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New geochemical and geophysical data of Northern Ireland

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Geological Survey of Northern Ireland

ABSTRACT: The Geological Survey of Northern Ireland has completed new geochemical and airborne geophysical surveys over the whole country that will promote further mineral exploration. The geochemical surveys map the distribution of 60 elements in three sample media and geophysical imagery provides great detail on potentially mineralised structures. New anomalies in gold, platinum group elements and base metals have been mapped. Regionally, the airborne geophysical imagery refines and extends existing structural mapping. Prominent magnetic anomalies correspond with major intrusive complexes, the extensive Palaeogene lava flows and dykes. The electromagnetic and radiometric results display significant variations over different lithologies. At a local scale the imagery reveals outstanding structural detail.

KEYWORDS: Tellus Project, Northern Ireland, geochemistry, geophysics, gold, platinum, base metals

1 SURVEYS OF THE TELLUS PROJECT

The comprehensive geochemical and airborne geophysical surveys of Northern Ireland which began in 2004 were completed in 2006. Digital datasets and images will be released by the Geological Survey of Northern Ireland (GSNI) during 2007. These data are expected to encourage further mineral exploration in Northern Ireland, for gold, PGE's and base metals.

The data were acquired by the Tellus Project, which has been funded by the Department of Enterprise, Trade and Investment and by the EU Building Sustainable Prosperity programme through the Department of Agriculture and Rural Development.

The project included three geochemical surveys across Northern Ireland under this programme and acquired the following data to the G-BASE standard established by the British Geological Survey (BGS). Soils were sampled at 20 and 50cm depths on a regular grid at one site per 2 km^2. Streams were sampled at an average of one site per 2.15 km^2. The following analytical methods for 60 elements and compounds were used:

- Soils: XRF and ICP with fire-assay for gold and PGEs,
- Stream sediments: XRF and fire-assay for gold and PGEs,
- Stream waters: ion chromatography and ICP.

Nearly 30,000 samples have been collected and analysed. Soils samples have been taken at a greater density in the urban areas of Belfast and Londonderry, primarily to establish an environmental baseline.

The low-level regional airborne geophysical survey was flown for the Tellus Project by the Joint Airborne-geoscience Capability, a partnership of the British Geological Survey and the Geological Survey of Finland, using a De

Havilland Twin Otter aircraft. The survey parameters were:

- ground clearance: 56m over rural areas and 250m over populated areas,
- line spacing: 200m,
- line direction: 345° and 165°.

The following data were acquired:

- Total magnetic field and horizontal gradient,
- Electrical conductivity,
- Four channel gamma-ray spectrometry.

The airborne magnetic results refine existing structural information, notably by extending the mapping of dyke swarms and delineating regional and local faults. The EM method maps predominantly shallow variations of electrical conductivity of geological, pedological or anthropogenic origins. Gamma-ray results show gross differences in the radioactivity of different lithologies and soils. The principal isotopes mapped are those of the uranium and thorium series and potassium-40.

2 PRECIOUS METALS

The styles of gold mineralisation in Northern Ireland have been summarised by Arthurs and Earls (2004). Of these, the most important is the mesothermal quartz vein gold occurring in the Neoproterozoic Dalradian Supergroup close to the Omagh Thrust Fault in Co. Tyrone. In this area the new geochemical results show prominent gold and arsenic anomalies in streams and soils, which may be followed westward from known mineralisation (Fig. 1). The new magnetic images display detailed magnetic textures within the Dalradian and underlying Palaeozoic rocks, all intruded by extensive Palaeocene dykes (Fig. 2). The electrical conductivity images reveal gross differences in conductivity between the principal formations and prominent linear anomalies arising from the major fault planes (Fig. 3). Numerous, previously unmapped linear features have been revealed, many correlating with gold occurrences.

East of the Curraghinalt gold deposit, stratabound gold occurrences of the Glenwagna Formation and volcanogenic occurrences of the Tyrone Igneous Complex correlate with structural features revealed on conductivity and magnetic images (Figs. 2 and 3).

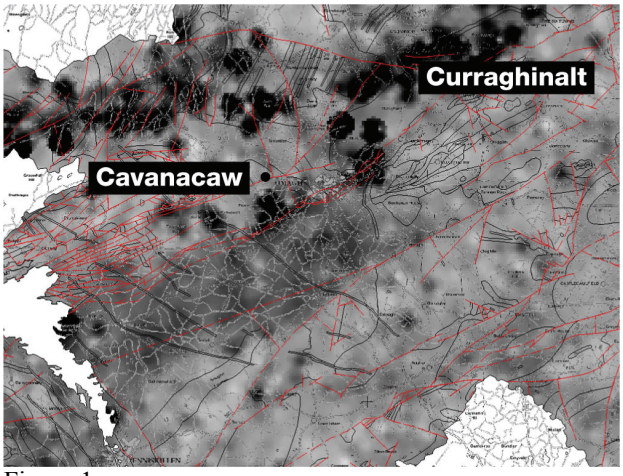

Figure 1.
Western Northern Ireland: anomalous soil arsenic trends and the locations of the deposits of Cavanacaw and Curraghinalt

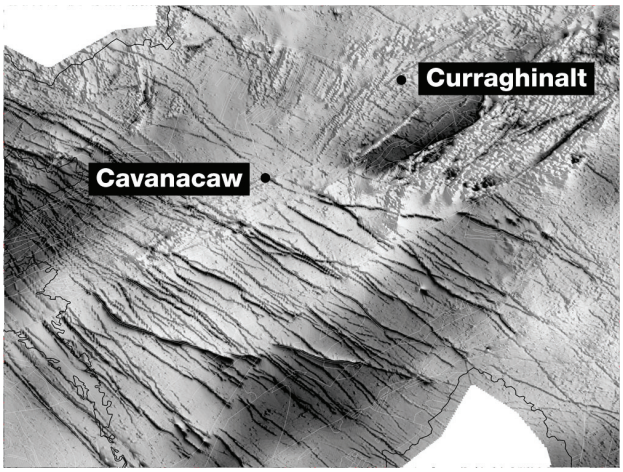

Figure 2.
Western Northern Ireland: derivative map of total magnetic intensity.

Prominent anomalies of gold, arsenic, antimony and other metals characterise the locality of another mesothemal vein gold deposit at Cargalisgorran in Co. Armagh. Intense arsenic anomalies have been recorded in Silurian greywackes and shales WSW and ENE of the Palaeogene granite intrusives of Counties Armagh and Down. Significant alluvial gold has been found in panned stream sediment concentrates in and along the margins of these intrusives. The intrusives display characteristic but different expressions of magnetisation, conductivity and

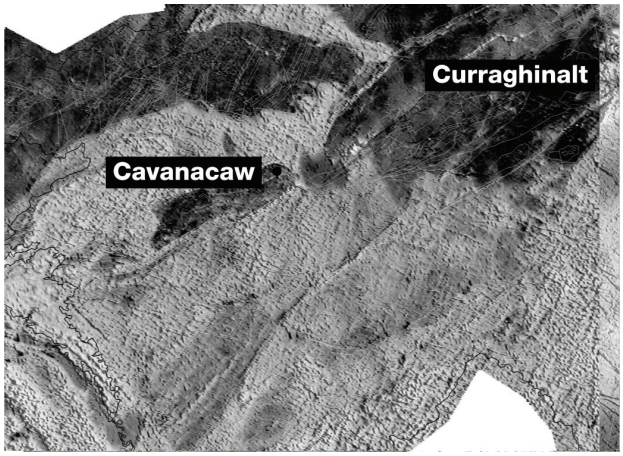

Figure 3.
Western Northern Ireland: apparent electrical conductivity.

radiation. The detailed lineaments and textures revealed in the new magnetic and conductivity images reflect shear zones, subsidiary fracturing and other structural elements in these intrusives (Fig. 4).

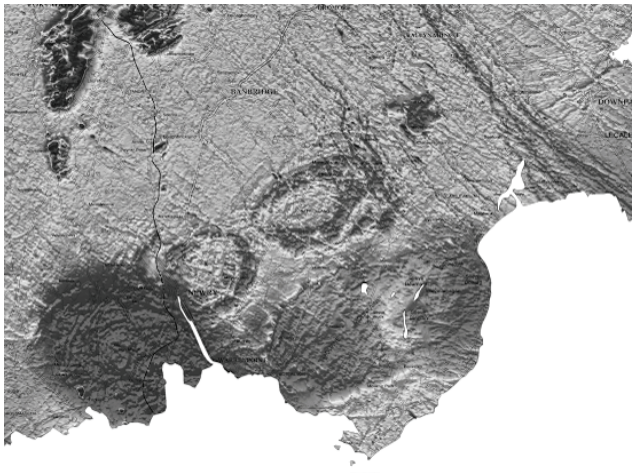

Figure 4.
Southeast Northern Ireland: derivative map of total magnetic intensity showing the anomalies of the intrusive complexes (in the south), the limit of Antrim basalts (in the northwest) and northwesterly trending dyke swarms.

Relatively high values of platinum were recorded in stream sediments and soils over the Antrim lavas, in the soils over the Co. Fermanagh and Co. Down dykes and in streams draining Upper Dalradian rocks in the Sperrin Mountains.

3 BASE METALS

Of the base metal geochemistry results so far analysed, the highest values of several metals occur in the soils and streams of the Antrim lavas. Copper, cobalt, chromium and nickel are all significantly higher than elsewhere in Northern Ireland. The lavas are clearly defined by the airborne magnetics and structures and lineaments within them are revealed or suppressed by different data transformations.

High nickel values are also associated with several of the dykes of Co. Fermanagh and a major dyke swarm in Co. Down. These trends beneath glacial cover are revealed clearly by the various magnetic transformations (Fig. 5).

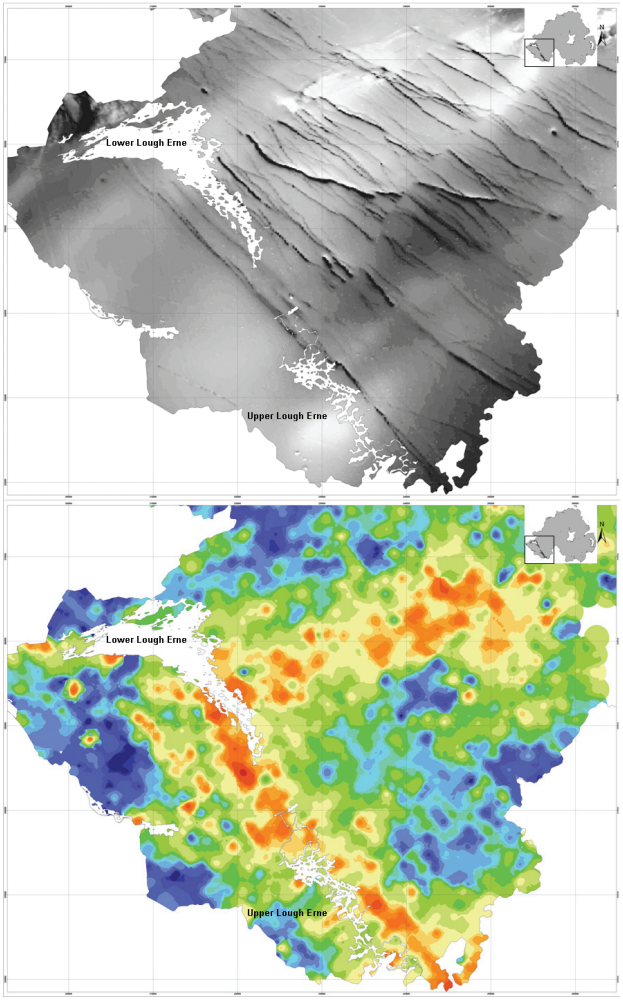

Figure 5.
Southwestern Northern Ireland: anomalous soil nickel trends (bottom) correlate with Palaeocene dykes indicated by the sunshaded image of the magnetic field (top).

REFERENCE

Arthurs JW, Earls G (2004) Minerals. In: Mitchell WI (ed) The Geology of Northern Ireland - Our Natural Foundation (Second Edition). Geological Survey of Northern Ireland, Belfast. pp 255-272.