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GIS based integration of airborne magnetic, radiometric, LiDAR, soil and sediment geochemistry: A case study of the TellusSW surveys, England

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This case study details the integration of stream, water and soil British Geological Survey GBase geochemistry with NERC-funded 2014 airborne radiometrics, magnetics [1] and LiDAR [2] over 11000 km^2 of SW England, as well as extensive, albeit partly dated, geological mapping. TellusSW data were combined in a GIS with vector and scanned geology as well as scanned and vector topographical coverage (1:2500-1:250000), including outlines of national parks and sensitive environmental areas. Other data used included detailed records of old mine workings and production statistics. The area is of particular interest as it includes the well-known mineralised areas of Devon and Cornwall and is therefore a good test of these methods for exploring less well-mapped areas.

Geochemical data were interpreted in their correct spatial locations by generating catchments for the ~3800 stream sediment samples from point data [3,4]. This was accomplished using 5 m resolution LiDAR height data in the Hydromodeler module of ArcGIS, coupled with final manual editing using scanned topography. This catchment approach allows much more detailed interpretation including recognition of disused mine workings within drainage basins as well as background calculation using digital geology. It is more accurate than using contoured sample locations that include areas downstream of sample location points. A notable case was the detection of previously unrecognised Sb mineralisation, the location of which was not detectable on contoured data [5].

Although few new areas for immediate Sn-W exploration were recognised, the integration of airborne data and geochemistry provide a much clearer picture of the distribution of mineralised outcrops. LiDAR data were noteworthy in detecting probable medieval workings on the subcrop of lodes and alluvial workings downstream from subcrop, using hillshaded images. When combined with airborne magnetics they also provide new insight of major mineralisation controlling NW-SE lineaments, previously mainly known from underground workings.

One major issue addressed was mapping of poorly-exposed Variscan granitic sub-units and controls on Sn-W-Cu-kaolinite mineralization. TellusSW data allow remapping of granites and temporally related rhyolite-porphyry (elvan) and lamprophyre dykes [6]. Radiometric data are particularly useful in providing an overview of units within individual granite plutons, notably by using eTh/eK ratios as Th is mainly immobile. When coupled with Nb, Ta and Zr stream sediment geochemistry these data allow interpretation of different granite units, supporting previous models of older, simpler, and younger, composite, plutons, which include topaz and Li-mica granites. Lamprophyre dykes can also be detected using a combination of eTh and LiDAR and elvans using LiDAR and eK.

References:

[1] TellusSW (2014) www.tellusgb.ac.uk

[2] Ferraccioli, F et al. (2014) data.gov.uk/dataset/lidar-based-digital-terrain-model-dtmdata-for-south-west-england
[3] Moon CJ (1999) J Geochem Expl 65: 111-132
[4] Carranza J (2008) *Geochemical Anomaly and Mineral Prospectivity Mapping in GIS:* Elsevier
[5] Moon CJ (2015) *Mineral Resources In A Sustainable World:* SGA, 5, 1973-1975
[6] Moon CJ (2015) Geosci SW Engl 13:459-470