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ar son na hAeráide & Comhshaoil
Department of Communications,
Climate Action & Environment



Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

2016 GSI Postdoctoral Projects funded

1. A detailed Sm-Nd and Pb isotope study of the pre-Carboniferous basement of Ireland, assessing its implications for Zn-Pb mineralization

Dr Steven Hollis, University College Dublin – School of Earth Sciences

Irish-type Zn-Pb deposits are the mainstay of the Irish mining industry. In the last 50 years, five ore bodies have been mined and over twenty sub-economic prospects discovered. With only one mine in Ireland currently operational, there is a sense of urgency to understand the complex interplay of structure, stratigraphy and fluid-mixing processes during mineralization.

A key, understudied aspect of this is the role and influence that inherited Caledonian terranes (and structures) have on the regional distribution of metals and the focussing of hydrothermal fluids from depth. Our research aims to use Sm-Nd and Pb isotopic methods to identify and map Lower Palaeozoic Caledonian terranes and deep-seated crustal structures across Ireland. Areas of juvenile and evolved crust will be identified through depleted mantle model ages (e.g. Nd2DM) and variations in ϵ_{Nd} , with data visualised in map form. Through a similar method using Pb isotope constraints from galena occurrences, a more direct link to mineralization will be established, with the two systems used in conjunction to investigate links between mineralization and crustal domains. Furthermore, we will investigate Pb isotopic variations throughout the Lisheen deposit in 3D to detail fluid-flow processes and assess if any isotopic vectors to mineralization can be established.

2. Optical remote sensing for bathymetry and seabed mapping in the coast of Ireland (BaSMal)

Dr Gema Casal, Maynooth University – National Centre for Geocomputation

The coastal shallow water zone can be a challenging and costly environment in which to acquire bathymetry and other oceanographic data using traditional survey methods. Navigation hazards and water column properties make some of these areas unfeasible to survey using ships or LIDAR. Thus, much of the coastal shallow water zone worldwide, and in particular within the Irish coastline, remains unmapped. The aims of BaSMal are to allow reliable derivation of coastal bathymetry, water column and seafloor properties using a combination of multispectral data (Sentinel-2), hyperspectral data (UAV) and in situ data. The methodology will utilize a set of Irish case studies, in a variety of coastal environments, to implement robust and novel research in the fields of satellite image processing and, empirical and physical modelling, by developing new web-enabled products. The aims of

BaSMal are closely aligned with national (INFOMAR) and EU (Copernicus) programmes through provision of applications and services under several thematic areas. Satellite bathymetry and coastal mapping products, and more importantly their repeatability over time, can offer solutions to important coastal zone management issues and address key challenges in the critical line between shoreline changes and human activity.

3. Quantifying Coastal Evolution along Wexford County using Remote Sensing Approaches

Dr Sojan Matthew, University College Dublin – Geography

Along shorelines of the South-eastern Irish coast, there is concern that a lack of sediment supply, rising sea level and climate change will have an impact on sediment circulation pattern, which in turn will lead to destabilization of nearshore-beach-dune systems through erosion, overwash, and backshore transgression. The proposed investigation aims to use high-resolution bathymetric/topographic elevation and geologic/geophysical data collected as part of INSS and INFOMAR programs to map approximately 30 km² of the shallow geomorphology along shorelines of Wexford County. The purpose of this investigation is to test the hypothesis of whether there is a relationship between shoreline change rates and beach/dune morphodynamics, to sediment availability and pathways in near/off-shore areas across the study area. This will be done using lidar, UAV, MBES and meteorological data, historic aerial/satellite imagery, existing topographic profiles and sediment characteristics. The relative significance of seasonal/ annual/ decadal processes versus response of nearshore-beach-dune system to broader geomorphic controls (relative sea level rise, storms) will be assessed. This proposal could be seen as a pilot study for developing an integrated system of modelling shoreline change and sediment budgets that will integrate measurements over different spatial and temporal scales, which can be used for the entire Irish coastline.

4. Seismic monitoring and high-resolution crustal imaging in Ireland

Dr Pierre Arroucau, Dublin Institute for Advanced Studies – School of Cosmic Physics

The seismic activity of Ireland is characterized by low magnitude, infrequent natural earthquakes and a large number of man-made events (quarry and mine explosions). The latter, thanks to their nearly homogeneous distribution across the country, and thanks to today's dense coverage of the country by permanent and temporary seismic networks, offer a unique opportunity for high-resolution seismic imaging of Ireland's crust and upper mantle, using local tomography methods. At the same time, monitoring seismic activity in such a context poses a significant detection and discrimination challenge. The interlinked goals of this project are (1) to combine abundant data from quarry and mine blasts, local earthquakes and previous controlled-source experiments in order to produce a new 3D tomographic model for Ireland, which will illuminate the subsurface at a new level of detail, with resolution as high as deposit-scale, benefiting the extractive industries; (2) to develop and implement robust detection and discrimination tools for local seismic activity monitoring that will contribute to the state-of-the-art scientific basis for the Irish National Seismic Network's services to the general public, educators, industry and government agencies.

