



The Geological Index of the Scottish Caledonides northwest of the Highland Boundary Fault

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The quantification and mapping of geodiversity have gained more interest in recent years due to practical application in natural resource management and conservation. The Geological Index (I_{Geo}) represents the quantitative expression of geological features and is part of a broader Geodiversity Index (I_{Geodiv}), which also includes geomorphological, pedological, paleontological and hydrological elements.

In Scotland, the area delimited by the Moine Thrust Zone to the northwest and the Highland Boundary Fault to the southeast represents a fragment of the Caledonian orogenic belt that extends across parts of North America, Greenland and Scandinavia. It includes the Highlands, most of the Inner Hebrides and the islands of Orkney and Shetland. The area is underlain by two tectonic blocks – the Northern Highlands Terrane and the Grampian Terrane – separated by a major strike-slip fault, the Great Glen. Both blocks consist of an Archaean-Paleoproterozoic basement covered by the Neoproterozoic metamorphic suites of the Moine and Dalradian Supergroups, together with a series of magmatic intrusions and other rocks of late Precambrian and Phanerozoic age.

The I_{Geo} was obtained from lithostratigraphic and lithodemic units, mapped at group and suite/complex level respectively, major geologic contacts and faults and minor igneous intrusions from the British Geological Survey 1:625k digital datasets. These were reclassified and analyzed using QGIS and ArcGIS software.

The results show overall medium and high values of I_{Geo} , with regional variations and well-individualized areas of very high and very low values. Conspicuous transitions between extremes are observed at the north and south edges of the study area.

High I_{Geo} values occur in five major areas across the mainland: 1). on the north coast, which exhibits small outcrops of varied lithologies; 2). in the northeast Grampian Mountains, where the deformed Dalradian rocks are intruded by the Cairngorms suite of the Newer Granites; 3). along the Great Glen, the meeting place of adjacent tectonic blocks; 4). in the Firth of Lorne area and further inland, where Neoproterozoic and Paleozoic rocks come into contact with more recent Cenozoic rocks of the Hebridean Province; 5). at the southern tip of the Kintyre Peninsula that contains isolated exposures of rocks characteristic of the nearby Midland Valley.

Low I_{Geo} values are encountered in three major areas of the mainland: 1). southeast of the Moine Thrust Zone, an area occupied by the oldest Moine group; 2). in the Pentland Firth area that consists of the Old Red Sandstone Supergroup; 3). in the Firth of Clyde area and further inland, around the main outcrop of the youngest Dalradian group.

Offshore, the islands of Orkney and Shetland have I_{Geo} values at opposite ends of the spectrum. The first are made up of a monotonous sedimentary cover. The latter comprise a mosaic of rocks of Precambrian and early Phanerozoic age.