

whole happy, years of college life, came the question of a career, professional or otherwise; but here the dark shadow of my brother's death crossed my path and tended to modify my course. I was now an only child, and it seemed to be my duty to remain with my parents and to sustain them in their declining years. My father's affairs had also by this time attained to a prosperous condition, and I might hope, as his assistant and successor, to enjoy a sufficient income, with some time and opportunity to follow scientific work, or to promote the educational and religious interests of our community, and of my native province, for which I entertained a strong patriotic feeling. My own views had undergone a great change, and had I then entered on any professional career, it would have been that of the Christian ministry, towards which end, after my academical course was finished, I had applied myself to the study of Hebrew and allied subjects, which I afterwards followed up in Edinburgh. In any case it would, I think, have been only in favour of this—to them the highest of all functions—that my parents would, at that time, have willingly devoted me.

CHAPTER III

STUDENT LIFE IN EDINBURGH, AND RELATIONS WITH LYELL AND LOGAN

THUS far no systematic instruction in geology had been accessible to me. All my knowledge had been acquired from books, or by my own observation. My collections and notes, however, already covered some of the more important geological formations of my native province, and I had begun to be regarded in my own locality as an authority on the subject. Other departments of natural history were represented in my collections—birds, insects, and molluscs especially—and I had a considerable herbarium of native plants. I now longed for some means of special instruction; but in those days scientific schools were to be found only abroad. Thus, after some thought and inquiry, it was decided in our little family council that I should have a session in Edinburgh, where there seemed to be good opportunities for obtaining the training desired.

The journey was undertaken in the autumn

of 1840 in a timber-laden ship, the *Harvest Home*, Captain Thompson, bound for Newcastle, a somewhat out-of-the-way port for a passenger from the west, but which had the advantage of being less distant from Edinburgh than some others more easily reached from America. Towards its close the voyage was a stormy one, and one night a sea broke on board which cleared our deck from stem to stern, tore away a large part of the bulwarks and injured two of the crew, besides destroying the wheel. The whole was the work of a moment, but left our ship an apparent wreck, as well as deluging the cabin with water. The storm abated as we entered the English Channel; and I was delighted with the beauty of the coast—seen at no great distance—as we passed in leisurely succession the cliffs of Cornwall and Devonshire, the rocks of the Isle of Portland, the green fields and woods of the Isle of Wight, the banks of Beachy Head, and the chalk cliffs of Dover—all already familiar to me by name through my geological reading. How I longed to be on shore, to examine their rocks and collect their fossils! Our difficulties were, however, not yet over, for in the North Sea we were again assailed by storms, and had to run before

a violent southerly gale, in very thick weather, through the dangerous shoals of the east coast. In the end we were driven far beyond the Tyne, and found ourselves near the historic island of Lindisfarne. Returning, when the gale abated, we passed the bar of the Tyne with some difficulty in a heavy sea. A glimpse of Flamborough Head, towering over us on a sudden lifting of the mist, and the many heavily-laden colliers, passed by us, lying to with the sea washing over their decks, remain as vivid pictures.

I stayed a day in Newcastle, and saw a little of this busy, smoky town, with its steep streets and stairways. On the one evening I passed here, I was introduced to a debating club of young men, and having taken some little part in the discussion, was complimented by a member on my speaking English so well. Possibly he supposed that my native tongue was Chipewewa or Micmac! This ignorance was an intimation of the insignificance of my own country that did not pass unnoticed. To Edinburgh I went by stage, and as the weather was cold and part of the journey to be by night, I thought it prudent to take an inside place, but was surprised to find that every one but myself was content to sit outside—a lesson to me in

that economy, so common in Scotland and in the north of England, which prefers discomfort to a little extra expenditure. In those days, before there were railways in the north, travelling was costly, and the poor man must stay at home, trudge on foot, or, at the best, must be content with the outside of the coach. Even in the inside I found the November night miserably cold, and learned that in the winter I might expect to suffer as much from that cause in Scotland as at home. In the morning I awoke from an uneasy sleep, to find myself in the High Street of Edinburgh, amid loud voices speaking in broad Scotch.

On arrival, I was received most cordially and hospitably by friends, to whom I had brought letters of introduction, and proceeded at once to enrol myself as a student in the University. As no entrance examination was required, I took out a ticket of matriculation in order to obtain the privileges of a regular student, although I proposed to devote myself entirely to studies in natural science. In addition to the general course of the Pictou Academy, I had a fair knowledge of the elements of chemistry and of physics, and could thus profitably enter on special studies. Besides attending lectures, I spent much time in the

University museum, and, providing myself with Maclaren's excellent book on the local geology, made frequent excursions in the vicinity of the city, both for exercise and practice in observation. I also read extensively in the library, making notes, abstracts, and drawings from books to which I could not have had access at home. The results of this winter's study were most valuable to me. Jameson, my principal geological teacher, devoted a large part of his earlier lectures to physical geography, and the remainder mostly to minerals and rocks, and it happened that these were just the points in which I was weakest. Later on, I was surprised to find how little even some of the more eminent English geologists of that day seemed to know of mineralogy, and consequently how uncertain was their diagnosis in the field, of the nature of rock masses. At the same time, I regretted that I could not obtain any systematic instruction in palæontology, in geological surveying, and in some other important subjects.

It became imperative for me to leave Edinburgh in the spring of 1841, but I determined, if possible, to return to complete what I had there begun. I knew that, in the meantime, I should become more fully aware of my defi-

ciencies in the knowledge necessary to the success of an observer, isolated as I should be from the centres of science and from the aid of specialists, and thrown entirely on my own resources. The interruption of the continuity of my studies was thus, in some respects, an advantage, especially as, in the interval, I had the privilege of associating in field work with Lyell and Logan.

Whilst in Edinburgh, I received much personal kindness and useful guidance from Jameson, Forbes, Balfour, and other leading men connected with the University. I also enjoyed the acquaintance of Alexander Rose, a most single-hearted and earnest man, and an excellent mineralogist,—being a special authority on the minerals of Scotland and Iceland. It was through him that I was introduced to Mr. Sanderson, the lapidary, who had sliced fossil wood for Witham and Nicol, and from whom I learned something of the art of preparing transparent slices of rocks and fossils for the microscope, which was afterwards of great advantage to me, although I never made this work a specialty, but employed it only as an accessory in general geology.

Even Edinburgh, in the years when I at-

tended its classes, was a very imperfect school of natural science, compared with those that now exist, but this imperfection was chiefly in minor specialties. There were many able and enthusiastic teachers, and, to a diligent student, pursuing a well-selected course, it gave a good general groundwork, suited to the requirements of the time. To any one prepared to build on it, by practical work, in the directions which his own gifts, or the nature of his field might indicate, the training thus acquired was likely to prove of great value. Whilst thus in pursuit of special education, I had also the benefit of learning, incidentally, something of the motherland and its institutions. I listened to the voices of some of its great orators and preachers, and, in Edinburgh, had the opportunity of knowing a little of the work of Chalmers and his contemporaries, and of witnessing the earlier signs of the national uprising, which led to the disruption of the Scottish establishment. My residence in Edinburgh also led, though some years later, to my entering into the most sacred and important of all relationships; but to this I must refer in a subsequent chapter.

It so happened, and I cannot help regarding this as one of those providential coincidences

which regulate the affairs of men, that in the summer succeeding my return from Edinburgh, in 1841, I met with two great geologists, whose friendship followed and assisted me through the earlier years of my career. These were—Sir Charles Lyell, who more than any other man gave form to modern geological science; and Sir William Logan, who gave the first great impulse to the systematic geology of the older rocks of the North American Continent, and originated the Geological Survey of Canada. To other men who have passed away, and whose friendship I have enjoyed, I owe much: Jameson, Murchison, Bigsby, Miller, Sedgwick, Phillips, the Carpenters, Hall, Agassiz, Salter, Dana, and Hunt, have all assisted me by their teaching and friendly cooperation; but to Lyell and Logan I owe most.

Lyell spent some time in Nova Scotia on the occasion of his first visit to America, in the summer of 1841. Being, at this time, specially interested in the correlation of the coal-bearing rocks of North America with those of Europe, he naturally visited the Pictou coal district. He had letters of introduction to gentlemen connected with the General Mining Association of London, then working the principal coal-seam of the district,

and one of these, Mr. Alexander P. Ross of Pictou, introduced me to him, and brought him to see my collection. He looked over my specimens with appreciation, and listened with interest to what I could tell him of the geology of the beds in which they occurred; especially, I could explain to him that the extensive deposits of reddish sandstones in the northern part of the county, which, under the name of New Red Sandstone, had been supposed to be much newer than the coal formation, were in reality connected with that formation. The evidence of the fossils, and the stratographical relations, also showed that certain beds on the south coast of Prince Edward Island were allied to them, though of somewhat later date. At that time we had not thought of separating these beds into three distinct groups—of Upper Coal formation, Permian, and Trias. Various names have since been given to them, but their actual relation to each other, as made out by me, has stood the test of time.

Many years later I referred to Lyell's visits to North America, and to his personal influence and genius as I knew them, in the following terms:¹—

¹ Presidential address to Natural History Society of Montreal, 1875.

"The benefits rendered by Lyell to American geology, in connection with his several visits to this continent, it would not be easy to overestimate. At the time of his first visit, few English geologists had seen those great breadths of the older, and of the more recent formations, by which this continent is distinguished, or had had the means of realising for themselves the resemblances and differences of the formations on the opposite sides of the Atlantic; and American and British workers in these subjects were little known to each other. The visits of Sir Charles Lyell did much to remedy all this. His own mind was filled with those grander aspects of geological phenomena which appear in America. He brought into correspondence with each other such workers in science as his intuitive tact perceived to be suited to give mutual aid. In British America, in particular, his agency in this way was very valuable in bringing together the widely-separated cultivators of science, and in linking them with the scientific movements of the mother country.

"Nor were his visits barren of purely scientific results. He may have made few discoveries of new facts—and he had not time

to enter into detailed stratographical studies—but in a thousand instances he cast new light on obscure investigations, gathered into a harmonious union detached fragments of evidence, and suggested new conclusions and interpretations. Of this character were, his rearrangement of the carboniferous rocks of Nova Scotia and New Brunswick, and the clear conceptions which he formed of the nature and origin of our post-pliocene formations, which are still, I think, in advance of those currently taught on this side of the Atlantic.

"Limited though his time for observation was, he always seized the salient and important points of any formation or locality, and I have often been struck with the truthfulness and completeness of the sketches which he gave of phenomena, with reference to which his opportunities of collecting information were very imperfect.

"In these American researches, the great gifts of the man were brought out in a light somewhat different from that in which they appear in his general works. The main distinction between Lyell and most of his contemporaries was his eminence as a thinker, whether in inductive or deductive reasoning. Like most of the English geologists of his

time, he had received less training in the characters of minerals and rocks than that which the more severe schools of science exacted, and his imperfect vision was a great hindrance in field work, and sometimes even a source of personal danger; but when facts, however complex, were once obtained, they grouped themselves in his mind in their natural relations with an unfailing certainty, while their connections with all the other parts of his vast stores of knowledge, and the general conclusions deducible from them, came out with a degree of clearness always beautiful, and often even startling.

“Another quality of his mind was the fresh and vivid interest, almost childlike, which every new truth awakened in him. This feeling is more or less that of every true naturalist. It depends on the clear perception of what is presented to us, and on the keen realisation of its relation to things previously known, and perhaps still more on the sudden breaking of those new relations upon the mind, as if with a flash of divine light. I well remember how, after we had disinterred the bones of *Dendropeton* from the interior of a large tree on the Joggins shore, his thoughts ran rapidly over all the strange circumstances of the burial of

the animal, its geological age, and its possible relations to reptiles and other animals, and he enlarged enthusiastically on these points, till, suddenly observing the astonishment of a man who accompanied us, he abruptly turned to me and whispered, ‘The man will think us mad if I run on in this way.’

“An allied feature of his mental character was the readiness with which he accepted new conclusions, and relinquished without regret views which he might have long held, when he perceived them to be shaken or untenable. He seemed wholly free from that common failing of men of science which causes them to cling with such tenacity to opinions once formed, even in the face of the strongest evidence. This quality eminently fitted him to be the expositor of a rapidly advancing science, and also to be the patron and helper of younger and less eminent men, and was connected with that warm and earnest interest which he ever felt in the progress of knowledge, and with the deference with which he received new facts and suggestions from any quarter.

“These qualities, apparent in his connections with American geology, were equally valuable in his relations to science in its general aspects. A man so gifted, fortunate in his genius, his

education, his outward circumstances, and in his appearance on the stage at a time when geology had gathered in some of its greatest harvests of facts, and was waiting for a master-mind to arrange them, had a great opportunity, which Lyell had the energy and ability to seize. He was thus able to become a guiding mind among his contemporaries in geological theory, and to hold his pre-eminence down to the end of his life, and through all the great changes which occurred in the rapid development of the science.

"The position which he occupied is one to which he was in every way justly entitled. His large and judicial mind had always a clear perception of the true method of natural history. He saw that the foundations of our knowledge of geology were to be laid in extensive and accurate collections of facts, and in reasoning on these by severely inductive methods. This idea he carried out in his 'Elements of Geology.' But in his 'Principles' he opened up a new field, not, as has been crudely conceived by some commentators on his work, one of the nature of deduction, as distinguished from induction, but rather another inductive investigation, leading to general conclusions as to the changes now in progress, in

order that, by a fair use of analogy, a key might be found to the interpretations of the facts and conclusions obtained by the study of the geological monuments of past ages. He has himself well stated this view of the case in the preface to the tenth edition of the 'Principles.'

"Viewed in this way the Lyellian geology rests on two inductive bases: the first relating to the facts discoverable in the earth's crust, and the second to the changes now in progress under our observation, and the connection of these, by an analogy, founded on identity of causes or conditions and identity of effects. This mode of treating the history of the earth was especially that of Lyell, and it was this that constituted his greatest contribution to the growth of modern geology.

"It is always interesting, in the case of a great student of nature, to ask what position he took in regard to those higher problems which directly affect man in his mental, moral, and spiritual nature. There is nothing in the study of nature to withdraw a man from sympathy with his fellows; and men of science who have so shut themselves up in their specialities, as to take no interest in the general welfare and progress of society, have necessarily failed

to secure for themselves and their subjects the hearty interest of mankind. In these respects Lyell was characterised by the same breadth which appears in his scientific investigations and reasonings. He was a warm personal friend, and full of sincere sympathy with all that concerned those he loved. He was active and earnest in promoting education and the diffusion of knowledge, and he took a lively interest in all movements for improving the social and political condition of the world at large. He was quite free from that tendency to attack or sneer at, everything that other men hold sacred, which characterises some of the advanced writers of the day. He neither tormented himself with the gloomy idea that men looked askance upon him, and wished to persecute him, nor did he desire to make any other man a martyr to his faith. In the earlier editions of the 'Principles,' he closed the work with a few paragraphs of 'Concluding Remarks,' in which he takes occasion to state his doctrine of the relation of natural science to religion in the following words, which, I find, remain unchanged in the latest edition:—

“‘We aspire in vain to assign limits to the works of creation in space, whether we exa-

mine the starry heavens or that world of minute animalcules which is revealed to us by the microscope; we are prepared, therefore, to find that in time also the confines of the universe lie beyond the reach of mortal man. But in whatever direction we pursue our researches, whether in time or space, we discover everywhere the clear proofs of a Creative Intelligence, and of His foresight, wisdom, and power. As geologists, we learn that it is not merely the present condition of the globe which is suited to the accommodation of myriads of living creatures, but that many former states also were adapted to the organisation and habits of prior races of being. The disposition of seas, continents and islands, and climates have varied, the species likewise have been changed, and yet they have all been so modelled on types analogous to those of existing plants and animals as to indicate throughout a perfect harmony of design and unity of purpose. To assume that the evidence of the beginning and end of so vast a scheme lies within the reach of our speculations, appears to be inconsistent with a just estimate of the relations which subsist between the finite powers of man and the attributes of an Infinite and Eternal Being.’”

Logan I first met in the same year (1841). He had come to Nova Scotia to familiarise himself with the carboniferous rocks, as developed there, in the interest of the Canadian Geological Survey. In the autumn of 1843 he again unexpectedly presented himself, in rough and weather-stained attire, and explained that he had spent the summer in Gaspé, where it had been reported that coal had been found, and had commenced there his great survey of Canada, in the hope—not destined to be realised—of the discovery of productive coal-measures. He had, however, accumulated a great mass of notes on the geology of that interesting region, and was full of anecdotes of the adventures he had met with. At the close of the summer he had taken passage to Pictou in a schooner to wait for the steamer for Quebec. His visit was short, but we spent many hours over his notes and drawings of fossils, which showed that he had been studying rocks older than those of the carboniferous system, and therefore not likely to contain coal. He showed me drawings of fossil plants he had observed, which, for the first time, gave me the idea I afterwards followed up, that Gaspé might afford a fossil flora much older than that of the coal formation.

Logan and Lyell, both able geologists, were men of entirely different stamps. The former was all for observation, measurement, and careful plotting and sketching, and therefore admirably fitted for the work of a detailed survey; the latter observant, yet always full of thought and comparison, and endeavouring to realise on the spot the relations of what he saw.

When travelling with Lyell, I told him frankly my plans, and my intention of remaining with my parents so long as they should have need of me, unless any attractive opening for scientific employment should appear. He approved of these, advised me to extend my studies and observations, and to throw my work into the form of papers for scientific societies. I remember too, that he cautioned me against entering into educational work, unless of such a kind as to give time for research, mentioning that many promising men had, in his experience, been lost to science in this way.

To me, from that time, the friendship of Lyell was of the greatest moment. His letters abounded with hints as to the newest subjects of discussion in geology; he was always ready to do anything in his power to advance my scientific or personal interests; and, as will

appear in the sequel, his placing me in relation with his friend Sir Edmund Head, had an important influence on my later life. In regard to local researches, his interest in the relations of the different members of the carboniferous system, led me to study these with care, and to prepare a series of papers on them. Our finding of reptilian remains in the interior of the erect trunk of a fossil tree at the South Joggins, led to an important series of discoveries. He entered, too, with zeal into my work on Devonian plants, and into those investigations of the fossils of the Laurentian limestones, in which, after my removal to Montreal, I was engaged, in connection with Logan, Carpenter, and Hunt.

With the memory of Sir Charles I must cherish that of his highly-gifted wife, a worthy helpmate for such a man,—who won the affection of all his friends by her geniality and true-heartedness, whilst in some departments of natural science she had attained a mastery that ensured respect, and enabled her to render important aid to her husband.

CHAPTER IV

MARRIAGE

BEFORE going further with these reminiscences it will be necessary to refer to an event which, in many respects, one is justified in regarding as the most important of all—namely, my marriage.

It was on my first visit to Edinburgh that I became acquainted with my future partner in life, and before long I came to regard her as one who, if I could but win her to share my lot, would at once assure my domestic happiness, and would afford a stimulus and incentive to fight well the battle of life. Truly, to love worthily a good woman is the first feeling that raises a youth to real manhood; and to win the love of such an one in return is to attain to the highest happiness that the world can bestow.

The Mercers were of an old Scotch family, resident at that time in Edinburgh, and it was to Margaret, the youngest daughter of the house, that my affections went out. It was