

the sea, affords ample opportunities for such investigations, and its waters teem with fish: from the gay striped bass and lordly salmon to the ever-hungry smelt—the delight of juvenile anglers. In such a basin, visited every day by the ocean tides, there is an endless variety of the humbler forms of aquatic life, and along the streams entering it a wealth of curious animals and plants with which an inquisitive boy could easily make himself familiar, in his rambles and occasional angling expeditions. But I now must leave these more domestic matters and youthful incidents and turn to others in which I had to do with the outside world.

CHAPTER II

EARLY EDUCATIONAL EXPERIENCES

BEFORE my birth, Pictou and the neighbouring country had been leavened to a great extent with earnest religious feeling, and purged from the rude ways of its early population of disbanded soldiers, principally through the missionary work of James MacGregor, a Scottish Presbyterian minister who had settled himself in the district while still in its infancy. He was a man of truly apostolic spirit, and gifted with rare energy and ability. He travelled through a wide district, then almost without any means of civilised communication, preached both in the English and Gaelic languages, and had done much to awaken among the people a zeal both for religion and education.

Such men are of inestimable value in recently settled countries. Families removed from old associations and restraints tend to relapse into a sort of heathenism and semi-barbarism, while the children without education, and with no experience other than those of a forest farm,

sink to a lower level than that of their parents, so that a rapid deterioration in mental and spiritual culture is soon apparent. No influence has been found so potent to counteract this downward tendency as that of the missionary preacher, proclaiming the gospel of Christ, advocating a high standard of life, establishing Sabbath schools and religious meetings, distributing the Bible and other useful books, encouraging the people to unite for public schools and similar important undertakings, and bringing them into relation with the religious and intellectual life of more advanced communities. This good work Dr. MacGregor did, in a very eminent degree, for a large district in eastern Nova Scotia. Before I was old enough to know much of such matters he was an aged man, and had retired from his more laborious work, which was in the hands of younger ministers, settled over congregations whose infancy he had cherished.

One of these men, the Rev. Dr. Thomas McCulloch, was destined to exercise great influence on the intellectual life of the district. He had come out from Scotland in 1803 to seek a settlement in America. The story ran that his intention was to go to Prince Edward Island, but that the head of the largest commercial firm

in Pictou—a local magnate of much importance—had his attention drawn to the young minister owing to some electrical apparatus which he had brought with him, and had induced him to remain in Pictou as a teacher and preacher. McCulloch was a man of an acute and vigorous intellect, remarkably versatile in its scope; he was well read in the literature and philosophy of the time, and had given some attention to physical and natural science for which he had strong innate tastes. He was a man of independent character, confident in himself and in his power of leading others, astute in guiding and regulating affairs, and a keen and incisive controversialist. With all this he was a patient teacher, and ready to add to the ordinary curriculum of the academy which he established much practical instruction gathered from his varied studies of nature and of man. In a larger field, with opportunity for original work and fewer distractions, he might have achieved a wide reputation. As it was, he became the founder and principal of one of the most important educational establishments in Nova Scotia, and exercised a large and lasting influence on the intellectual life of that province.

It thus happened that, before I was ready

to commence my education, there was established in Pictou, a grammar school on the plan of the parish schools of Scotland, and a college known as the Pictou Academy, primarily, as in many similar cases, for the training of young men for the Christian ministry. The curriculum of the latter, based on the arts course in Glasgow, where McCulloch had been educated, extended over four years. The college was furnished with a respectable library, philosophical apparatus, and, what was less usual at that time, a collection of natural history, mainly composed of local specimens, collected by the principal and his sons, but including a small set of fossils from some typical localities in Great Britain. It gave no degrees, because, under the narrow system then existing, that power was restricted to a college under the auspices of the Church of England, to whose articles students were expected to subscribe, a restraint not to be borne by stiffnecked Scottish Presbyterians, who, besides, regarded their own college as the better of the two.

My first scholastic training was the work of a woman of a degree of culture and refinement not common, at that time, in our little community. Educated in Scotland, in the subjects then usual in schools for ladies, she had been, I

believe, for a time a governess. Her subsequent married life was of a chequered and not very prosperous character, and, being left a widow in a strange land, she established a small private school. In this, with her quiet lady-like ways, her motherly kindness, and Christian character, together with her elementary teaching, she wielded no small power for good over the little boys and girls committed to her care. I have always retained a loving remembrance of this good woman, have visited her when in Pictou, and have rejoiced to give her the credit of laying the foundation of whatever attainments I have made. She lived to give their earliest lessons to my own two elder children. I may add that by her interest in flowers, and such objects as we collected, as well as by the occasional exhibition of a model of Solomon's Temple of her own making, she cultivated tastes and desires for knowledge beyond the limits of the three R's.

From this quiet little corner I was transferred to the higher arena of the grammar school, intended for boys only, and managed on the good old-fashioned plan of long hours, hard lessons, no prizes, but some punishments; and with the usual amount of roughness among the pupils, aggravated somewhat

by the fact that the reputation of the school attracted to it boys from distant places.

I was a moderately diligent, but, I fancy, not very brilliant pupil, and had throughout the misfortune, from rapid growth in stature, and perhaps also because of having somewhat more than the average amount of intelligence, to be in a class with boys older than myself. Partly, perhaps, from this cause, partly because of my mother's dread lest I should contract bad habits by association with low companions, I did not mix much with my schoolfellows, but generally ran home after school to enter into small pursuits of my own, such as angling, gardening, roaming along the shores and in the woods, or, in bad weather, taking up some book. A little later, when I began to make special collections, in which I was greatly encouraged by my parents, I went in search of shells, fossils, insects, and rare birds.

At this time, I suspect that many hours which should have been given to lessons were devoted to the above pursuits, or to miscellaneous reading, though, perhaps, not more than other boys were devoting to sports and games. We had a circulating library in the town, which abounded in works of fiction, history, travel, and biography. These books I

devoured with avidity, and if they did not bear on daily school work, they at least furnished a fund of general knowledge of value at a later period. In due time I was promoted from the grammar school to the college, and became a student, with a scarlet gown on the pattern of that of Glasgow, and with no little addition to self-importance. New privileges, most congenial to me, in the way of experimental lectures in elementary physics, and access to books and specimens in the college, were now enjoyed. These made the work much more agreeable than that of the school, though, I confess, my happiness was still greatly marred by the necessity of continual grind at classics and mathematics. Even in these, however, there was improvement on the school work, and I derived much pleasure from the historical parts of Greek and Latin literature, as well as from philological subjects; and was delighted to find that mathematics could become of some interest when applied to the problems of physics and astronomy. Somewhat later, I became, by a fortunate purchase at a sale of books, the possessor of a copy of Hadenger's translation of Mohs' Mineralogy, and learned, that the mysteries of solid geometry and trigonometry had been materialised in the crystals

of quartz, calcite, and zeolite, which I had collected from ballast piles on the wharves, or from the quarries and coast cliffs. At this time also, in connection with the chemical lectures, I set up a little laboratory of my own, and met with other students occasionally, for chemical experiments. Natural history had for me, however, greater charms, and as one of our principal's sons was a skilful preparer of birds and insects, and was willing to impart his knowledge to me, I worked for a time at preparing collections of birds, butterflies, and moths, the greater part of which were afterwards destroyed by fire in Montreal. Another employment was drawing, some lessons in which I had obtained from an itinerant teacher of the art. Elocution was now added to my studies, through the agency of a Scottish teacher of this subject, who settled himself for a time in the town, and was wisely encouraged by Dr. McCulloch to form a class in the college. This was my first experience in the value of training the voice for speaking and reading. In connection with this, a local literary and scientific society was formed, in which I took an active part, and before which, in 1836, my first scientific lecture was delivered. It bore the somewhat ambitious

title: "On the Structure and History of the Earth."

Whilst I was still a student (in 1835), my father became the proprietor of a printing establishment, and I had thus an opportunity of learning something of proof-reading, and matters connected with publication, which has not been without use to me in after life. Soon afterwards, in connection with one of my father's publishing ventures, I made a journey to Boston. In those days we travelled by stage-coach from Pictou to Halifax, and the means of communication thence to Boston was by sailing packet. The journey to Halifax occupied two days, and unless the wind was favourable, the voyage from Halifax might extend to a week. This expedition was a memorable one to me, as being my first long absence from home, and my first visit to any large city.

I had introductions to friends of my parents at Halifax, and among these was one to Joseph Howe, afterwards so well known as a political leader, but at that time building up his reputation as the ablest of our newspaper writers. Howe was very kind to me, inviting me to his house and giving me some books to read on the voyage. This was my first intercourse with

a man who worked a revolution in the constitution of his province, and exercised some influence on my own after life. Another family with which I then became acquainted was that of the Youngs,—my mother, on her voyage to Nova Scotia, having been a fellow-passenger with Miss Renny, a sister of Mrs. Young. The Hon. John Young was a leading merchant of Halifax and prominent in political affairs. Miss Renny had married Mr. Thompson, a West Indian gentleman, and her home was for some years in Jamaica, but after his death she had returned to Halifax, with her three sons, the oldest a little younger than myself. Mrs. Young also had three sons—William, afterwards Sir William Young, Chief Justice of Nova Scotia; George, for many years a leading lawyer and public man; and Charles, who was nearer to my own age than his brothers.

A somewhat shy and rustic boy, I was thrown into the society of these young men, considerably my seniors, and much my superiors in some kinds of culture, and in knowledge of the world. They were all very courteous and kind to me, and afterwards we became fast friends. On many subsequent visits to Halifax, Mrs. Thompson acted to me with motherly kindness and hospitality.

In Boston I had an introduction to Nathaniel Willis, then the editor of the only paper for children published in America, and a good and kindly man. Through him I saw much that was of interest to me in Boston and Cambridge. At that time there was no indication of the great development of natural science which took place under Agassiz, but the Natural History Society of Boston, then in its old building, had already valuable collections. I was also introduced to Augustus Gould, the eminent conchologist, who afterwards aided me not a little in the study of shells, both recent and ancient. I had previously exchanged specimens with Mr. Taylor of New Bedford, who gave me the names of many new species, and also enabled me to establish the resemblance of the molluscs of Northumberland Strait to those south of Cape Cod, a fact not published till very much later. I visited, too, one of the then famous nursery gardens of the village of Newton, in going to which I, for the first time, travelled by railway.

Some rudimentary excursions and expeditions which went on *pari passu* with my academic education, and occupied me for a short time after its completion, may here be referred to. At the time they were merely recreations

or amusements which might have been for ever laid aside in the interest of more serious pursuits, but which, in my case, had an important influence in determining the current of my life.

Under the town of Pictou, and partially exposed in quarries, road-cuttings, and coast and river cliffs in that vicinity, are beds of shale and sandstone, belonging to the upper members of the carboniferous system, in which, on the banks of the eastern of the three rivers flowing into the harbour, are the great beds of the Pictou coalfields; and these rocks near the town of Pictou often show specimens of fossil plants characteristic of the coal formation.

It happened, when I was a mere schoolboy, that an excavation in a bank not far from the schoolhouse exposed a bed of fine clay-shale, which some of the boys discovered to be available for the manufacture of home-made slate pencils. So we used to amuse ourselves occasionally by digging out flakes of the stone, and cutting them into pencils with our pocket-knives. While engaged in this occupation, I was surprised to find that one of the flakes had on it what seemed to be a delicate tracing in black, of a leaf like that of a fern. I was at the time altogether ignorant of geology and of fossil

plants, but was greatly struck by this unexpected discovery. I can remember, as well as if it were only yesterday, the effect on my mind of this new and mysterious fact, which was the beginning of many similar discoveries that have been among the chief pleasures of my life. Digging farther into the bed, I found more fragments of leaves, and soon had a little collection of them laid out on the shelf of a cupboard in which I kept my childish treasures. But the strangeness of the fact dwelt in my mind, and I was puzzled by the question whether they were real leaves or not, and, if real, how they came to be in the stone. My mother knew that such things were said to be found in the collieries near her old home in Scotland, but she had not given any attention to them, and such literature as I had access to was silent on the subject. My father, at length observing that I dwelt on the matter and had made a considerable collection of specimens, advised me to show some of them to Dr. McCulloch. I was then only a schoolboy, but I ventured, with some trepidation, to seek an interview with the man of learning, taking with me some of my best impressions of leaves. He received me kindly, and assured me that the impressions were real leaves

imbedded in the stone when it was being formed, and showed me some fossil plants of the coal-formation from England, and from Cape Breton, which were in the college collection. He further condescended to accept a few of my specimens, for the college cabinet, and encouraged me to continue collecting. This was of the more importance, as the other boys had derided the pursuit, and I had felt somewhat ashamed of being seen digging for the fossils. From that time I became a geological collector, and extended my researches to all the excavations and cliffs within reach, as well as to the cargoes of limestone imported to supply the limekilns near the town. In these I found shells, crinoids, and other marine fossils.

About this time there came into my hands a series of popular articles, published in the *Penny Magazine* of the Society for the Diffusion of Useful Knowledge, which gave a comprehensive summary of the facts of geology as then known. I was thus able to pursue with some intelligence the forming of a collection, and to explain to others the meaning of my efforts. Not long after, I was so fortunate as to make the acquaintance of Mr. Richard Brown, F.G.S., then manager of the

Sydney coal-mines, a sound and well-informed geologist, and author of the "Sketch of the Geology of Nova Scotia," appended to Haliburton's history of the province. He looked over my little collection and gave me some useful information. Dr. Gesner also, who was then collecting materials and soliciting subscriptions for his book on the geology of Nova Scotia, delivered a lecture on the subject, which was of some use to me, especially in regard to mineral localities. I obtained from him a few named specimens of minerals from the western part of Nova Scotia in exchange for some of my fossils.

After I entered college, I took longer excursions in the vacations. One of these was an expedition to the wonderful coast-cliffs of the South Joggins, on Cumberland Bay, an arm of the Bay of Fundy. The grotesque name of this place is supposed to be of aboriginal origin, and to be derived from the Micmac or Malicete language. These remarkable cliffs had already been mentioned by Brown and by Gesner, but had not been described in detail, and I was naturally desirous to see them for myself and to collect specimens of their fossils. The locality, however, was somewhat distant from Pictou, and the means of

getting there not very direct. The kindness of an old friend of my father's, the Hon. Daniel MacFarlane, gave me the opportunity I desired. He had occasion to visit Amherst, only fourteen miles from the nearest part of the Joggins shore, and offered to take me with him so far. We travelled for the most part by night, or in the evening and early morning, to avoid the heat of the day. From Amherst, I set off early for the ferry at the estuary of the Herbert River, crossing the pleasant Amherst marsh-lands, through clover-scented fields. On arriving at the ferry, the tide being low, I had an hour or two to wait. (The great tides of the Bay of Fundy extend into all its branches and estuaries, and restrict navigation to the time of high water.) I reached Minudie, a village some miles from the nearest part of the Joggins shore, only to find that there was no conveyance or practicable road, except for walking. So, armed with my hammer and a basket for specimens, I set out for the shore by a mere track through the woods. After a warm walk, I came out on the coast at the grindstone quarries of Lower Cove, where, as it was now evening, I was glad to find supper and a bed in the rough building occupied by the quarrymen. The

grindstone of the Joggins is a curious illustration of a little nicety in the work of nature. It owes its celebrity, as well as its sale and use, to the circumstance that the grains of sand composing it are very uniform in size, sharp, angular, and loosely cemented together, which qualities are exactly those required.

The tide being low in the forenoon, I rose early next morning, and taking some luncheon in my basket, walked along the shore to the south-westward for several miles. I was amazed at the grand succession of stratified beds exposed as plainly as in a pictured section, and was interested beyond measure in the beds of coal, with all their accompaniments, exposed in the cliffs and along the beach, the erect trees (*Sigilaria*) represented by sandstone casts,¹ and the numerous fossil plants displayed in the beds. The tide favoured my expedition, and the day was fine, though small banks of fog drifted up the bay from time to time, dissolving as they touched the cliffs, warmed by the sun. I returned in the evening to the quarrymen's shanty, thoroughly fatigued, but loaded with fossils, delighted with the knowledge I had acquired, and with my enthusiasm

¹ See "Acadian Geology": description of Cumberland coal-field.

for geology raised to a higher point than ever before. Such was my first visit to the celebrated coast-section of the Joggins, on which I have since spent so many pleasant and profitable days.

Another such expedition was my first visit to the Minas Basin. On this occasion my father, who had some business in that part of the country, took me with him. We drove in a light carriage along the north shore of the basin from Truro westward. At the Five Islands we left the highway, and continued along the beach at low tide, passing close to the base of great cliffs of volcanic agglomerate, and alighting occasionally to collect the crystalline minerals which abound in the veins and cavities of this rock. The beautiful scenery of this coast greatly impressed me, owing to its difference from the tamer shores of eastern Nova Scotia; and the complicated relations of the volcanic rocks with beds of triassic red sandstone and dark carboniferous shales, afforded intricate and novel geological studies. Our solitary drive along the wide expanse of flat shore, exposed at low tide between the dark masses of the two islands and the great cliffs of the mainland, and our scrambles around the rugged sides of Partridge Island and Cape

Sharp, with the curious and beautiful minerals we collected, are bright spots in my memories of early days; and many of the specimens then obtained are still preserved in the Peter Redpath Museum.

Another geological excursion was made about this time, in company with Mr. George Thompson, to Cape Blomidon, the most prominent and beautiful feature in this part of Nova Scotia, as well as a remarkable example of an outflow of volcanic rock over the triassic red sandstones. Practical studies of this kind undertaken by me as a novice in geology were profitable employment for vacations, and gave me some general acquaintance with the features and productions of my native province.

It was at this time that I obtained a copy of Lyell's "Elements and Principles of Geology," in this edition united in one volume. I had also read De la Beche's "Manual," and Phillips' "Elementary Geology." These works did much to give definiteness to my ideas on the subject, but I still greatly felt my deficiency in practical knowledge of rocks, minerals, and fossils, as well as in the methods of field work; and that I was, after all, as yet but an untrained amateur.

At the close of the few busy, and on the

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