

Janet Watson—an appreciation and bibliography

D. R. Bowes

With the passing of Professor Janet Vida Watson FRS the earth sciences in the U.K., and throughout the world, lost one of its most distinguished and well known personalities. For while Janet Watson spent most of her academic career in London, at Imperial College (after graduation with a First Class General Honours degree at Reading University in 1943), she was known throughout the world not only for her exceptional gift of clear and persuasive exposition both at the lecture bench and the committee table, but also as a major contributor to the advancement of the earth sciences. Her death on 29 March 1985, at the age of 61, brought to an untimely end a distinguished career which had seen many honours showered on her. The Geological Society of London, which had elevated her to the office of President in 1982–84, had previously awarded her, jointly with her husband (Professor John Sutton FRS) both the Lyell Fund (1954) and the Bigsby Medal (1965). They also honoured her with the Lyell Medal (1973) as they had her father (Professor D. M. S. Watson FRS) nearly 40 years previously. The Edinburgh Geological Society awarded her the Clough Medal (1980), she was President of Section C of the British Association for the Advancement of Science (1972), elected a Fellow of the Royal Society of London (1979) and a member of its Council and Vice-President (1983 until her death). To the various offices she held, Janet brought the directness, the precision and the liveliness of mind she had shown in one of the very first offices she had held as an earth scientist, that of a steward at the 18th International Geological Congress held in London, at Imperial College, in 1948—‘Tell John (later to be her husband) 1 . . . , 2 . . . and 3 . . .’, with each part of the message clearly and precisely stated. Yet perhaps it was not in the professional societies, congresses and committees where she received most recognition, but in the student societies throughout the country. They consistently put her at the top of their lists of speakers to be invited, and she consistently responded by using her talent of clear, precise and persuasive exposition to excite as well as instruct many a budding earth scientist.

It was Scotland that provided Janet with the outdoor laboratory that she loved the most. The initial choice was that of her teacher, mentor and co-author of a number of books, Professor H. H. Read FRS, who first set her to study one of his

favourite topics, the migmatites of Sutherland, an aspect of which was the subject of her first publication. He then directed her and her contemporary as a research student, John Sutton, to parts of the Lewisian complex of NW Scotland where there were abundant migmatitic and igneous rocks. This, together with the research being done by Professor W. S. Pitcher and others at Imperial College on the granitic rocks of Donegal, was to test and apply the concepts of place and time in plutonism enunciated by Professor Read in his Presidential Addresses to the Geological Society of London in 1948 and 1949. The young research workers went to the rocks of NW Scotland from which B. N. Peach, J. Horne, C. T. Clough and other members of a distinguished team from the Geological Survey had developed ideas that had made such a big impact on geological thinking at the turn of the century. However, despite such a daunting prospect, both Ph.D. theses were accepted in the summer of 1949, just in time for a wedding, and a honeymoon in the Channel Islands, a venue that accounts for a publication about the Isle of Sark that does not appear to be cognate to their main body of published work. For the next three decades, there flowed from their pens a succession of publications that had a profound impact on geological thinking and the direction of research, particularly in basement complexes, both in the UK and abroad. Many were under the authorship of J. Sutton and J. Watson, but in later years, as her husband progressively became more involved in administrative matters, more of Janet’s publications were her own, or with other authors, including a succession of research students and officers of the British Geological Survey with whom she worked on a number of projects.

The initiation of the partnership, both scientific and personal, had really taken place in 1948 when, after separate field studies at Scourie–Loch Laxford (J. W.) and Torridon (J. S.), and joint studies in the former area with their supervisor, they set off by bicycle (on roads that seemed to consist largely of blocks of Torridonian conglomerate) to look at other parts of the Lewisian complex, particularly around Gruinard Bay. They tested their conclusions that the complex contained the products of two separate orogenic episodes (Scourian and Laxfordian) and that chronological subdivision could be made using basic dykes as time markers.

Of all the many papers Janet published, there is no doubt that the resulting publication (1951) with her husband had the greatest impact on geology in Britain. Not that the basis used for subdividing the Lewisian complex, or the proposed concept of wholesale reactivation of basement, were not questioned in the discussion that followed the verbal presentation in London early in 1950, and time and again subsequently. But the paper set out to show that a Precambrian 'fundamental complex' was amenable to chronological subdivision using field observations. It also presented a model that could be tested. Subsequently the ideas were 'exported' to Greenland at the time of a major surge of field study, and later tested there, and in Scotland, at a stage of major advancement in isotopic geochemistry. While the isotopes pointed to new crustal additions of mantle-derived products being more widespread than those resulting from wholesale reactivation of existing basement, they clearly demonstrated *c.* 1 Ga between the Scourian and Laxfordian episodes. However to Janet the size of this time gap seemed secondary to the field evidence that pointed to chronological subdivision. Intuitively she trusted rocks she could see more than isotopes that she could not see and it was to the field that she returned time and again for evidence. It was to the field that her students were directed first. There she imparted to them an enthusiasm to find out for themselves and her own indefinable sense that rocks had 'character'. How could anyone, except someone who had spent time in the field with Janet, understand what 'happy rocks' were?

Only those who knew the earth sciences at Imperial College in the late 1940s can really appreciate the changes that took place during the forty years she spent there. In these changes Janet played no insignificant role. She was part of the research powerhouse that, initially under the inspiration and guidance of H. H. Read, began the major expansion of the research school, the great extension of the range of research interests and facilities and the almost complete rebuilding of the accommodation. There can be little doubt that the type of precise evaluation and clear statement of requirements transmitted to her future husband during the 1948 Congress were in evidence as he progressively assumed more administrative responsibility at Imperial College. Yet her students and research colleagues saw her principally as a research worker who inspired them and also acted as a catalyst for advances in fields other than those which were mainstream to

her at the time. An illustration of such a catalytic effect is in the field of structural geology. Following the work that Janet and her husband had done on the Moine rocks and Moine-Lewisian relationships in northern Scotland in the early-mid 1950s, Professor John Ramsay FRS, who had graduated at Imperial College, was launched into research in these fields. What had been initiated to further understanding of the geology of Scotland became a major advance in understanding processes of rock deformation. In turn this added to the stature of the earth sciences at Imperial College and to its impact on the academic community at home and abroad, things which were constantly in the forefront of Janet's thinking and actions.

While field studies, particularly in the Lewisian complex, were a major part of Janet's work, as instanced by the research group she supervised in the Outer Hebrides and the help she gave to the initiation and carrying out of a programme of mapping there by the Geological Survey, progressively she became involved in other fields, particularly ore genesis and regional geochemistry. In these she worked closely with Dr. Jane Plant and other members of the Geological Survey and she considered that the affinity she had with the Survey partly stemmed from H. H. Read's association with it. She was too modest to claim that her very wide field experience, her breadth of knowledge over such a wide range of aspects of the earth sciences and her outstanding ability to integrate and make a synoptic presentation meant that she had a very great deal to offer co-workers.

To the world-wide earth science community who did not know Janet Watson personally, it will not be the conclusions of field studies in Scotland by which she will be remembered particularly, but the clearly thought out and elegantly written distillations of ideas and concepts over a wide range of topics that embody her exceptional gifts of both written and spoken exposition. For those who knew her, and particularly those who spent time in the field with her, the extensive list of publications will be secondary to the insights gained from her both in agreement and in disagreement, the opportunities provided, the enthusiasm generated and the memories, even of very wet boots being dried by an open fire in a highland cottage near Gruinard Bay. For the rocks would be waiting out there tomorrow, not to have data wrested from them, but to give up more of their secrets to a scientist who communicated with the Earth.

Publications of Janet Vida Watson (1923–1985)

- 1948 Late sillimanite in the migmatites of Kildonan, Sutherland. *Geol. Mag.* **85**, 149–62.
- 1951 Varying trends in the metamorphism of dolerites. *Geol. Mag.* **88**, 25–35 (J. Sutton & J. Watson).
- 1951 The pre-Torridonian metamorphic history of the Loch Torridon and Scourie areas in the north-west Highlands, and its bearing on the chronological classification of the Lewisian. *Q. J. Geol. Soc. London*, **106** (for 1950), 241–307 (J. Sutton & J. Watson).
- 1951 Scourie dykes and Laxfordian metamorphism. *Geol. Mag.* **88**, 299–301 (J. Sutton & J. Watson).
- 1953 The supposed Lewisian inlier of Scardroy, Central Ross-shire and its relations with the surrounding Moine rocks. *Q. J. Geol. Soc. London*, **108** (for 1952), 99–126 (J. Sutton & J. V. Watson).
- 1953 Current bedding in the Moine Series of north-western Scotland. *Geol. Mag.* **90**, 377–87 (G. Wilson, J. Watson & J. Sutton).
- 1954 On the status of certain Lewisian inliers. *Trans. Geol. Soc. Glasgow*, **21**, 480–502 (J. Sutton & J. Watson).
- 1954 Ice-borne boulders in the Macduff Group of the Dalradian of Banffshire. *Geol. Mag.* **91**, 391–8 (J. Sutton & J. Watson).
- 1954 The structure and stratigraphical succession of the Moines of Fannich Forest and Strath Bran, Ross-shire. *Q. J. Geol. Soc. London*, **110**, 21–53 (J. Sutton & J. Watson).
- 1954 A study of the metamorphic rocks of Karema and Kungwe Bay, western Tanganyika. *Bull. Geol. Surv. Tanganyika*, **22**, 1–70 (J. Sutton, J. Watson & T. C. James).
- 1955 The deposition of the Upper Dalradian rocks of the Banffshire coast. *Proc. Geol. Assoc. London*, **66**, 101–33 (J. Sutton & J. Watson).
- 1956 The Boyndie syncline of the Dalradian of the Banffshire coast. *Q. J. Geol. Soc. London*, **112**, 103–30 (J. Sutton & J. Watson).
- 1957 The development of lineation in complex fold systems. *Geol. Mag.* **94**, 1–24 (P. Clifford, M. J. Fleuty, J. G. Ramsay, J. Sutton & J. Watson).
- 1957 The structure of Sark, Channel Islands. *Proc. Geol. Assoc. London*, **68**, 179–203 (J. Sutton & J. Watson).
- 1959 Metamorphism in deep-seated zones of transcurrent movement at Kungwe Bay, Tanganyika Territory. *J. Geol.* **67**, 1–13 (J. Sutton & J. Watson).
- 1959 Structures in the Caledonides between Loch Duich and Glenelg, North-West Highlands. *Q. J. Geol. Soc. London*, **114** (for 1958), 231–57 (J. Sutton & J. Watson).
- 1962 *Introduction to Geology* Volume 1 *Principles*, 693 pp. London: Macmillan (H. H. Read & J. Watson).
- 1962 Festoon bedding. *Geol. Mag.* **99**, 286–7 (J. Sutton and J. V. Watson).
- 1962 An interpretation of Moine–Lewisian relations in central Ross-shire. *Geol. Mag.* **99**, 527–41 (J. Sutton & J. Watson).
- 1962 Further observations on the margin of the Laxfordian complex of the Lewisian near Loch Laxford, Sutherland. *Trans. R. Soc. Edinburgh*, **65**, 89–106 (J. Sutton & J. Watson).
- 1963 Structures in shallow-water Precambrian sediments from northwest Scotland. *Sedimentology*, **2**, 207–14 (J. Sutton & J. Watson).
- 1963 Some problems concerning the evolution of the Caledonides of the Scottish Highlands. *Proc. Geol. Assoc. London*, **74**, 213–58.
- 1963 Some underwater disturbances in the Torridonian of Skye and Raasay. *Geol. Mag.* **100**, 224–43 (R. C. Selley, D. J. Shearman, J. Sutton & J. Watson).
- 1964 Some aspects of Torridonian stratigraphy in Skye. *Proc. Geol. Assoc. London*, **75**, 251–89 (J. Sutton & J. Watson).
- 1964 Conditions in the metamorphic Caledonides during the period of late orogenic cooling. *Geol. Mag.* **101**, 457–65.
- 1965 Lewisian. In CRAIG, G. Y. (ed.) *The Geology of Scotland*, 49–77. Edinburgh: Oliver & Boyd.
- 1965 Isotopic age-determinations of rocks from the British Isles, 1955–64. 1. Introduction. *Q. J. Geol. Soc. London*, **121**, 477–87 (P. A. Sabine & J. V. Watson).
- 1966 *Beginning Geology*, 246 pp. London: Macmillan and Allen & Unwin (H. H. Read & J. Watson).
- 1967 Isotopic age-determinations of rocks and minerals from the British Isles, 1965. 1. Introduction. *Q. J. Geol. Soc. London*, **122** (for 1966), 443–7 (P. A. Sabine & J. V. Watson).
- 1967 Evidence of mobility in reactivated basement complexes. *Proc. Geol. Assoc. London*, **78**, 211–35.
- 1968 *Introduction to Geology* Volume 1 *Principles* (2nd edn), 693 pp. London: Macmillan (H. H. Read & J. Watson).

- 1968 Post-Scourian metadolerites in relation to Laxfordian deformation in Great Bernera, Outer Hebrides. *Scott. J. Geol.* **4**, 53–67.
- 1969 The Precambrian gneiss complex of Ness, Lewis, in relation to the effects of Laxfordian regeneration. *Scott. J. Geol.* **5**, 269–85.
- 1969 Remnants of an early metasedimentary assemblage in the Lewisian complex of the Outer Hebrides. *Proc. Geol. Assoc. London*, **80**, 387–408 (M. P. Coward, P. W. Francis, R. H. Graham, J. S. Myers & J. Watson).
- 1969 Scourian–Laxfordian relationships in the Lewisian of northwest Scotland. In: WYNNE-EDWARDS, H. R. (ed.) *Age relations in high-grade metamorphic terrains*, 119–28. *Spec. Pap. Geol. Assoc. Can.* **5** (J. Sutton & J. Watson).
- 1970 The Alderney Sandstone in relation to the ending of plutonism in the Channel Islands. *Proc. Geol. Assoc. London*, **81**, 577–84 (J. Sutton & J. Watson).
- 1970 Large-scale Laxfordian structures of the Outer Hebrides in relation to those of the Scottish mainland. *Tectonophysics*, **10**, 425–35 (M. P. Coward, P. W. Francis, R. H. Graham & J. Watson).
- 1970 Early clastic formations of certain orogenic cycles. In: *Studies in Earth Sciences: West Commemorative Volume*, 10–16. Saugur University, India (J. Sutton & J. Watson).
- 1970 An apparent age for a member of the Scourie dyke suite in Lewis, Outer Hebrides. *Scott. J. Geol.* **6**, 214–20 (R. StJ. Lambert, J. S. Myers & J. Watson).
- 1973 The pre-Laxfordian complex of the Outer Hebrides. In: PARK, R. G. & TARNEY, J. (eds) *The Early Precambrian of Scotland and Related Rocks of Greenland*, 45–50. University of Keele (J. Watson & R. J. Lisle).
- 1973 Concluding remarks: the evolution of a polycyclic gneiss complex. In: PARK, R. G. & TARNEY, J. (eds) *The Early Precambrian of Scotland and Related Rocks of Greenland*, 191–4, University of Keele.
- 1973 Effects of reworking on high-grade gneiss complexes. *Phil. Trans. R. Soc. London A* **273**, 433–55.
- 1973 The Archaean craton of the North Atlantic region. *Phil. Trans. R. Soc. London, A* **273**, 493–512 (D. Bridgwater, J. Watson & B. F. Windley).
- 1973 Influence of crustal evolution on ore deposition. *Trans. Inst. Min. Metall.* **B 82**, 107–13.
- 1974 Tectonic evolution of the continents in Proterozoic times. *Nature, London*, **247**, 433–5 (J. Sutton & J. Watson).
- 1974 Torridonian tourmaline–quartz pebbles and the Precambrian crust northwest of Britain. *J. Geol. Soc. London*, **130**, 85–91 (P. Allen, J. Sutton & J. V. Watson).
- 1975 *Introduction to Geology Volume 2 Earth History Part 1 Early Stages of Earth History*, 221 pp. Part 2 *Later Stages of Earth History*, 371 pp. London: Macmillan (H. H. Read & J. Watson).
- 1975 The Precambrian rocks of the British Isles—a preliminary review. In: HARRIS, A. L., SHACKLETON, R. M., WATSON, J., DOWNIE, C., HARLAND, W. B. & MOORBATH, S. (eds) *A correlation of Precambrian rocks in the British Isles*, 1–10. *Spec. Rep. Geol. Soc. London*, **6**.
- 1975 The Lewisian Complex. In: HARRIS, A. L., SHACKLETON, R. M., WATSON, J., DOWNIE, C., HARLAND, W. B. & MOORBATH, S. (eds) *A correlation of Precambrian rocks in the British Isles*, 15–29.
- 1975 The tectonic evolution of the Lewisian complex in northern Lewis, Outer Hebrides. *Proc. Geol. Assoc. London*, **86**, 45–61 (F. B. Davies, R. J. Lisle & J. Watson).
- 1976 Vertical movements in Proterozoic structural provinces. *Phil. Trans. R. Soc. London, A* **280**, 629–40.
- 1976 The Earth's crust in Precambrian times. *Proc. Yorks. Geol. Soc.* **41**, 145–62.
- 1976 Mineralization in Archaean provinces. In: WINDLEY, B. F. (ed.) *The Early History of the Earth*, 443–53. London: Wiley.
- 1976 Variations in crustal level and geothermal gradient during the evolution of the Lewisian complex of northwest Scotland. *Precambrian Res.* **3**, 363–74 (B. B. Dickinson & J. Watson).
- 1976 *Eo-Europa: the evolution of a craton*. In: AGER, D. V. & BROOKS, M. (eds) *Europe from Crust to Core*, 59–78. New York: Wiley.
- 1977 Intrusion into moving crust. In: SAXENA, S. & BHATTACHARJI, S. (eds) *Energetics of Geological Processes*, 20–30. New York: Springer-Verlag (J. Sutton & J. Watson).
- 1977 Early basic bodies in the type Laxfordian complex, NW Scotland and their bearing on its origin. *J. Geol. Soc. London*, **133**, 123–31 (F. B. Davies & J. V. Watson).
- 1977 Precambrian thermal regimes. *Phil. Trans. R. Soc. London, A* **288**, 431–40.
- 1977 The Outer Hebrides: a geological perspective. *Proc. Geol. Assoc. London*, **88**, 1–14.
- 1978 Review lecture. Ore deposition through

- geological time. *Proc. R. Soc. London*, **A 362**, 305–28.
- 1978 The basement of the Caledonide orogen in Britain. In: *Caledonian-Appalachian Orogen of the North Atlantic Region*, 75–7. *Geol. Surv. Can. Pap.* 78–13.
- 1979 Basement-cover relations in the British Caledonides. In: HARRIS, A. L., HOLLAND, C. H. & LEAKE, B. E. (eds) *The Caledonides of the British Isles – reviewed*, 67–91. *Spec. Publ. Geol. Soc. London*, **8** (J. Watson & F. W. Dunning).
- 1979 Regional geochemistry of the Northern Highlands of Scotland. In: HARRIS, A. L., HOLLAND, C. H. & LEAKE, B. E. (eds) *The Caledonides of the British Isles – reviewed*, 117–28 (G. S. Johnstone, J. Plant & J. V. Watson).
- 1979 Caledonian granites in relation to regional geochemistry in northern Scotland. In: HARRIS, A. L., HOLLAND, C. H. & LEAKE, B. E. (eds) *The Caledonides of the British Isles – reviewed*, 663–7 (G. S. Johnstone, J. Plant & J. V. Watson).
- 1979 Regional geochemistry of uranium as a guide to deposit formation. *Phil. Trans. R. Soc. London A* **291**, 321–38 (J. V. Watson and J. Plant).
- 1980 Metallogensis in relation to mantle heterogeneity. *Phil. Trans. R. Soc. London*, **A 297**, 347–52.
- 1980 The origin and history of the Kapuskasing structural zone, Ontario, Canada. *Can. J. Earth Sci.* **17**, 866–75.
- 1980 Basement heat flow and metalliferous mineralization in England and Wales. *Nature, London*, **288**, 657–9 (G. C. Brown, J. Cassidy, E. R. Oxburgh, J. Plant, P. A. Sabine & J. V. Watson).
- 1981 Regional geochemistry in relation to the structures in the south-west Highlands. *Geophys. J. R. astr. Soc.* **65**, 246 (J. Plant & J. Watson).
- 1982 The role of metalliferous and mineralised uranium granites in the formation of uranium provinces. In: *Proceedings of the Symposium on Uranium Exploration Methods*, 157–68. Paris: Nuclear Energy Agency (P. R. Simpson, J. A. Plant, J. V. Watson, P. M. Green & M. B. Fowler).
- 1982 Uranium provinces in relation to metamorphic grade and regional geochemistry. In: *Proceedings of the Symposium on Uranium Exploration Methods*, 235–47. Paris: Nuclear Energy Agency (J. Watson, M. B. Fowler, J. A. Plant, P. R. Simpson & P. M. Green).
- 1982 Layered ultramafic-gabbro bodies in the Lewisian of northwest Scotland: geochemistry and petrogenesis. *Earth Planet. Sci. Lett.* **58**, 345–60 (J. D. Sills, D. Savage, J. V. Watson & B. F. Windley).
- 1983 *Geology and Man—An introduction to applied earth science*, 150 pp. London: Allen & Unwin.
- 1983 A geochemical study of Lewisian meta-sedimentary granulites and gneisses in the Scourie-Laxford area of north-west Scotland. *Mineral. Mag.* **47**, 1–9 (P. O. Okeke, G. D. Borley & J. Watson).
- 1983 Metalliferous and mineralized Caledonian granites in relation to regional metamorphism and fracture systems in northern Scotland. *Trans. Inst. Min. Metall.* **B 92**, 33–42 (J. A. Plant, P. R. Simpson, P. M. Green, J. V. Watson & M. B. Fowler).
- 1983 Lewisian. In: CRAIG, G. Y. (ed.) *Geology of Scotland* (2nd Edn), 23–47. Edinburgh: Scottish Academic Press.
- 1984 The ending of the Caledonian orogeny in Scotland. *J. Geol. Soc. London*, **141**, 193–214.
- 1984 Continental crustal regimes as factors in the formation of sedimentary ore deposits. *J. Geol. Soc. London*, **141**, 215–20.
- 1984 Variscan–Caledonian comparisons: late orogenic granites. *Proc. Ussher Soc.* **6**, 2–12 (J. Watson, M. B. Fowler, J. A. Plant & P. R. Simpson).
- 1984 Moine–Dalradian relationships and their palaeotectonic significance. *Proc. R. Soc. London*, **A395**, 185–202 (J. A. Plant, J. V. Watson & P. M. Green).
- 1985 Northern Scotland as an Atlantic-North Sea divide. *J. Geol. Soc. London*, **142**, 221–43.
- 1986 Architecture of the continental lithosphere. *Phil. Trans. R. Soc. London*, **A317**, 5–12.
- 1987 The Lewisian complex: questions for the future. In: *The Evolution of the Lewisian and Comparable Precambrian High Grade Terrains*, 7–11. *Spec. Publ. Geol. Soc. London*, **27**, 7–11. Blackwell Scientific Publications, Oxford.