

---

## References

- ALLISON, I., MAY, E. and STRACHAN, R.A. (eds) 1988. *An excursion guide to the Moine geology of the Scottish Highlands*. Scottish Academic Press.
- ANDREWS, S. 2008. Climatic cyclicity recorded in the Middle Old Red Sandstone of the Orcadian Basin. Univ. Aberdeen PhD thesis (unpubl.).
- ANDREWS, I.J. and BROWN, S. 1987. Stratigraphic evolution of the Jurassic, Moray Firth. *In*: Brooks, J. and Glennie, K.W. (eds) *Petroleum Geology of North-West Europe*. Proceedings 3rd Conf. Pet. Geol. N.W. Europe. 785–95. Graham and Trotman.
- ANDREWS, I.J., LONG, D., RICHARDS, E.C., THOMSON, A.R., BROWN, S., CHESHER, J.A. and McCORMAC, M. 1990. *United Kingdom offshore regional report: the Geology of the Moray Firth*. London: HMSO for the British Geological Survey.
- ANON. 1869a. Something from 'the diggings' in Sutherland. *The Illustrated London News*. April 20, 1–31. 1869b. The gold-fields of Sutherlandshire. *The Illustrated London News*. May 29, 535–8.
- ARMSTRONG, M., DONOVAN, R.N. and MYKURA, W. 1978. Western Moray Firth and Caithness. *In*: Friend, P.F. and Williams, B.P.J. (eds) *A field guide to selected outcrop areas of the Devonian of Scotland the Welsh Borderland and South Wales*. 32–37. Palaeontological Association International Symposium on the Devonian System 1978.
- ASTIN, T.R. 1985. The palaeogeography of the Middle Devonian Lower Eday Sandstone, Orkney. *Scottish Journal of Geology* 21, 353–75.
- ASTIN, T.R. 1990. The Devonian lacustrine sediments of Orkney, Scotland; implications for climate cyclicity, basin structure, and maturation history. *Journal of the Geological Society London* 147, 141–57.
- ASTIN, T.R. and ROGERS, D.A. 1991. 'Subaqueous shrinkage cracks' in the Devonian of Scotland reinterpreted. *Journal of Sedimentary Petrology* 61, 850–9.
- BAILEY, E.B. AND WEIR, J. 1932. Submarine faulting in Kimmeridgian Times: East Sutherland. *Transactions of the Royal Society of Edinburgh* 57, 429–67.
- BARRON, H.F. 1986. Dinoflagellate cyst biostratigraphy and palynofacies analysis of the Upper Jurassic strata at Helmsdale, N.E. Sutherland. Univ. Aberdeen M.Sc. Thesis (unpubl.).
- BARRON, H.F. 1989. Dinoflagellate cyst biostratigraphy and palaeoenvironments of the Upper Jurassic (Kimmeridgian to basal Portlandian) of the Helmsdale region, east Sutherland, Scotland. *In*: Batten, D.J. (ed.) *Studies in NW European micropalaeontology and palynology*. 192–213. British Micropalaeontological Society Series, Ellis Horwood, Chichester.
- BATTEN, D.J., TREWIN, N.H. and TUDHOPE, A.W. 1986. The Triassic-Jurassic junction at Golspie, Inner Moray Firth Basin. *Scottish Journal of Geology* 22, 85–98.
- BELL, B. R. and WILLIAMSON, I. T. 2002. Tertiary igneous activity. *In*: Trewin, N.H. (ed.) *The Geology of Scotland* (4th Edn), 371–407. The Geological Society, London.
- BENTON, M.J. and WALKER, A.D. 1985. Palaeoecology, taphonomy, and dating of Permo-Triassic reptiles from Elgin, north-east Scotland. *Palaeontology* 28, 207–34.
- BERRIDGE, N.G. 1967. Brora Coalfield. Geological report on the evidence of 5 boreholes drilled on November, 1966. I.G.S. internal report.

- BERRIDGE, N.G. and IVIMEY-COOK, H.C. 1967. The geology of a Geological Survey borehole at Lossiemouth, Morayshire. *Bulletin Geological Survey G.B.* 27, 155–69.
- BEVERIDGE, R, BROWN, S., GALLAGHER, M.J. and MERRITT, J.W. 1991. Economic Geology. *In: Craig, G.Y. (ed). Geology of Scotland* (3rd Edn). 545–95. The Geological Society, London.
- BLAKE, J.E 1902. On a remarkable inlier among the Jurassic rocks of Sutherland and its bearing on the origin of the breccia-beds. *Quarterly Journal of the Geological Society of London* 57, 290–312.
- BOULTON, G.S., PEACOCK, J.D. and SUTHERLAND, D.G. 2002. Quaternary. *In: Trewin, N. H. (ed.) The Geology of Scotland* (4th Edn) 409–430. The Geological Society, London.
- BRITISH GEOLOGICAL SURVEY. 2005. Dounreay, Scotland, parts of sheets NC96, NDO6 and NDO7 Bedrock. 1:25 000 Geology Series. British Geological Survey, Keyworth.
- BROOKFIELD, M.E. 1976. The age of the Allt na Cuile Sandstones (Upper Jurassic, Sutherland). *Scottish Journal of Geology* 12, 181–6.
- BROWN, R.E. 1991. Caledonian and earlier magmatism. *In: Craig, G.Y. (ed.) Geology of Scotland* (3rd Edn) 229–93. The Geological Society, London.
- CARROLL, S. 1990. Terrestrial, fluvial and marginal lacustrine ecosystems in the Old Red Sandstone of the Orcadian Basin. University of Aberdeen PhD thesis (unpubl.).
- CHAPMAN, R. 2007. An overview of gold mineralization in the Caledonides of Great Britain and Ireland: insights from placer gold geochemistry. *In: C.J. Andrew et al. (eds) Digging Deeper Proc. 9th Biennial SGA Meeting. Dublin.* 943–46.
- CHARLESWORTH, J.G. 1956. The late glacial history of the Highlands and Islands of Scotland. *Transactions of the Royal Society of Edinburgh* 62, 769–928.
- CHESHER, J.A. and LAWSON, D. 1983. *The geology of the Moray Firth*. Report of the Institute of Geological Sciences, No. 83/5, 32pp.
- CLARK, N. D. L. 1999. The Elgin Marvel. *Open University Geological Society Journal* 20, 16–18.
- COLLINS, A.G. and DONOVAN, R.M. 1977. The age of two Old Red Sandstone sequences in southern Caithness. *Scottish Journal of Geology* 13, 53–57.
- COWARD, M.P. and ENFIELD, M.R. 1987. The structure of West Orkney and adjacent basins. *In: Brooks, J. and Glennie, K.W. (eds) Petroleum geology of northwest Europe*. Proceedings 3rd. Conference on the Petroleum Geology of NW Europe. 687–96. Graham & Trotman.
- COWARD, M.P., FRANCIS, P.W., GRAHAM, R.H., MYERS, J.A. and WATSON, J. 1969. Remnants of an early sedimentary assemblage in the Lewisian complex of the Outer Hebrides. *Proceedings of the Geologists' Association* 80, 387–408.
- CRAMPTON, C.B. and CARRUTHERS, R.G. 1914. *The geology of Caithness*. Memoirs of the Geological Survey, Scotland.
- CROWELL, J.C. 1961. Depositional structures from the Jurassic boulder beds, East Sutherland. *Transactions of the Edinburgh Geological Society* 18, 202–20.
- CUNNINGHAM, H.R.J. 1841. Geognostical Account of the County of Sutherland. *Transactions of the Highland and Agricultural Society of Scotland New Series* 7, 73–114.

- DAWSON, J. and GALLACHER, M.J. 1965. Alluvial gold in Scotland. *Mining Journal*. March 12. 193.
- DEC, T. 1992. Textural characteristics and interpretation of second cycle, debris-flow-dominated alluvial fans (Devonian of Northern Scotland). *Sedimentary Geology* 77, 269–296.
- DESMOND, A.J. 1974. On the coccosteid arthrodire *Millerosteus minor*. *Zoological Journal of the Linnean Society* 54, 277–298.
- DONOVAN, R.N. 1973. Basin margin deposits of the Middle Old Red Sandstone at Dirlot, Caithness. *Scottish Journal of Geology* 9, 203–211.
- DONOVAN, R.N. 1975. Devonian lacustrine limestones at the margin of the Orcadian Basin, Scotland. *Journal of the Geological Society London* 131, 489–510.
- DONOVAN, R.N. 1978. The Middle O.R.S. of the Orcadian Basin. In: Friend, P.F. and Williams, B.P.J. (eds). *A field guide to selected outcrop areas of the Devonian of Scotland, the Welsh Borderland and South Wales*. 37–53. Palaeontological Association International Symposium on the Devonian System 1978.
- DONOVAN, R.N. 1980. Lacustrine cycles, fish ecology and stratigraphic zonation in the Middle Devonian of Caithness. *Scottish Journal of Geology* 16, 35–50.
- DONOVAN, R.N. and FOSTER, R.J. 1972. Subaqueous shrinkage cracks from the Caithness Flagstone Series (Middle Devonian) of north-east Scotland. *Journal of Sedimentary Petrology* 42, 309–17.
- DONOVAN, R.M., FOSTER, R.J. and WESTOLL, T.S. 1974. A stratigraphical revision of the Old Red Sandstone of North East Caithness, *Transactions of the Royal Society of Edinburgh* 69, 167–201.
- DUNCAN, A.D. and HAMILTON, R.F.M. 1988. Palaeolimnology and organic geochemistry of the Middle Devonian in the Orcadian Basin. In: Fleet, A.J., Kelts, K. and Talbot, M.R. (eds) *Lacustrine Petroleum Source Rocks*. Geological Society, London, Special Publications 40, 173–201.
- DUNCAN, W.I. and BUXTON, N.W.K. 1995. New evidence for evaporitic Middle Devonian lacustrine sediments with hydrocarbon source potential on the East Shetland Platform, North Sea. *Journal of the Geological Society, London* 152, 251–8.
- EWING, C.J.C. 1956. *Geological Report on the Brora Coalfield*. N.C.B. Report.
- EWING, C.J.C. 1958. *Brora Coal Field — Geological Report on borings*. N.C.B. Report.
- FLINN, D. 1992. The history of the Walls Boundary fault, Shetland: the northward continuation of the Great Glen fault from Scotland. *Journal of the Geological Society, London* 149, 721–6.
- FROSTICK, L., REID, I., JARVIS, J. and EARDLEY, H. 1988. Triassic sediments of the Inner Moray Firth, Scotland; early rift deposits. *Journal of the Geological Society London* 145, 235–48.
- GILLEN, C. 1987. Hundy, Elgin and Lossiemouth. In: Trewin, N.H., Kneller, B.C. and Gillen C. (eds) *Excursion guide to the geology of the Aberdeen Area*. 149–60. Scottish Academic Press.
- GLENNIE, K.W. 1998. *Petroleum geology of the North Sea*. 4th Edn. Blackwell, Oxford.
- GLENNIE, K.W. 2002. Permian and Triassic. In: Trewin, N H (ed.) *The Geology of Scotland* (4th Edn), 301–21. The Geological Society, London.
- GLENNIE, K.W. and BULLER, A.T. 1983. The Permian Weisslied of N. W. Europe: the partial deformation of aeolian dune sands caused by the Zechstein transgression. *Sedimentary Geology* 35, 43–81.

- GLUYAS, J.G. and HITCHENS, H.M. (eds) 2003. *United Kingdom Oil and Gas Fields Commemorative Millennium Volume*. Geological Society, London, Memoirs 20.
- HAMILTON, R.E.M. 1986. Comparative palaeolimnology of the Middle Devonian Orcadian Basin. Univ. Aberdeen PhD thesis (Unpubl.).
- HAMILTON, R.E.M. and TREWIN, N.H. 1985. *Excursion to the Devonian of Caithness*. Petroleum Exploration Society of G.B. Aberdeen Branch 1–35.
- HAMILTON, R.E.M. and TREWIN, N.H. 1988. Environmental controls on fish faunas of the Middle Devonian Orcadian Basin. In: McMillan, N.J., Embry, A.E and Glass, D.J. (eds) *Devonian of the World*. Canadian Society of Petroleum Geologists, Memoir 14, Vol III, 589–600.
- HAMILTON, R.E.M. and TREWIN, N.H. 1994. Taphonomy of fish beds from the Upper Flagstone Group of the Middle Old Red Sandstone, Caithness. *Scottish Journal of Geology* 30, 175–81.
- HARKER, S.D. 2002. Cretaceous. In: Trewin, N H (ed.) *The Geology of Scotland* (4th Edn), 351–60. The Geological Society, London.
- HARRIS, A.L. and JOHNSON, M.R.W. 1991. Moine. In: Craig, G.Y. (ed.) *Geology of Scotland* (3rd Edn). 87–123. The Geological Society, London.
- HARRIS, T.M. and REST, J.A. 1966. The flora of the Brora coal. *Geological Magazine* 103, 101–9.
- HUDSON, J.D. 1962. The Great Estuarine Series (Middle Jurassic) of the Inner Hebrides. Unpublished Ph.D. thesis, Univ. Cambridge.
- HUDSON, J.D. 1964. The petrology of the Great Estuarine Series, and the Jurassic palaeogeography of NE Scotland. *Proceedings of the Geologists' Association* 75, 499–527.
- HUDSON, J. D. and TREWIN, N.H. 2002. Jurassic. In: Trewin, N. H. (ed.) *The Geology of Scotland* (4th Edn), 323–50. The Geological Society, London.
- HURST, A. 1980. The diagenesis of Jurassic rocks of the Moray Firth N.E. Scotland. Univ. Reading Ph.D. Thesis (unpubl.).
- HURST, A. 1981. Mid Jurassic stratigraphy and facies at Brora, Sutherland. *Scottish Journal of Geology* 17, 169–77.
- HURST, A. 1982. The clay mineralogy of Jurassic shales from Brora, NE Scotland. In: van Olphen, H. and Veniale, F. (eds) *International Clay Conference 1981*. Developments in Sedimentology. 35, 677–84, Elsevier.
- HURST, A. 1985. The implications of clay mineralogy to palaeoclimate and provenance during the Jurassic in N.E. Scotland. *Scottish Journal of Geology* 21, 143–60.
- JANAWAY, T.M. and PARNELL, J. 1989. Carbonate production within the Orcadian Basin, Northern Scotland: a petrographic and geochemical study. *Paleogeography Palaeoclimatology Palaeoecology* 70, 89–105.
- JANVIER, P. and NEWMAN, M.J. 2005. On *Cephalaspis magnifica* Traquair, 1893, from the Middle Devonian of Scotland, and the relationships of the last osteostracans. *Transactions of the Royal Society of Edinburgh: Earth Sciences* 95, 511–25.
- JARVIK, E. 1948. On the morphology and taxonomy of the Middle Devonian Osteolepid fishes of Scotland. *Kungliga Svenska Vetenskapsakademiens Handlingar* 25, pp301.

- JOASS, J.M. 1869. Notes on the Sutherland gold field. *Quarterly Journal of the Geological Society of London* 25, 314–26.
- JOHNSTONE, G.S. and MYKURA, W. 1989. The Northern Highlands of Scotland. British Regional Geology (4th Edition). British Geological Survey, HMSO, London.
- JONK, R. 2003. The origin and diagenesis of intruded sandstones. Univ. Aberdeen PhD thesis (unpubl.).
- JUDD, J.W. 1873. The secondary rocks of Scotland. *Quarterly Journal of the Geological Society of London* 29, 97–195.
- KELLY, S.B. 1992. Milankovitch cyclicity recorded from Devonian non-marine sediments. *Terra Nova* 4, 578–84.
- KINNY, ED., FRIEND, C.R.L., STRACHAN, R.A., WATT, G.R and BURNS, I.M. 1999. U-Pb geochronology of regional migmatites, East Sutherland, Scotland: evidence for crustal melting during the Caledonian orogeny. *Journal of the Geological Society, London* 156, 1143–52.
- KNELLER, B.C. 1987. A geological history of north-east Scotland. In: Trewin, N.H., Kneller, B.C. and Gillen, C. (eds) *Excursion guide to the geology of the Aberdeen area*. 1–50. Scottish Academic Press.
- KNOX, R. W, O'B. 2002. Tertiary sedimentation. In: Trewin, N.H. (ed.) *The Geology of Scotland* (4th Edn), 361–370. The Geological Society, London.
- LAM, K. and PORTER, R. 1977. The distribution of palynomorphs in the Jurassic rocks of the Brora Outlier, N. E. Scotland. *Journal of the Geological Society, London* 134, 45–55.
- LEE, G.W. 1925. Mesozoic rocks of East Sutherland and Ross. In: Read, H.H., Ross, G. and Phemister, J. *The geology of the country around Golspie, Sutherland*. Memoirs of the Geological Survey 65–115.
- LEEDER, M.R., BOLDY, S.R., RAISWELL, R and CAMERON, R. 1990. The Carboniferous of the Outer Moray Firth Basin, quadrants 14 and 15, Central North Sea. *Marine and Petroleum Geology* 7, 29–37.
- LINSLEY, P.N. 1972. The stratigraphy and sedimentology of the Kimmeridgian deposits of Sutherland, Scotland. Univ. Lond. Ph.D. Thesis (unpubl.).
- LINSLEY, P.N., POTTER, H.C., McNAB, G. and RACHER, D. 1980. The Beatrice field, Inner Moray Firth, U.K. North Sea. In: Halbouty, M.T. (ed.) *Giant oil and gas fields of the decade 1968–1978*. Memoir American Association of Petroleum Geologists 30, 117–29.
- McALPINE, A. 1977. The Upper Old Red Sandstone deposits of Hoy and Dunnet Head, Northern Scotland. University of Newcastle-on-Tyne PhD thesis. (unpubl.).
- MACDONALD, A.C. 1985. Kimmeridgian and Volgian fault-margin sedimentation in the northern North Sea area. Univ. Strathclyde Ph.D. Thesis (unpubl.).
- MACDONALD, A.C. and TREWIN, N.H. 1993. The Upper Jurassic of the Helmsdale Area. In: Trewin, N. H. and Hurst, A. (eds) *Excursion Guide to the Geology of East Sutherland and Caithness*. Scottish Academic Press, Edinburgh, 75–114.
- MACDONALD, R. and FETTES, D.J. 2007. The tectonomagmatic evolution of Scotland. *Transactions of the Royal Society of Edinburgh; Earth Sciences* 97, 213–95.
- MACFADYEN, C.C.J. 1992. *The Achanarras Quarry Site of Special Scientific Interest and National Nature Reserve, Caithness*. Earth Science Documentation Series. Scottish Natural Heritage.
- MACGREGOR, M. 1916. A Jurassic shoreline. *Transactions of the Geological Society of Glasgow* 16, 75–85.

- McQUILLAN, R., DONATO, J.A. and TULSTRUP, J. 1982. Development of basins in the Inner Moray Firth and the North Sea by crustal extension and dextral displacement of the Great Glen Fault. *Earth and Planetary Science Letters* 60, 127–139.
- MACLENNAN, A.M. and TREWIN, N.H. (1989). Palynofacies and sedimentology of the Late Bathonian-Mid. Callovian in the Inner Moray Firth. In: Batten, D.J. (ed.) *Studies in NW European micropalaeontology and palynology*. British Micropalaeontological Society Series, 92–117. Ellis Horwood, Chichester.
- MARSHALL, J.E.A., BROWN, J.G. and HINDMARSH, S. 1985. Hydrocarbon source rock potential of the Devonian rocks of the Orcadian Basin, *Scottish Journal of Geology* 21, 301–320.
- MARSHALL, J.E.A., ROGERS, D.A. and WHITELEY, M.J. 1996. Devonian marine incursions into the Orcadian Basin, Scotland. *Journal of the Geological Society, London* 153, 451–66.
- MARSHALL, J.A.E., ASTIN, T.B., BROWN, J.F., MARK-KURIK, E. and LAZAUSKIENE, J. 2007. Recognising the Kacak Event in the Devonian terrestrial environment and its implications for understanding land-sea interactions. In: Becker, R.T. and Kirchgasser, W.T. (eds) *Devonian Events and Correlations*. Special Publications, Geological Society, London 279, 133–55.
- MILLER, H. 1841. *The Old Red Sandstone*. John Johnstone, Edinburgh.
- MILLER, H. 1854. The fossiliferous deposits of Scotland. *Proceedings of the Royal Physical Society of Edinburgh* 1, 1–29.
- MILLER, H. 1859. *Sketch book of popular geology*. Thomas Constable and Company, Edinburgh.
- MURCHISON, R.I. 1827. On the coal-field of Brora in Sutherlandshire. *Transactions of the Geological Society of London* 2, 293–326.
- MYKURA, W. 1976. British Regional Geology, Orkney and Shetland M.S.O. Edinburgh.
- MYKURA, W 1991. Old Red Sandstone. In: Craig, G.Y. (ed.) *Geology of Scotland*, (3rd Edn) 297–344. The Geological Society, London.
- NEVES, R. and SELLEY, R.C. 1975. A review of the Jurassic rocks of North-East Scotland. In: Finstad, K.G., Selley, R.C. (eds) *Proceedings of the Jurassic Northern North Sea Symposium Stavanger, Sept. 1975*. Norsk Petroleum-forening. JNNS/5, 1–29.
- NEWMAN, M.J. 2002. A new naked jawless vertebrate from the Middle Devonian of Scotland. *Palaeontology* 45, 933–941.
- NEWMAN, M.J. and DEAN, M.T. 2005. *A biostratigraphical framework for geological correlation of the Middle Devonian strata in the Moray-Ness Basin Project area*. British Geological Survey Internal Report IR/05/160.
- NEWMAN, M.J. and DEN BLAAUWEN, J.L. 2007. A new dipnoan fish from the Middle Devonian (Eifelian) of Scotland. *Palaeontology* 50, 1403–1419.
- NEWMAN, M.J. and DEN BLAAUWEN, J.L. 2008. New information on the enigmatic Devonian vertebrate *Palaeospondylus gunni*. *Scottish Journal of Geology* 44, 89–91.
- NEWMAN, M.J. and TREWIN, N.H. 2001. A new jawless vertebrate from the Middle Devonian of Scotland. *Palaeontology*, 44, 43–51.
- NEWMAN, M.J. and TREWIN, N.H. 2008. Discovery of the arthrodire genus *Actinolepis* (class Placodermi) in the Middle Devonian of Scotland. *Scottish Journal of Geology* 44, 83–88.

- NORTON, M.G., McCLAY, K. and WAY, N.A. 1987. Tectonic evolution of Devonian basins in northern Scotland and southern Norway. *Norsk Geol. Tidsskrift*, 67, 323–38.
- OMAND, D. 1973. The glaciation of Caithness. Univ. Strathclyde MSc thesis. (Unpubl.) OWEN, J.S. 1995. *Coal mining at Brora, Sutherland 1529–1974*. Inverness Highland Libraries.
- PANKHURST, R.J. 1982. Geochronological tables for British igneous rocks. In: Sutherland, D.S. (ed.) *Igneous rocks of the British Isles*. 575–581. John Wiley & Sons, Chichester.
- PANKHURST, R.J. and SUTHERLAND, D.S. 1982. Caledonian granites and diorites of Scotland and Ireland. In: Sutherland, D.S. (ed.) *Igneous rocks of the British Isles*. 149–190. John Wiley & Sons, Chichester.
- PARNELL, J. 1983. The distribution of hydrocarbon minerals in the Orcadian basin. *Scottish Journal of Geology* 19, 205–231.
- PARNELL, J. 1986. Devonian Magadi-type cherts in the Orcadian Basin, Scotland. *Journal of Sedimentary Petrology* 56, 495–500.
- PEACOCK, J.D., BERRIDGE, N.G., HARRIS, A.L. and MAY, F. 1968. *The geology of the Elgin district*. Memoirs of the Geological Survey, Scotland.
- PEARSON, M.J. and WATKINS, D. 1983. Organofacies and early maturation effects in Upper Jurassic sediments from the Inner Moray Firth Basin, North Sea. In: Brooks, J. (ed.) *Petroleum Geochemistry and Exploration of Europe. Special Publications, Geological Society, London* 12, 147–160. Blackwell.
- PETERS, K.E., MULDOWNAN, J.M., DRISCOLE, A.R. and DEMAISON, G.J. 1989. Origin of Beatrice oil by co-sourcing from Devonian and Middle Jurassic source rocks, Inner Moray Firth, United Kingdom. *Bulletin American Association of Petroleum Geologists* 73, 454–471.
- PHEMISTER, J. 1960. *British Regional Geology: The Northern Highlands*. (3rd Edn). Edinburgh, H.M.S.O.
- PICKERING, K.T. 1983. Small scale syn-sedimentary faults in the Upper Jurassic 'Boulder Beds'. *Scottish Journal of Geology* 19, 169–181.
- PICKERING, K.T. 1984. The Upper Jurassic 'Boulder Beds' and related deposits: a fault-controlled submarine slope, N. E. Scotland. *Journal of the Geological Society London* 141, 357–74.
- PIDGEON, R.T. and AFTALION, M. 1978. Cogenetic and inherited zircon U/Pb systems in granites: Palaeozoic granites of Scotland and England. In: Bowes, D.R. and Leake, B.E. (eds) *Crustal evolution in north-western Britain and adjacent regions*. Geological Journal Special Issue 10, 183–220.
- PLANT, J. and COLEMAN, R.F. 1972. Application of neutron activation analyses to the evaluation of placer gold concentrations. In: Jones, M.J. (ed.) *Geochemical exploration 1972- Prospecting in glaciated terranes*, 373–87. IMM, London.
- RAMSAY, A.C. 1865. The glacial theory of lake basins. *Philosophical Magazine* 29, 285.
- RAYNER, E.H. 1963. The Achanarras Limestone of the Middle Old Red Sandstone, Caithness, Scotland. *Proceedings of the Yorkshire Geological Society* 34, 1–44.
- READ, H.H. 1931. *The geology of central Sutherland*. Memoirs of the Geological Survey Scotland (Sheets 108, 109).
- READ, H.H., RUSS, G. and PHEMISTER, J. 1925. *The geology of the country around Golspie, Sutherland*. Memoirs of the Geological Survey Scotland.

- RICE, C.M. 2002. Metalliferous minerals. *In: Trewin, N.H. (ed.) The Geology of Scotland (4th Edn) 431–448.* The Geological Society, London.
- RICHARDS, P.C., LOTT, G.K., JOHNSON, H., KNOX, R.W.O'B. and RIDING, J.B. 1993. Jurassic of the Central and Northern North Sea. *In: Knox, W.R.O'B. and Cordey, W.G. (eds) Lithostratigraphic nomenclature of the UK North Sea.* BGS, Nottingham.
- RICHARDSON, J.B. 1967. Some British Lower Devonian spore assemblages and their stratigraphical significance. *Reviews of Palaeobotany and Palynology* 1, 111–29.
- RILEY, L.A. 1980. Palynological evidence of an early Portlandian age for the uppermost Helmsdale Boulder Beds, Sutherland. *Scottish Journal of Geology* 16, 29–31.
- ROBERTS, A. 1989. Fold and thrust structures in the Kintradwell 'Boulder Beds', Moray Firth. *Scottish Journal of Geology* 25, 173–86.
- ROBERTS, A.M., BADLEY, M.E., PRICE, J.D. and HUCK, L.W. 1990. The structural history of a transtensional basin: Inner Moray Firth, NE Scotland. *Journal of the Geological Society London* 147, 87–103.
- ROGERS, D.A. and ASTIN, T.R. 1991. Ephemeral lakes, mud-pellet dunes and wind-blown sand and silt: reinterpretations of Devonian lacustrine cycles in north Scotland. *In: Anadon, P., Cabrera, L. and Kelts, K. (eds) Lacustrine Facies Analysis.* International Association of Sedimentologists Special Publication 13, 199–221.
- ROGERS, D.A., MARSHALL, J.E.A. and ASTIN, T.R. 1989. Devonian and later movements on the Great Glen fault system, Scotland. *Journal of the Geological Society London* 146, 369–72.
- SAXON, J. 1975. *The fossil fishes of the North of Scotland (2nd Edn).* 1–49. Caithness Books, Thurso.
- SAXON, J. (undated). *The Kildonan gold rush.* Caithness Books, Thurso.
- SEWARD, A.C. 1911. The Jurassic flora of Sutherland. *Transactions of the Royal Society of Edinburgh* 47, 643–709.
- SISSONS, J.B. 1968. *The evolution of Scotland's scenery.* Oliver and Boyd, Edinburgh.
- STEPHEN, K.J., UNDERHILL, J.R., PARTINGTON, M.A. and HEDLEY, R.J. 1993. The genetic sequence stratigraphy of the Hettangian to Oxfordian succession, Inner Moray Firth. *In: Parker, J.R. (ed.) Petroleum Geology of Northwest Europe: Proceedings of the 4th Conference.* Geological Society, London.
- STEVENS, V 1991. The Beatrice Field, Block 11/30a, UK North Sea. *In: Abbotts, I.L. (ed.) United Kingdom Oil and Gas Fields, 25 Years Commemorative Volume.* Geological Society Memoir 14, 245–52.
- STOPES, M.C. 1907. The flora of the Inferior Oolite of Brora. *Quarterly Journal of the Geological Society of London* 63, 375–82.
- STOW, D.A.V., BISHOP, C.D. and MILLS, S.J. 1982. Sedimentology of the Brae oilfield, North Sea: fan models and controls. *Journal of Petroleum Geology* 5, 129–48.
- STRACHAN, R.A., FRIEND, C., ALSOP, G.I. and MILLER, S. (Eds) 2009a (in press). *A Field Guide to the Moine Geology of the NW Highlands of Scotland* Edinburgh and Glasgow Geological Societies.
- STRACHAN, R.A., HOLDSWORTH, R.E., and ALSOP, G.I. 2009b (in press). Introduction to the Moine Geology of the NW Highlands of Scotland. *In: Strachan et al (eds) A Field Guide to the Moine Geology of the NW Highlands of Scotland.* Edinburgh and Glasgow Geological Societies.

- STRACHAN, R.A., HOLDSWORTH, RE., FRIEND, C., BURNS, I. and ALSOP, G.I. 2009c (in press). Excursion 13 North Sutherland. *In: Strachan et al (eds) A Field Guide to the Moine Geology of the NW Highlands of Scotland*. Edinburgh and Glasgow Geological Societies.
- STRACHAN, RA., SMITH, M., HARRIS, A.L. and FETTES, D.J. 2002. The Northern Highland and Grampian terranes. *In: Trewin, N.H. (ed.) The Geology of Scotland (4th Edn) 81–147*. The Geological Society, London.
- SYKES, R.M. 1975a. The stratigraphy of the Callovian and Oxfordian stages (Middle-Upper Jurassic) in Northern Scotland. *Scottish Journal of Geology* 11, 51–78.
- SYKES, R.M. 1975b. Facies and faunal analysis of the Callovian and Oxfordian Stages (Middle-Upper Jurassic) in N. Scotland and E. Greenland. Univ. Oxford Ph.D. Thesis (unpubl.).
- TAIT, D. 1912. On a large glacially transported mass of Lower Cretaceous rock at Leavad in the County of Caithness. *Transactions of the Edinburgh Geological Society* 10, 1–9.
- TAYLOR, J.C.M. 1990. Upper Permian–Zechstein. *In: Glennie, K.W. (ed.) Introduction to the Petroleum geology of the North Sea (3rd Edn)*. 153–190. Blackwells.
- THOMSON, K. and UNDERHILL, R 1993. Controls on the development and evolution of structural styles in the Inner Moray Firth Basin. *In: Parker, J.R. (ed.) Petroleum Geology of Northwest Europe: Proceedings of the 4th Conference Geological Society, London*. 1167–78.
- THOMSON, KS., SUTTON, M. and THOMAS, B. 2003. A larval Devonian lungfish. *Nature*, 426, 833–4.
- TREWIN, N.H. 1985. Mass mortalities of Devonian fish - the Achanarras fish bed, Caithness, *Geology Today*, 1, 45–9.
- TREWIN, N.H. 1986. Palaeoecology and sedimentology of the Achanarras fish bed of the Middle Old Red Sandstone, Scotland. *Transactions of the Royal Society of Edinburgh: Earth Sciences* 77, 21–46.
- TREWIN, N.H. 1987. Pennan, unconformity within the Old Red Sandstone. *In: Trewin, N.H., Kneller, B.C. and Gillen, C. (eds) Excursion guide to the geology of the Aberdeen area*. 127–130. Scottish Academic Press.
- TREWIN, N.H. 1989. The petroleum potential of the Old Red Sandstone of northern Scotland. *Scottish Journal of Geology* 25, 201–25.
- TREWIN, N.H. 1991. *Jurassic sedimentation and tectonics in the Brora-Helmsdale area, and Old Red Sandstone fluvial and lacustrine facies in N Scotland*. Field Guide No. 8. Compiled for the 13th International Sedimentological Congress, Nottingham, 1990.1–86. British Sedimentological Research Group, Cambridge.
- TREWIN, N.H. 1992. 'Subaqueous shrinkage cracks' in the Devonian of Scotland re-interpreted Discussion. *Journal of Sedimentary Petrology* 62, 921–2.
- TREWIN, N.H. (ed.) 2002. *The Geology of Scotland (4th Edn)* The Geological Society, London.
- TREWIN, N.H. 2008. *Fossils Alive! or new walks in an old field*. Dunedin Academic Press, Edinburgh.
- TREWIN, N.H. and KNELLER, B.C. 1987. Old Red Sandstone and Dalradian of Gamrie Bay. *In:*
- TREWIN, N.H., KNELLER, B.C. and GILLEN, C. (eds) *Excursion guide to the geology of the Aberdeen area*. 113–126. Scottish Academic Press.
- TREWIN, N.H. and ROLLIN, K.E. 2002. Geological history and structure of Scotland. *In: Trewin, N.H. (ed.) The Geology of Scotland (4th Edn)*, 1–26. The Geological Society, London.

- TREWIN, N.H. and THIRLWALL, M.F. 2002. The Old Red Sandstone. *In: Trewin, N.H. (ed.) The Geology of Scotland* (4th Edn), 213–250. The Geological Society, London.
- TURNER, C.C., COHEN, J.M., CONNELL, E.R. and COOPER, D.M. 1987. A depositional model for the South Brae Oilfield. *In: Brooks, J. and Glennie, K.W. (eds.) Petroleum Geology of North-west Europe*. Proceedings 3rd Conf. Pet. Geol. N.W. Europe. 853–864. Graham and Trotman, London.
- TWEEDIE, J.R. 1979. Origin of uranium and other metal enrichments in the Helmsdale Granite, eastern Sutherland, Scotland. *Transactions of the Institute of Mining and Metallurgy* 88, B145–53.
- TWEEDIE, J.R. 1981. The origin of uranium and other metal concentrations in the Helmsdale Granite and the Devonian sediments of the north-east of Scotland. Univ. Aberdeen PhD Thesis. (unpubl).
- UNDERHILL, J.R. 1991. Implications of Mesozoic-Recent basin development in the western Inner Moray Firth, UK. *Marine and Petroleum Geology* 8, 359–69.
- UNDERHILL, J.R. 1994. Discussion on the paleoecology and sedimentology across a Jurassic fault scarp, NE Scotland. *Journal of the Geological Society London* 151, 729–31.
- UNDERHILL, J.R. 1998. Jurassic. *In: Glennie, K. W. (ed.) Petroleum Geology of the North Sea* 4th Edn. Blackwell, Oxford. 245–293.
- UNDERHILL, J.R. and BRODIE, J.A. 1993. Structural geology of Easter Ross, Scotland: implications for movement on the Great Glen Fault. *Journal of the Geological Society London* 150, 515–27.
- UNDERHILL, J.R. and PARTINGTON, M.A. 1993. Jurassic thermal doming and deflation in the North Sea: implications of the sequence stratigraphic evidence. *In: Parker, J. R. (ed.) Petroleum Geology of Northwest Europe: Proceedings of the 4th Conference*. Geological Society, London. 337–346.
- VAGLE, G.B., HURST, A., DYPVIK, H. 1994. Origin of quartz cements from the Jurassic of the Inner Moray Firth (UK). *Sedimentology* 41, 363–77.
- VAGLE, G.B., HURST, A., DYPVIK, H. 1995. Origin of quartz cements from the Jurassic of the Inner Moray Firth (UK) Discussion. *Sedimentology* 42, 375–8.
- VAN DER BURGH, J. 1987. Macroflora of the Kimmeridgian of Sutherland - a preliminary report. *Documenta Naturae* 41, 1–10. Munchen.
- VAN DER BURGH, J. and VAN KONIJNENBURG-VAN CITTERT, J.H.A. 1984. A drifted flora from the Kimmeridgian (Upper Jurassic) of Lothbeg Point, Sutherland, Scotland. *Reviews of Palaeobotany and Palynology* 43, 359–96.
- WALKER, E.F. 1985. Arthropod ichnofauna of the Old Red Sandstone at Dunure and Montrose, Scotland. *Transactions of the Royal Society of Edinburgh: Earth Sciences* 76, 287–297.
- WATERSTON, C.D. 1951. The stratigraphy and palaeontology of the Jurassic rocks of Eathie (Cromarty). *Transactions of the Royal Society of Edinburgh* 62, 33–51.
- WESTOLL, T.S. 1951. The vertebrate-bearing strata of Scotland. *Report 18th International Geological Congress* 2, 5–21.
- WIGNALL, P.B. and PICKERING, K.T. 1993. Palaeoecology and sedimentology across a Jurassic fault scarp. N E Scotland. *Journal of the Geological Society London* 150, 323–340.
- WILSON, G.V., EDWARDS, W, KNOX, J., JONES, R.C.B., and STEPHENS, J.B. 1935. *The Geology of the Orkneys*. Memoir of the Geological Survey of Great Britain.

WINDLE, T.M.F. 1979. Reworked Carboniferous spores: an example from the Lower Lias of northeast Scotland. *Reviews of Palaeobotany and Palynology* 27, 173–84.

WOODWARD, H.B. 1911. In: Seward, A.C. The Jurassic flora of Sutherland. *Transactions of the Royal Society of Edinburgh* 47, 643–709.

ZIEGLER, P.A. 1982. *Geological atlas of western and central Europe*. Shell Internationale Petroleum Maatschappij 130pp, The Hague.