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# A geological excursion guide to the Moine geology of the Northern Highlands of Scotland

Edited by Rob Strachan, Clark Friend, Ian Alsop and Suzanne Miller

National Museums of Scotland

**Dedicated to the late Frank May and Val Moorhouse who both contributed much to our present understanding of the Moine geology of Northern Scotland.**

Published in 2010 by Edinburgh Geological Society Geological Society of Glasgow in association with NMS Enterprises Limited – Publishing a division of NMS Enterprises Limited National Museums Scotland Chambers Street Edinburgh EH1 1JF

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ISBN: 978 1 905267 33 0

Publication layout and design by NMS Enterprises Limited – Publishing.

Cover artwork by Mark Blackadder; photograph by Anna Bird. Cover image: High-grade Moine gneisses and meta-igneous intrusions of the Naver Nappe, Torrisdale Bay, Sutherland.

Printed and bound in China by Eurasia.

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## Foreword

The Neoproterozoic rocks of the Moine Supergroup underlie an extensive tract of the Lower Palaeozoic Caledonian mountain belt in NW Scotland. The region contains numerous classic geological localities that have been illustrated in geology textbooks for many years. The superb geology of the region continues to attract field parties of amateur groups, undergraduate students and international scientists. This guide is a new edition of the first 'Moine fieldguide' that was published by Scottish Academic Press in 1988 on behalf of the Edinburgh and Glasgow geological societies, and is now more or less unavailable. As was the case with the first guide, the aim is to provide an up-to-date summary of the geological evolution of the Moine Supergroup, illustrated by the field evidence on which it is based. Owners of the first fieldguide will see that a number of excursions have survived more or less intact, although at a minimum all have been updated to take account of new geological information, as well as any new outcrops and/or additional constraints on access. Other excursions have been more or less completely rewritten. A key feature of this second edition is the inclusion of new excursions to the Ross of Mull, West Glenelg and Loch Hourn, East Glenelg and Loch Duich, Glen Strathfarrar and Loch Monar, South and Central Sutherland, Durness, and the Great Glen (Figure F.1).

The editors acknowledge the substantial contributions made by Iain Allison and the late Frank May who co-edited the first 'Moine fieldguide'. The authors of the various excursions acknowledge discussions with colleagues too numerous to mention, and also the role of the Natural Environment Research Council who funded studentships which allowed much of

the research reported here to be carried out.

## Editorial Introduction

The aim of this excursion guide is to allow geological field parties to see the wide variety of rocks and structures that occur within the outcrop of the Moine Supergroup, as well as the Moine Thrust Zone that separates these rocks from those of the Caledonian foreland to the NW. The guide has been written for those who have some previous knowledge of geology: informed amateurs, undergraduate students and professional geologists. Books that provide useful background reading include *The Mapping of Geological Structures* by Ken McClay, and *The Field Description of Metamorphic Rocks* by Norman Fry, which are both published by John Wiley & Sons as part of their 'Geological Field Guide Series'. Two other publications that provide much useful background information are the 2002 edition of the *Geology of Scotland*, published by the Geological Society of London and edited by N. Trewin, and the British Geological Survey *Northern Highlands Regional Guide* published in 1995.

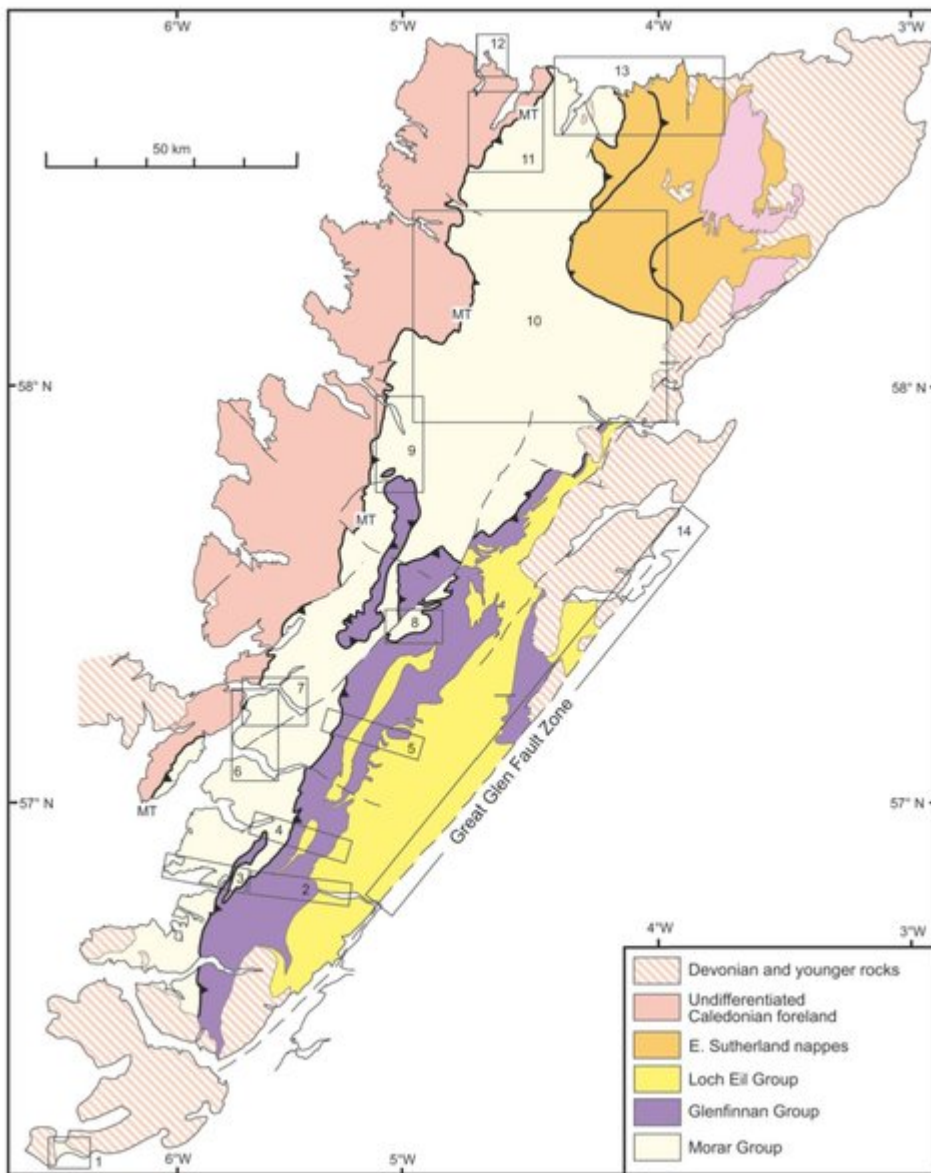
The excursions are mostly easily accessible from the various roads that cross the Moine outcrop. Statutory rights of public access were established over most land through the Land Reform (Scotland) Act 2003. Nonetheless, stalking of red deer occurs from early August and shooting of grouse from 12 August, and field parties should take account of reasonable requests to minimise disturbance at these times. A guide to access rights is published by the Ramblers' Association Scotland. Field parties are also reminded that many of the excursions include localities that have Site of Special Scientific Interest (SSSI) status and hammering and collection of material at these sites is prohibited without permission. Details of SSSIs can be obtained from Scottish Natural Heritage.

It is assumed that all geological field parties will adhere to the codes of practice for safety published by the Geological Society of London and/or the Geologists' Association. Visitors to the Scottish Highlands should be aware that the weather can be highly unpredictable, even in summer. Stout footwear, warm clothing and waterproofs are all necessary, even if the weather looks set fair. Generations of Highland geologists will testify to the need to carry insect repellent during the summer months!

Since the publication of the first 'Moine field guide' in 1988, a number of new geological maps of the Moine Supergroup have been produced by the British Geological Survey (BGS). Additionally, the application of modern geochronological techniques has placed important constraints on the timing of major metamorphic and structural events. Despite these significant advances, there still remains a lack of consensus concerning the correlations of certain tectonostratigraphic units and structures, and the nature of the Neoproterozoic evolution. In this guide, no attempt has been made to force a single view; individual authors present the evidence on which they base their views and the reader is invited to follow the excursion guide, to study the rocks and their relationships in the field and to form his or her own conclusions.

Geologists have shown that the Moine Supergroup has been affected by several phases of deformation. These phases, giving rise to recognisable sets of structures, may all be part of one mountain-building event spanning some tens of millions of years, or they may be related to different orogenic events perhaps hundreds of millions of years apart. Some structures, formed during a single phase of deformation, can be correlated over large areas, while others are quite local phenomena. One cannot assume, therefore, that structures with certain labels in one excursion are the same as those with the same label in another excursion. The shorthand terms are D for phase of deformation, S for planar fabric (surface), L for a linear fabric and F for folds. Subscripts (e.g.  $D_2$ ) are added to denote which phase is being referred to. Thus  $S_2$  is a planar fabric formed during the second (local) phase of deformation (i.e.  $D_2$ ). The term  $S_0$  may be used to indicate original sedimentary bedding.

## References



*Locations of the excursions on a generalized geological map of the Northern Highlands of Scotland.*