

H. A. NICHOLSON (1844-1899): PIONEER OF THIN SECTION TAXONOMY

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LIFE AND WORK

Nicholson was one of the most prolific and well-known invertebrate palaeontologists of the latter half of the 19th century. He wrote 150 papers and monographs on all aspects of invertebrate fossils of the Palaeozoic of Britain, North America, and Europe. His main contributions were in Lake District geology, graptolites, and in pioneering the structural study of thin sections for the classification of rugose and tabulate corals, Bryozoa, and stromatoporoids. In addition to his original scientific works, Nicholson published 12 popular textbooks of zoology, palaeontology, and geology.

Henry Alleyne Nicholson was born on 11th September, 1844 in Penrith, Cumberland. He was educated at Appleby Grammar School, and then attended the University of Göttingen where he worked in zoology. From 1862 to 1867 he studied medicine and surgery in Edinburgh, and obtained a gold medal for his thesis "On the Geology of Cumberland". His degrees were MA, PhD (Göttingen), BSc (Edinburgh, 1866), MB, CM, DSc (Edinburgh, 1867), MD (Edinburgh, 1869). In 1869 he was appointed Lecturer on Natural History in the Extra-Academical School of Medicine attached to Edinburgh University, and continued his researches on Lake District geology and graptolites. In 1871 he visited Toronto, and was offered the Chair of Natural History there. He held this position for three years and produced reports on the Silurian and Devonian fossils of Ontario and Ohio - his introduction to fossil corals and Bryozoa. He returned to the Professorship of Biology in the Durham College of Physical Sciences (now part of Newcastle University) in 1874 and then moved, in 1875, to the Chair of Natural History in St Andrews. He made important studies, during this time, on Carboniferous rugose corals (with James Thomson of Glasgow), the fossils of Girvan (with R. Etheridge jun.), and produced his revisions of the 'Tabulata' (1879) and of the 'Monticuliporoids' (1881). In 1882 he accepted his final position, as Professor of Natural History in Aberdeen University, where he stayed until his death in 1899. During this time, he published his important works on stromatoporoids (1886-1892), as well as numerous coral and bryozoan papers.

Nicholson was a prodigious worker, judging by the range and extent of his work in a relatively short career (30 years). He was also an inspiring teacher: "Professor Nicholson commanded the eager attention of his students... he was most deeply interesting, lucid, and attractive... the lecture hour passed away all too quickly" (Brown, 1899, p 117). Nicholson also improved the teaching of zoology and geology in St Andrews and Aberdeen by the encouragement of practical work. One of his former students referred to his "extraordinary gentility and charm of manner... his humour was bright and overflowing" (Japp, 1899, p 117).

Nicholson was famous for his field trips which were eagerly attended by students, and he would spare "neither trouble nor expense to make the students learn the principles of field work and enjoy themselves at the same time" (Gibb, 1899, p 119). His favourite areas for field trips were his native Lake District and Girvan, in south-west Scotland. A Glasgow naturalist,

A. S. Alexander (1925, p 57) describes Nicholson in the field as follows: "His fine shepherd-like form, clad in plain dark-grey tweed and crowned by a round, soft, felt hat shading black locks, dark-brown luminous eyes, and a long black beard from a white, pale-pinkish face of delicate mould with a sharp-pointed conspicuous nose, broad in the middle but narrow at the bridge, is clear in memory. He walked with a swing as a shepherd would, and in long strides,... with his eyes looking far out over the valley to some remote horizon, seeing all in true relation, and calmly declaring the truth."

Biographical information on Nicholson was obtained from the following sources:

- Anon. 1899. A lost leader. Alma Mater, Aberdeen University Magazine, 16: 115, portr.
- Brown, A., 1899. Henry Alleyne Nicholson. Ibid, 16: 115-117.
- Japp, F. R., 1899. Impressions of Professor Nicholson. Ibid, 16: 117-118.
- Gibb, A. W., 1899. Dr Nicholson as a teacher of geology. Ibid, 16: 118-119.
- Alexander, A. S., 1925. Tramps across watersheds. 304pp, Glasgow (see pp. 56-58).
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CORAL THIN SECTION WORK AND NICHOLSON'S CONTRIBUTION

Early coral workers, like Goldfuss, Michelin, Lonsdale, M'Coy, Milne-Edwards, and Haime, working between 1825 and 1860, figured whole specimens of corals and the occasional slightly magnified broken specimen. Classification was based on overall form and surface calicle appearance, but internal structures were little used. In the 1850s H. C. Sorby wrote revolutionary papers on the structure of sedimentary rocks using microscopic sections and sectioning of corals was suggested by the German K lliker in 1865.

Nicholson's papers of 1874 and 1875 on corals and stromatoporoids refer to internal structures only so far as they could be seen in broken specimens. Apparently Nicholson began cutting sections in 1875, published his first figures of these in 1876, and based all his subsequent work on them. Zittel (1901, p. 390-1) records that in 1882 the German workers Pratz and Koch published works showing illustrations of thin sections, but Nicholson had already thoroughly established the technique by then.

In 1875, in the introduction to a study of Carboniferous Rugosa, Thomson and Nicholson (1875a) write: "The method of investigation pursued has, in the main, consisted of slicing and polishing the specimens in different directions, and in preparing thin sections for microscopic examination... we feel that the above method of investigation is the only one which is capable of leading to really sound and reliable conclusions". The authors proceed to justify this new technique in terms of its greater accuracy in taxonomy and evolution. The work of Nicholson's coauthor, James Thomson, an amateur collector from Glasgow, should not be underestimated. He had been sectioning corals for some time before Nicholson worked with him and he had published some small papers in 1874 and 1875. In a footnote (Thomson and Nicholson, 1875a: 306), they write: "our collections embrace several thousands of cut and polished specimens of Palaeozoic corals, together with a large number of thin sections for microscopic examination..." and these would have been made mainly by Thomson. The two published a series of nine papers revising the classification of certain rugose corals, but they did not cooperate after that time. Some disagreement between the two seems to have arisen (Nicholson (1888a) is an extensive criticism of Thomson's work). Thomson is renowned for the vast

number of new species and genera of Rugosa that he established for identical forms (c.f. Hill, 1938: 3-4) and this apparent lack of an appreciation of the relative value of taxonomic characters may have alienated the careful and conservative Nicholson who would have disliked Thomson's taxonomic over-exuberance.

Following his work with Thomson, Nicholson published a paper containing low magnification drawings of sections of some of his Ohio bryozoans (1876). Nicholson's first monograph on stromatoporoids (Nicholson and Murie, 1878) is a masterly exposition of the structure and relations of a problematic group that he placed tentatively in the calcareous sponges on the basis of external morphology and especially internal detail. He outlines the use of thin sections and the necessity of using sections in various dimensions in order to elucidate anatomical features. Similar monographic works on the so-called 'Tabulata' (1879a), 'Monticuliporoids' (1881b), and stromatoporoids (1886-1892) relied heavily on microscopic work. In the introduction to his large stromatoporoid monograph, Nicholson (1886a: iii) writes: "In preparing the figures illustrative of microscopic structure, I have been in many cases greatly assisted by an excellent series of micro-photographs" taken by Mr George Gellie of Aberdeen. Four glass negatives of unpublished stromatoporoid figures for his proposed work on Russian forms are preserved in the British Museum (Natural History) with the Nicholson type stromatoporoid collection.

The quality of Nicholson's slides, although a little thick by modern standards, is shown by the fact that many recent works (e.g. Stearn, 1966, Perry et al., 1973, Jull, 1976a, b, Bathurst, 1971: 35-38) use them as research and illustrative material.

NICHOLSON COLLECTIONS

Nicholson obtained a lapidary's wheel around 1875 and proceeded to cut many thousands of sections over the next 20 years, of which at least 4000 still survive. Examples of completed slides and unground thick sections on glass plates may be seen in the Royal Scottish Museum, British Museum (Natural History), and Aberdeen University, Geology Department.

Nicholson collected Palaeozoic corals, Bryozoa, and stromatoporoids in Britain (Girvan, Devon, Shropshire, etc.), Germany (Eifel), Sweden (Isle of Gotland), USSR (Estonia), Canada (Ontario) and USA (Ohio). These collections were distributed around various institutions during and after his lifetime, and important collections are as follows:

1. Royal Scottish Museum: Canadian material and an important collection of 1000 slides presented by Dr D. N. Nicholson, grandson of Henry Alleyne: many type and figured.
2. British Museum (Natural History): Canadian corals and Bryozoa, type and figured stromatoporoids.
3. Aberdeen University, Geology Department: Canadian and European corals and Bryozoa: some type and figured (catalogue: Benton and Trewin, 1977). Full details of the Nicholson material in these and other repositories, together with a complete bibliography and listing of most of Nicholson's type and figured material are given in Benton (1979).

NICHOLSON'S WORK

CANADA 1873-5: Nicholson published two reports on the Silurian and Devonian fossils of Canada (1874j, 1875e), and one on those of Ohio (1875i), as well as numerous related papers (1873b, c, 1874a-1, 1875a-d, f-h, Nicholson and Hinde, 1874). In these, he describes and figures 12 new species of stromatoporoids, 36 new species of corals, and 56 new species of Bryozoa, and numerous others. More important than these descriptions was the fact that Nicholson made vast collections in Canada and Ohio which formed the basis of all his significant later work.

RUGOSA 1875-6: Throughout 1875 and 1876 Nicholson worked with James Thomson, and published a series of papers mainly on the Carboniferous rugose corals of Ayrshire and Fife (Thomson and Nicholson, 1875a, b, 1876a-e; Nicholson and Thomson, 1876a, b), illustrated with detailed figures from large-size slides of longitudinal and transverse sections.

TABULATA 1877-1889: Using thin sections, Nicholson and Etheridge (1877) revised the genus Alveolites and its relatives. Nicholson's monograph on the structure and affinities of the "Tabulate Corals of the Palaeozoic Period" (1879a, also 1879b) provided original descriptions of all species that had been regarded as such. This included Millepora, Labechia, Chaetetes, Stenopora, and Monticulipora, although Nicholson had reservations about the relationships of these diverse elements of the classic "Tabulata". Nicholson also described corals from Girvan (Nicholson and Etheridge, 1878, 1880), and other accounts of the comparative microscopic anatomy of tabulates, illustrated with fine drawings by the author, are Etheridge and Nicholson (1878), Nicholson (1881a, 1882, 1884a, 1886c, 1887b, 1888a, 1889b), Nicholson and Etheridge (1877, 1879a, b), and Nicholson and Foord (1886).

BRYOZOA 1877-1886: Nicholson's work on Tabulata led to a study of the 'Monticuliporoids', most of which he extracted from the rag-bud genus Chaetetes and reclassified in the new genera Heterotrypa, Diplotrypa, Monotrypa, Prasopora, and Peronopora (1879a, 1881b). Further work on other Bryozoa is documented in Etheridge and Nicholson (1878), Nicholson (1877, 1883), Nicholson and Etheridge (1880, 1886), and Nicholson and Foord (1885).

STROMATOPOROIDS 1874-1892: Finally, we come to the group for which Nicholson is best remembered. He described some Canadian forms of Stromatopora in 1874a, j, 1875e, i, and in Nicholson and Murie (1878), published a detailed review of the structure and classification of the group, introducing the new class Stromatoporoidea, and placing it in the calcareous sponges. However, his main work was published as a "Monograph of the British Stromatoporoids", and other papers (1886a, b, d, 1887a, 1889a, 1891a, b, 1892). Of this work, Lecompte (1956: W123-4) says: "The essential starting point and most fundamental work on stromatoporoids consist of studies recorded by Nicholson (1886)".

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