SOME REMINISCENCES OF ERNEST MARSDEN’S DAYS WITH RUTHERFORD AT MANCHESTER*

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The name of Marsden is inseparably connected with that of Rutherford, as symbolized, perhaps, by the fact that not only were they both given one Christian name only, which is unusual, but the name was in both cases the same, Ernest, an outstanding example of the Importance of being Ernest. Further, the two men are closely associated with New Zealand, a country dear to both their hearts. Rutherford, of course, was born there and loved his native land, visiting which in 1914 gave him the greatest pleasure: Marsden went thither at the beginning of the next year, 1915, to take up the post at Victoria College where he was to win such distinction and render such great services to education. I propose to set down here something of Marsden’s research work in his Manchester days, where, as John Harling Fellow, the unworthy successor of Moseley, I spent the academic year 1913-1914 and so saw much of Marsden. I was looking forward to working for a few years with the great Rutherford, but the outbreak of war in 1914 put an end to that.

Marsden’s research work in the Manchester Laboratory was entirely concerned with the behaviour of alpha particles, the alpha particle being, as Rutherford had shown, the nucleus of a helium atom shot out spontaneously by certain radioactive elements, that is, the particle is a very swift projectile of very small dimensions. The alpha particles were Rutherford’s pets and, as has been said, how he made them work! Marsden, as a—to use his own descriptive word—callow youth from Blackburn, had already, as an undergraduate, helped Geiger, a man some years older, and a close collaborator of Rutherford’s, in work concerning the way in which alpha particles were turned aside, or scattered, to use the customary word, in their passage through very thin foils of metal, and in this way had shown his ability to such an extent that it seemed fitting to let him engage in regular research.

To set down Rutherford’s oft-quoted words, ‘One day Geiger came to me and said: “Don’t you think that young Marsden, whom I am training in radioactive methods, ought to begin a small research?” Now I had thought that too, so I said: “Why not let him see if any alpha particles can be

* This article was prepared for Sir Ernest Marsden’s 80th Birthday Booklet to be published privately in Wellington, New Zealand, in February 1969.
scattered through a large angle?" Accordingly Geiger and Marsden set to work on the scattering of alpha particles by thin metal foils, the particles being detected by the scintillations that they produced on a suitable phosphorescent screen. A famous result of this work, published in the *Proceedings of the Royal Society* in 1909,* was the finding that some few of the alpha particles were turned through an angle so large that they emerged from the foil through the side by which they entered, were thrown back in a way that demanded an enormous atomic force. Rutherford's well-known comment on the result was: 'It was quite the most incredible event that has ever happened to me in my life. It was almost as incredible as if you fired a 15-inch shell at a piece of tissue paper and it came back and hit you.'

After prolonged consideration Rutherford concluded that the only way to account for a force big enough to produce this large angle scattering of the alpha particles was to assume that, with all atoms, the mass was concentrated in a positively charged particle, extremely small compared to the size of the atom, which size was determined by a complicated structure of electrons, planets distributed in the space surrounding this minute sun. The positively charged particle became known as the nucleus of the atom: it was not so called in Rutherford's original paper. Thus, at the age of twenty, Marsden was closely associated with the birth of the nuclear structure of the atom, a concept that dominates modern physics.

In 1910 another paper on alpha particles by Geiger and Marsden appeared, and in 1912, the year in which Marsden was appointed research assistant, one on the transformation of the active deposits of thorium, written in collaboration with Darwin. When, as John Harling Fellow, I went to Rutherford's laboratory in Manchester in the autumn of 1913, Marsden was at the height of his research activity and his stimulating vigour pervaded the laboratory. He had some half a dozen young men working under his guidance, with each of whom he carried out a research, published in the *Philosophical Magazine*, that has an assured place in the history of radioactivity. He was keenly interested in everything that was going on in the laboratory: I remember, for instance, that he would talk with me on the work that I was doing with Rutherford on the wave-length of the gamma rays. Even the few researches that were proceeding on subjects outside the radioactive field attracted his interest.

The coming of the war in the summer of 1914 put an end, of course, to the research life of the laboratory as it had prevailed up to then. In January

* It is perhaps worth recording that the paper was received 19 May, read 17 June and published 31 July, the interval between receipt and publication being typical of those more leisurely days.
1915 Rutherford wrote to Schuster of how he had returned without untoward adventure from his visit to New Zealand, adding: ‘Possibly you have heard that Marsden has been appointed Professor of Physics in Victoria College, Wellington, in succession to Laby, who gained the post in Melbourne. He is leaving here in a week’s time to take up his duties . . . I think you know that I have a very high opinion of Marsden, and the large amount of important work he has already done in radioactivity is the best indication that he will continue to do good research in that subject in the future.’ Such words from Rutherford are the best tribute to Marsden’s outstanding ability as a physicist. His arrival in New Zealand, however, was to turn his creative energies to a new interest, education, in connexion with which his great achievements are well known. His significant services during the First World War lie, like his services to New Zealand, outside my present scope.

Marsden’s close connexion with Manchester was renewed at the Commemorative Session held at that city in 1961, the fiftieth anniversary of Rutherford’s discovery of the nuclear structure of the atom from consideration of the large angle scattering of alpha particles with which Marsden was so closely connected. The Session was thus, in a way, a Rutherford-Marsden celebration. Others, I feel sure, will be writing of this outstanding occasion with greater authority and ability than I can muster, but, with the exception of Chadwick, I think that I was the only one present of the old Manchester Rutherford men now living. The assembly was dominated, in the most amiable and effective fashion, by Marsden, who was made an Honorary Doctor of Laws of Manchester, his old home. He delivered the impressive opening address on ‘Rutherford at Manchester’, which is printed in the book entitled *Rutherford at Manchester,* where a full account is given of the proceedings. This book also contains many other matters of Rutherford interest, such as a full list of his papers, and is indispensable to anyone concerned with the life and doings of the great man. Incidentally, a photograph, reproduced in the book, was taken on this occasion of Marsden standing together with four other old members of Rutherford’s Manchester school: Andrade, Bohr, Chadwick and Darwin. I much regret to have to put my name first, but the great law of alphabetical order—certainly no other remotest reason—demands it: A, B, C, D.

Rutherford’s international fame is attested by the fact that the best account of his life and work is *Rutherford,* by Daniel Danin, written in Russian and published in Moscow in 1966, in which, naturally, Marsden appears prominently.

*Edited by J. B. Birks. London: Heywood (1962).*
Marsden’s achievements at Manchester, which he left at the age of twenty-four, are truly remarkable. He had, of course, the good fortune to be closely associated with Rutherford, the effect of whose stimulating encouragement of those working under him—‘gingering them up’, to use his favourite phrase—cannot be overestimated. This stimulation, however, could do no more than help to produce what was best in a man, and in Marsden’s case, as will have been seen, what was best was quite exceptionally good.