Using image analysis techniques to integrate radiometric stream sediment data: an example from the Bodmin Moor Granite, UK

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The Tellus South West survey collected Airborne Radiometric (ARM) data over South West England. The Bodmin Moor Granite (BMG) forms part of a composite batholith. It is an area of poor exposure and has proven difficult to map. ARM data are continuously sampled and largely overcome these challenges. Elsewhere in the region, four principal granite types have been defined displaying different mineralogical and geochemical characteristics [1]. These classifications have not been applied to the BMG and are absent from current 1:50 000 maps.

Data Preparation

ARM data measures potassium, thorium and uranium concentrations. The gridded concentration data (40x40 m pixels) were clipped to the current mapped surface extent of the BMG. High soil moisture in peat bogs attenuates ARM data. To overcome this, a principal component analysis was conducted to remove uncorrelated variance in problem areas. Subsequently, minima over these areas were removed using a 'supervised' classification and a 200 m buffer was applied to account for a halo effect in the gridding.

Data Integration

A first-pass classification was conducted using the relative abundances and ratio of potassium and thorium, omitting the use of uranium based on work by Moon [2]. This demonstrated that the ARM data hold insufficient information to determine four distinct granite types. Stream-sediment data was divided into upstream catchment areas and rasterised to provide further geochemical discriminators. Zirconium and niobium based on [1], as well as ARM data, were integrated using an 'unsupervised' image classification technique. We present a revised classification for the BMG and discuss how this technique can be applied world-wide for geological mapping and mineral exploration.

[1] Manning et al. (1996), *JGSL* **153**, 827-838. [2] Moon (2015), *Proc. Ussher Soc.* **13**, 459-470.