

Moine geology of North Sutherland - an excursion

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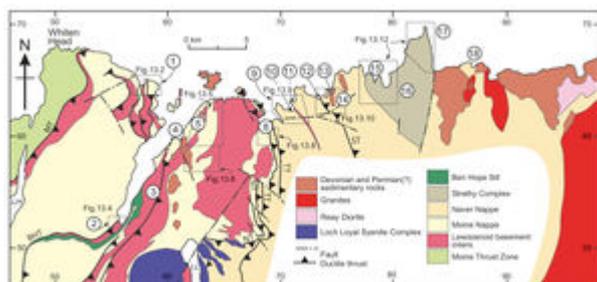


Fig. 13.1 Simplified geological map of north Sutherland together with the localities for the excursion.

Table 1: Table of structural events		
	MOINE NAPPE	NAVER NAPPE
SCANDIAN (c. 4.15-4.25 Ma)	Emplacement of the Loch Loyal Syenite Complex . D₄ formation of the transpressive Torridale Steep Belt, as well as the major synform-and-form pair within the Kirtomy gneisses and the Strathly Complex. D₃ tight-to-open, asymmetric recumbent folding. D₂ NW-directed ductile thrusting (e.g. Swardly, Naver and Ben Hope thrusts) accompanied by widespread tight to isoclinal interfolding of Moine and Lewisianoid basement; recumbent folds commonly curvilinear about NNW- to NW-trending mineral and extension lineation.	
GRAMPIAN (c. 4.70-4.60 Ma)	Not recorded.	D_{1M} upper amphibolite facies metamorphism and migmatization; minor tight development of S_{1M} foliation and N-S-trending L_{1M} mineral and extension lineation.
LATE NEOPROTEROZOIC	Intrusion of alkaline Loch a' Mhoid Metagabbro Suite .	Not recorded.
KNOXDARTIAN? (c. 820-800 Ma)	D_{1M} garnet-staurolite grade metamorphism, S_{1M} foliation, minor isoclinal folding.	Amphibolite facies metamorphism and fabric development inferred but not observed due to intensity of Grampian overprint.
EARLY NEOPROTEROZOIC (c. 1000-870 Ma)	Deposition of Moine sediments in an extensional basin within the Rodinia supercontinent, accompanied by emplacement of mafic igneous intrusions such as the Ben Hope Sill .	

Fig. 13.4 Locality 13.2. A. The Ben Hope Thrust and basement-cover relations in the Ben Hope to Kinloch area of the Moine Nappe; B. detailed map of the Kinloch area; C. Interpretative sketch of D3 structures in the Kinloch area (from Moorhouse et al.,

1988).

Excursion 13 North Sutherland

<i>Purpose:</i>	A general traverse across the Caledonian thrust nappes that outcrop between the Moine Thrust and the sedimentary cover of the Devonian Orcadian Basin.
<i>Aspects covered:</i>	Various metasedimentary lithologies, metamorphic minerals and migmatites, Lewisianoid basement gneisses, Precambrian and Lower Palaeozoic (meta)igneous intrusions, Caledonian ductile structures, late to post-Caledonian brittle faults, Devonian and probable Permo-Triassic sedimentary rocks.
<i>Useful information:</i>	Hotel and B&B accommodation and camping are available at Talmine, Tongue and Bettyhill.
<i>Maps:</i>	OS: 1:25,000 sheets 446 Durness & Cape Wrath, 447 Ben Hope, Loch Loyal & Kyle of Tongue, 448 Strath Naver & Loch Loyal, 449 Strath Halladale & Strathy Point; BGS: 1:50,000 sheets 114W Loch Eriboll, 114E Tongue and 115W Strathy Point.
<i>Type of terrain:</i>	Rocky coastline, moorland, quarry and roadside exposures.
<i>Distance and time:</i>	The excursion is best followed from a base in either Tongue or Bettyhill, taking 4 days. See each locality for suggested times.
<i>Short itinerary:</i>	Localities 13.1, 13.4 and 13.8 could be accomplished in one day.

Excursion 13 Moine geology of North Sutherland is composed of the following articles:

- Excursion 13 North Sutherland - introduction
- [The Melness area. Locality 13.1](#)
- [South and east side of Tongue Bay. Localities 13.2 to 13.5](#)
- [Loch Cormaic and Borgie peat cuts. Localities 13.6 to 13.7](#)
- [Torrisdale Bay. Locality 13.8](#)
- [Craig Ruadh to Glaisgeo. Localities 13.9 to 13.11](#)
- [Swordly Bay, Kirtomy Bay and Cnoc Mor. Localities 13.12 to 13.14](#)
- [Port Mor to Portskerra. Localities 13.15 to 13.18](#)

The traverse along the well-exposed north coast of Sutherland ([Fig. 13.1](#)) provides the best opportunity to examine the complex regional structure of the Moine and Naver nappes, as well as a number of the Archaean basement inliers that crop out in the area. Particular points of interest include the nature of the relationships of these inliers with the Moine, and the evidence for their pervasive reworking during the Caledonian orogeny. These basement inliers have often been correlated with the Lewisian gneisses of the foreland, although unambiguous correlation remains to be demonstrated. Accordingly, use of the less specific term 'Lewisianoid' is employed here to denote basement that is of similar age and lithology to that of the foreland. Both the basement inliers and the Moine have undergone a complex polyphase deformation history. Complications in attempting to erect a consistent chronology across the traverse arise from the recognition that in the Moine Nappe the earliest structures and metamorphic fabrics recognizable in the field are Neoproterozoic in age, whereas in the Naver Nappe they are Ordovician (Grampian). It is assumed that Neoproterozoic fabrics were originally present within the Naver Nappe, but were extensively reworked during Ordovician high-grade metamorphism and migmatization ([Table S.1](#)). The Grampian event has so far not been recognized within the Moine Nappe. In the deformation chronology presented in [Table S.1](#), we therefore recognize D_1 (Moine Nappe) and D_{1N} (Naver Nappe) events that are of different ages. Both thrust nappes record a similar polyphase Silurian (Scandian) history: sets of structures assigned to D_2 , D_3 and D_4 episodes are thought to have resulted from a continuous, progressive deformation.

References

At all times follow: [The Scottish Access Code](#) and [Code of conduct for geological field work](#)

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