysical, multispectral and LiDAR survey

### Supervisors:

#### Paul Lusty (British Geological Survey) – Main supervisor

Dr Robin Shail (Camborne School of Mines, University of Exeter)

Dr Stephen Grebby (British Geological Survey)

Paul Williamson (British Geological Survey)

**Host institution:** British Geological Survey (Keyworth)

**Project description:** NERC has invested £1.7m in a comprehensive high-resolution airborne survey of South West England (Tellus South West). These new data include magnetic, radiometric, multispectral and LiDAR. The project will interrogate these new data against, and integrate them with, existing datasets in order to develop an enhanced geoscience model for South West England. Principal aspects of geological evolution being addressed include Devonian-Carboniferous passive margin stratigraphy and development, Variscan/post-Variscan deformation, granite magmatism, Permo-Triassic sedimentation, mineralisation and the legacy of these processes for Cenozoic-Recent landscape evolution and near surface processes.



**Above:** Aerial surveys reveal magnetic and radiometric data of the subsurface.

Stakeholders requiring improved geoscience models of South West England include those associated with: (i) renewed mineral exploration for base (e.g. tin, copper) and ‘critical’ metals (e.g. tungsten, Wolf Minerals - Hemerdon); (ii) development of deep (4–5 km) proof-of-concept geothermal systems targeting major fault zones within granite; (iii) evaluating structurally-controlled landslides in ‘hard rock’ coastal zones.

The principal elements of the project are:

- (i) Integration of the new and legacy data, i.e. regional geochemistry, bedrock and superficial mapping, land-based gravity, to produce innovative geological maps and interpretations for the region.
- (ii) Use of novel approaches for spatial data analysis, interrogation, filtering, modelling, visualisation and fusion of multi-resolution and multi-source geological data to emphasise patterns and associations. Of particular interest is the application of the new LiDAR data for enhanced and automated lithological and structural mapping [e.g. 1]. South West England provides an opportunity to test this approach in a well-vegetated terrane with less pronounced topographic variation – something that limits the applicability of conventional remote sensing approaches.
- (iii) Ground-based verification of the results of the data analysis and mapping, for selected areas with contrasting geology;
- (iv) Development of regional scale prospectivity models [e.g. 2] and quantitative resource assessments for this world class mineral province, based upon a range of techniques (e.g. logistic regression, artificial neural networks).

This project offers the first chance to undertake research on the new data and a unique opportunity to work on one of the best surveyed parts of the planet. Datasets produced by this study (e.g. digital

terrain models, lineament and fracture density maps) will have wide ranging and novel applications (e.g. hydrogeological and environmental modelling), which could inform the attribution of 3D models of the region at a variety of scales. The project will provide the student with excellent data interpretation, numerical and modelling skills – some of the most desirable skills for the next generation of environmental scientists.

[1] **Grebby S** et al, 2010. Lithological mapping of the Troodos ophiolite, Cyprus, using airborne LiDAR topographic data. *Remote Sensing of Environment*, 114, 713–724. [2] **Lusty PAJ** et al, 2012. Reconnaissance-scale prospectivity analysis for gold mineralisation in the Southern Uplands-Down-Longford Terrane, Northern Ireland. *Natural Resources Research*, 21, 359–382.