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J. P. Lesley.

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PETER LESLEY

Introduction.—For more than the later fifty years of the last century, the name and work of Peter Lesley were closely bound up with the geology of Pennsylvania. He became assistant on the first Geological Survey of the State in 1839 and drew the geological map that was published in the Final Report of that Survey twenty years later; he was extensively consulted as expert in various geological problems, but particularly in connection with coal, iron and oil; he was director of the Second Geological Survey of the State and closely superintended all of its work. He undoubtedly knew more about the geology of Pennsylvania and was more widely known as representing the geological formations and resources of that State than any other man, but his knowledge ran far beyond the State boundaries.

The two admirable volumes, "Life and Letters of Peter and Susan Lesley," edited by their elder daughter, Mrs. Mary Lesley Ames, of St. Paul, Minn., and dedicated to the younger daughter and the ten grandchildren (Putnam's Sons, New York, 1909), afford unusually abundant and authentic material from which to frame the narrative of this memoir. Sketches by a number of Lesley's associates* have supplied personal estimates of his career; extracts from these latter sources are often indicated by single quotation-marks. My own knowledge of

* B. S. Lyman. Biographical sketch of J. Peter Lesley. Trans. Amer. Inst. Mining Engineers, 1903; 35 pp. and portrait.

P. Frazer. J. Peter Lesley. Amer. Geol., xxxii, 1903, 133-136.

B. Halberstadt. Obituary of J. P. Lesley. Mines and Minerals, xxiii, 1903, 556; portrait.

J. J. Stevenson. Science, N. S., xviii, 1903, 1-3.

J. J. Stevenson. Memoir of J. Peter Lesley. Bull. Geol. Soc. Amer., xv, 1904, 532-541; with bibliography.

A. Geikie. Notice of J. P. Lesley in anniversary address. Quart. Journ. Geol. Soc., lx, 1904, xlix-lv.

H. M Chance. A biographical notice of J. Peter Lesley. Proc. Amer. Phil. Soc., xlv, 1906, i-xiv.

Lesley's work for a number of years and a high admiration for it, supplemented by personal acquaintance as a junior with him and his family, have given me courage to attempt a task that could have been better done by one of my seniors. The task was undertaken directly after the completion of a memoir of Major J. W. Powell, and grew to be particularly interesting from the contrast in the materials on which the two memoirs are based, as well as from the extraordinary differences between the two personalities that they reveal. The records of Powell's work were found almost wholly in his official reports and scientific articles; no personal letters were available to disclose the more intimate side of his life. Lesley's published work has also been drawn upon as a means of indicating the nature of his studies, but his numerous and voluminous letters, published by his daughter but not necessarily in what might be in more senses than one called the "original spelling," have served as an unconsciously prepared autobiography, revealing his ambitions, moods and difficulties, his discouragements, hopes and successes; and these have been drawn upon largely in the wish to set before American geologists of today something of the remarkable character and the vast accomplishment of a man of an earlier generation, whom most workers at the present time can know only by name.

Ancestry.—Peter Lesley, the fourth of that name in direct succession, was born in Philadelphia on September 17, 1819. The first of the four Peters was a miller in Fifeshire, Scotland; the second, a carpenter or cabinet-maker who came from Aberdeenshire to Boston in the 1700's, and went thence on foot to Philadelphia, where he established his shop. The eldest son of his second wife, Catherine Ketler, of German origin, was the third Peter, born in 1792(?). He became a cabinet-maker, like his father, and married in 1816(?) Elizabeth Oswald Allen, daughter of John and Sarah Allen, of Charlestown, Mass., and later of Philadelphia, where Allen was a printer. The home of Peter (the third) and Elizabeth Lesley, on Vine Street below Sixth, was one of small means and numerous cares; into this family the fourth Peter, the third of many children but the first of eight sons, was born. Although baptized "Peter Lesley," like his forebears, our pro-

tagonist is known to the geological world as "J. P. Lesley," because about 1850 he prefixed the letter J. to indicate "junior," and abbreviated Peter, a name that he did not then like, to its initial. In later years he came to prefer his baptismal name. His varying usage might well confuse the unwary reader: the first report of the Second Geological Survey of Pennsylvania bears the name of J. P. Lesley on the title page; in the list of officers the state geologist is given as Peter Lesley, and in a sketch of survey history one of the early workers is named Peter Lesley, Jr.; but these three names all refer to one individual.

Boyhood: 1819–1834.—Young Lesley was a nervous and sensitive child, abnormally near-sighted; he considered himself homely and was timid accordingly. Many years later an old aunt told him that he had been a beautiful child, and he remarked:—"I must have been surrounded by wise people, for I grew up with the depressing conviction that I was ill-favored"; but he added:—"My life would have been made much easier for me, if somebody had told me that I was a handsome boy." He had an early liking for geography and maps and for making imaginary journeys, in which he took great pleasure. He later tells that he had practice in the use of tools, that he made toy machinery in his father's shop, and that with his brothers he was "drilled daily by his father in describing events so that they could be understood, and in drawing every kind of object in its true proportions." As his father was an accurate draftsman, drawing was fortunately taught the boy not simply as a manual exercise with a pencil, but as a means of expression; his professional work in mature years shows how frequently he made use of this valuable art and how notable a success he reached in it. In his later boyhood (1836) he wrote:—"Father, would you believe it, I really think I have received more benefit and good, wholesome learning at our breakfast meals, than in all the schooling and collegation of ten years"; and in a much later reference to early home life he says:—"I owe all that I am, and have been able to do, to the early training which I received from a very wise father and the artistic nature of my mother. * * * I am proud of my mother's family, humble, poor, virtuous, benevolent, beneficent, endowed

richly with the best faculties of the heart and head of the old New England or English stock."

Under parents of such quality, the young family was carefully nurtured. "Neither our reasoning faculties nor our imagination were allowed repose, and no mischievous or silly literature entered the house." Lesley and his brothers were sent to the best schools and were not only taught Latin and Greek, but had private lessons in French and German. It appears from the records by Peter the fourth that his father, Peter the third—the second cabinet-maker—"was a lover of the English classics, read aloud to us modern and ancient histories, and was thoroughly versed in theological controversies:" he evidently had an exceptional interest in the intelligent education of his children, and as a devout Scotch Presbyterian and an ardent church-goer, he as evidently had strict views as to religious training, for young Lesley ordinarily heard three religious services every Sunday, besides attending two sessions of Sunday school. Thus the boy learned the Bible, particularly the Old Testament, almost by heart: he devoured books and remained an active reader on many subjects all through his life; his favorite books he re-read many times. A letter written in his fifteenth year, describing a political meeting, is in thought and phrasing a superior composition. The youth showed great earnestness of feeling and fortunately formed the habit of saying what he felt; the outspoken expression of his inner thought, sincere, absorbed, unaffected, free from self-consciousness, was a marked characteristic of the man all his life. In 1835 he wrote to his father of a journey northward:—"How shall I describe midnight on the Hudson! My soul was lifted it seemed higher than ever I felt it before, towards the throne of God. Joy such as the lover of nature's pure romance alone can feel, I felt. * * * Oh, evening on the Hudson! Give it me even before the Mohawk's glorious scenes, whose western sky and rolling mists present a splendid conflagration of a world. Italia's scenes are fair (so travellers say), but give me Hudson's flood at eve of day." This, whether original or quoted, is surely a touching revelation of poetic feeling in the early years of a young man brought up as a Scotch Presbyterian in Quaker Philadelphia: yet when the

grown man, forty years later, found a package of his own early letters to his father, he tore one up, "it was so terribly soft."

First Geological Work, 1839–1841.—Young Peter went at the age of fifteen (1834) to the University of Pennsylvania, where he took high rank, gained membership in the Phi Beta Kappa, and received the bachelor's degree in arts in 1838; three years later he was given the degree of master of arts. He grew tall rapidly and his strength was uncertain. Although it had been intended that he should devote himself to the Presbyterian ministry, the fear of the bad effects of continued college study on the young man's health led his father to accept the advice of his friend, A. D. Bache, afterwards Superintendent of the Coast Survey, that the son should have a season of outdoor work on the Geological Survey of Pennsylvania, which had been established shortly before under H. D. Rogers, who was himself only twenty-eight years old when he assumed the office of director in 1836. Thus there was added to the staff, in great part hardly more than boys, still another young and inexperienced member, whose geological training really began in the field where he was given his tasks; for nothing was then more difficult than to find persons of scientific education, suitable for survey duties. So in 1839 young Lesley, before he was nineteen, began geological surveying, on which he then spent three summers. He worked for a time with Whelpley and Henderson, then was set to collecting information from collieries in the anthracite basins; in 1840 he made a topographical and geological sketch of the Siluro-Devonian belt from Harrisburg northeast to the New York State line; in 1841 he made a reconnaissance of the bituminous coal basins in the forest-covered wilderness of northwestern Pennsylvania, and then returning to the anthracite region completed a map that Whelpley had left unfinished two years before—all this before his twenty-second birthday! One of his assistants on the Second Geological Survey many years later describes this early work as "mere reconnaissance," yet he adds that when it was reviewed in the '70's it required little correction; for "the skill with which Lesley and his youthful colleagues unravelled complicated structure was little short of divination."

Lesley's letters from the field were full of descriptions of scenery; his manner of writing about the people he met in villages and on farms shows him to have been a thorough democrat. That first summer in the anthracite coal regions, the sober-minded, poetic-souled young man, then in his twentieth year, took with him Cowper and Carlyle for reading and carried along his flute for pleasure; but he was reluctant to play it before the young people of the villages where he was quartered. He rose at five o'clock, read a chapter "in the German," and prayed for grace and protection for the day, which was spent in the saddle over the hills. Before he was twenty-one, his work gained praise from his chief, who gave him credit "for the faithful and laborious manner in which he had unfolded the geology of the occasionally complicated zone of country, and for the accurate and neat map which he had constructed of its formations and topography."

Early Appalachian Study.—Lesley himself presents fifteen years later a delightful record of survey work in those earlier days:—"In Pennsylvania paleontology and detailed local stratigraphy were impossible; we were untrained in both. * * * Nothing remained to study but dynamic forms; and these so numerous, so grand, so variously grouped that they excited a perpetual enthusiasm, and led us on to infinite research. * * * They were a world of the exhibition of natural forces by itself, and as such we took possession of it and settled in it as our fathers did in the valleys themselves, and thus became * * * not geologists in the full sense of the term, but topographers, and topography became a science and was returned to Europe and presented to geology there as an American invention. The passion with which we all studied it is inconceivable, the details into which it led us were infinite" (Coal and its Topography, 1856, 123, 124). Nearly forty years after the First Survey, Lesley delights to give credit to his early fellow-workers for the first explanation of anticlinal valleys in 1837-38. Then "first appeared before the eyes of students of the science on this side the water, those symmetrical vaults and basins into which the seven-mile thick earth-coat of Old-Age Rocks [this phrase is his substitute for Paleozoic] had been pressed; to heights higher than the

Himalaya Mountains, and to depths deeper than the deepest ocean soundings. Arched roofs of Coal Measures, invisible to common eye, were now seen by the geologist's instructed vision spanning in air the interval between the crest of the Allegheny and the crest of Broad Top—mountains forty miles distant from each other. * * * Before these stupendous structures, some of which must have been six or seven miles higher than the present surface, Alps and Andes hide their diminished heads. In 1838, the erosion of the earth's surface was first clearly revealed to geologists in America in all its magnitude, and took its place as prime factor in their calculations. It was not adequately felt by European geologists until long afterwards. * * * The doctrine of vast subaerial erosion, which now plays so prominent a rôle in all discussions of the physics of the earth, and especially of dynamic and sedimentary geology, may therefore be justly called a Pennsylvanian discovery, dating from the years 1837 and 1838. * * * In 1838 this master-key thought in structural geology became the common property of the Assistants on the Pennsylvania Survey" (Second Geol. Survey Penna., Vol. A, 1876, 85, 86). But the most touching reference to this early work is found in a personal letter dated January 17, 1887:—"I commenced my dictation [of a Survey report] today, after a rest of half a week * * * and dictated with great ease the southern outcrop along the Kittatinny Mountain, describing the water gaps in succession. * * * It is intensely interesting, in spite of my long acquaintance with the subject—long enough to wear out any amount of enthusiasm. It was in 1839 (48 years ago) that I found the first block of ore in No. V. ever seen east of the Susquehanna—at Port Clinton, one fine morning while I was fighting my way through the underbrush and over the rock slides along the bank of the Little Schuylkill, at the foot of the mountain. I was as usual alone, in a forest, utterly secluded from men and men's affairs. * * * I could only see the beautiful water by my side, and the rocks over which I stumbled, the trees which thickly covered the steep mountain slope, and now and then a fleck of sky. How happy I was in those days of strength and zeal and poetry! How pure life seemed; how unending the career of mortal man!"

Theology and Geology at Princeton, 1841–1844.—Three seasons in the field seem to have strengthened young Lesley, so that at the end of the summer of 1841, when the Survey was disbanded for lack of appropriations, he began three winters of study in theology at Princeton. Some of his time there and during his vacations was given to work for Rogers on the geological map and sections of Pennsylvania: the compilation of the base was a difficult task demanding great patience and skill, for the best existing maps were full of inaccuracies and blunders, and the different parts had to be adjusted so as to humor their errors when brought together. The mountains, which had been the chief guides of the geologists, were carried over from county to county, as the best guides to the corrected representations of the minor watercourses. The county lines were forced into adjustment from both ends of the State to the Susquehanna River, where the total error accumulated; then this gross error was distributed backward east and west over the whole State. The work occupied eighteen months in 1842 and 1843.

Lesley's letters of this period show a curious mixture of the two rival 'ologies between which his interests oscillated. The more earthly one nearly gained the day in 1844, when having in his twenty-fifth year completed his course at Princeton and been licensed to preach by the Presbytery of Philadelphia, he was again offered a place on the Pennsylvania Survey by Rogers; but it was defeated by his desire for foreign travel and theological study in Germany.

A Year Abroad, 1844–1845.—Lesley proposed to cross the ocean in the steerage of a sailing vessel, so as better to prepare himself for preaching to poor parishioners later; his father persuaded him to be content with the second cabin, which he found none too comfortable; and this experience of humble travel seems to have been sufficient, for a year later he returned as first-class as possible, yet still with the unimpaired determination to follow his chosen career in the service of the poor and the ignorant. He brought back seven volumes of closely written diaries, illustrated with many sketches of scenery and architecture, for a large part of his traveling had been done on foot and to one side of beaten tracks. The diaries consti-

tute an unusually interesting record of a year abroad by an unsophisticated traveler at a time of unconventional travel.

Young Lesley stopped briefly in England and then passed a month in Paris, where he worked hard on French, but without much success; he liked the language less than the people. He saw French ways more truly than many another American, for he wrote:—"There is a show of simple-hearted affection among all classes of the French population which impresses a stranger with a very favorable idea of their domestic life." In Paris he met Elie de Beaumont, gave him a copy of the Bear Gap section in Pennsylvania, and received from him the loan of a copy of "his large and very beautiful geological map of France" for study. In early August he left Paris—a slender young fellow, a little over six feet in height, clad in a belted blouse, wearing spectacles and carrying knapsack on back and umbrella in hand—for a trip down the Seine by train and on foot. He notes all sorts of things:—"The scenery of the Seine bears much resemblance to that of the Mohawk, and from the same cause; a wide valley of denudation; excavated in a rolling country of nearly horizontal dip; and filled and flattened by diluvial and alluvial deposits"; but later, on reaching Duclair and Caudebec near the river mouth, he writes of architecture, history, and religion, and not of the superb meanders that the river has there incised. He made a point of seeking out French protestant clergymen, with some of whom he developed warm and lasting friendship. From Normandy he passed to Brittany, where he had a race with the tide across the sands from Mont St. Michel, reaching the mainland wet to the knees and exhausted; then to Auvergne, where he seems somewhat disappointed because the volcanoes are extinct and the lavas cold; "the exhibition is over," is his brief comment, as if he ought to have gone there earlier! Next south into the Pyrenees, then across the lower Rhone and past Grenoble to Geneva, where he met several noted Swiss divines.

It was at this time that he saw the Jura Mountains, which have so often been compared with the Appalachians, but never more forcibly than by the young Pennsylvanian when, fourteen years later, he recalls this part of his foreign journey: he counted himself "fortunate in being the first geologist who had

an opportunity to approach the dynamic phenomena of the Jura with an American eye, trained on this typical [Appalachian] ground. * * * The moment, therefore, one of us beheld the ranges of the Jura, with their combes and offsets, their vast escarpments, and far glittering white gaps, he felt at home among friends where geologists born among them felt that they were strangers" (Coal and its Topography, 1856, 122-124). Finally he went northward to Halle, and there for six months he studied German and theology. Geology was laid aside: the young theologian said:—"I feel an ever-increasing, ever-more continuous desire of seeking the salvation of the souls around me; yet this desire is never gratified." He found Tholuck, whose lectures seem to have attracted him to Halle, less narrow than some of his American friends, and free to declare that many things in the Bible are not true. Some of the spiritual debating within himself he wrote down; his position was staunchly conservative.

In the spring of 1845 Lesley made a short visit to Berlin, where he saw the famous theologian, Neander, and called on "little old von Buch," who was polite, but not cordial. The young Pennsylvanian was surprised to hear no mention of dynamical problems from the great German; all the talk turned on lithological comparison and paleontological identification. "When I said I thought the Jura just like the Allegheny, he looked at me a decided No; for he had but one idea—the Jura limestone does not cross the Atlantic. Rogers will wake them to new life when he comes to Europe this summer." A touch like this shows that geology was still a strong undercurrent in Lesley's thoughts; his dismay at the failure of an old master to see new light was an experience that others have shared. After another month in Halle, he embarked in a sailing vessel at Bremerhaven, May 9, and crossed the Atlantic in six weeks.

Preaching in Pennsylvania, 1845–1846.—After his return he acted for over a year, 1845-1846, as colporteur for the American Tract Society among the country folk of secluded villages and farms in the forest counties of Pennsylvania, by whose benighted condition he had been deeply touched during his survey work five years before. Lesley took this engagement with great seriousness. He wrote at divers times:—"The vastness

and importance of the work I never saw rightly until yesterday afternoon, when I felt myself suddenly crushed down by it. * * * I feel now that *for me* there is nothing but this worth living for. * * * Preaching five or six times a week is not often called for. I feel a little weak, but otherwise pretty well. Am exciting an interest in the county, and have every prospect of succeeding in getting these wealthy farmers and iron-masters to support the good work among their own hills. I love dearly to lay their duty before them and see how earnest and solemn they become. * * * I wish you could see me from day to day, how happily I find myself in the households of the good people. The only trouble is that I am too much among the rich and well educated, and therefore too well used." He was imprudent and independent enough to like some of the tracts that he had to distribute better than others, and gave them the preference, a discrimination that was disapproved by his employers. But the work proved too heavy for him, and after two seasons of constant mental excitement, bodily fatigue, and exposure, his itinerant preaching had to be given up. Fortunately a letter came in November, 1846, from Rogers, who was then living in Boston and who had an immense amount of undigested geological material on hand, which he was trying to put into shape for publication, largely at his own expense. Of this Lesley tells that his former chief "requests me to aid him in preparing to present his report to the Legislature in the spring in its final form, and offers me great facilities for study and observation, and $400 for my services for the four months." The young theologian thereupon went to Boston and thus began his association with New England, where the deepest pleasures of his later life seemed to have been found, though his tasks and duties were chiefly in Pennsylvania.

Geological Work in Boston, 1846–1847.—Could there have been a greater contrast than that between the summers, which Lesley spent preaching and distributing tracts among the uneducated country people of central Pennsylvania, and the winters following in and near Boston, where, besides working with Rogers, he met Channing, Parker, and Clarke, Emerson, Garrison, and Phillips, Agassiz, Lyell, and Guyot. Little wonder

that the young orthodox licentiate felt some astonishment and confusion of mind at what he daily saw and heard, and less wonder that his father, on learning of it, wrote: "I am very solicitous about your exposure to being drawn away from the simplicity of the Gospel in the cold Unitarian atmosphere of Boston." The son guilelessly replied: "Your fears are natural, but I trust groundless." He was seldom a good prophet, and never a poorer one than in this instance.

Lesley was precisely the right man to enjoy the Boston of that time, for it was a tolerably serious city and he was a very serious young fellow, however much he enjoyed a certain kind of fun at times. He had had a much wider and more varied experience than most young men of his age and period; he had acquired an astonishing amount of information on many subjects, and he possessed a "generous, appreciative sympathy with another's views that added such a charm to intercourse with him. His skill in conversation was wonderful, and he delighted to practice it * * * for the pleasure or profit of his companion as well as his own." He eagerly took advantage of his new opportunity. "What a strange society," he writes, "is this! Not a man, not a woman I meet, but has a distinctive character, of which I can learn something either by precept or example." After a year and a half in such company he wrote frankly to his father:—"My stay among Unitarians has changed me no doubt, but not in any way I think that your views of gospel truth or hearty piety would cause you to regret. * * * But I am changed and am still changing." His father wrote again: "I cannot divest myself of anxiety about your stay in Unitarian society." The sequel shows how fully these fears were justified; for, although during the son's change of opinions he relieved himself by calling the Unitarians some hard names, he found warm friends among them, and in later years he more openly accepted their liberal faith, though he never joined their organization.

In the meantime young Lesley was working as draftsman for Rogers, duplicating the map and sections that he had previously drawn at Princeton; and in June, 1847, he wrote home:—"The map [of Pennsylvania] * * * is surprisingly beautiful, and will receive the last stroke perhaps on Thursday

next. Two more days will be required for laying in the tints upon the one we mean to color, and then I shall be a happy man." A few days later he adds:—"I put the last stroke to the map, and turned to coloring the original, which I half accomplished, beginning with fear, but ending in delight; it excels our hopes." This is the original of the fine geological map of Pennsylvania that was printed in Edinburgh and published with the two-volume report on the Geology of Pennsylvania in 1858. While working in Boston the young draftsman felt a warm friendship and high admiration for Rogers; indeed, these feelings were maintained longer by Lesley than by most of Rogers' early assistants; but the friendship weakened afterwards when the two were again associated in geological work; and sad disappointment, with violent revulsion of feeling, was caused by the manner of publication of the survey report twelve years later, when the geological map of Pennsylvania appeared without Lesley's name upon it!

Preaching in Milton, 1848–1850.—As the work for Rogers was approaching completion, Lesley looked around him for some other occupation. Opportunity to serve as a Presbyterian minister at Williamsport, in northern Pennsylvania, had been opened to him in the spring of 1847, but he seems to have felt no disposition to return among the people to whose service he had in his earlier enthusiasm wished to devote his life; he had come to prefer a community of greater intelligence. He wrote:—"From all I can learn of it by intercourse with the orthodox brethren here, I decidedly prefer the Congregational form of government and the whole church polity of New England, and the tone of feeling and religious spirit of the country, to their counterparts with us." It was a good fortune, in view of this change of heart, which was only the prelude to a still deeper overturning, that he was invited in the late summer of 1847 to preach for a few Sabbaths in a Congregational church in Milton, a delightful village on the south of Boston, for this invitation later resulted in a call to fill the pulpit there for an indefinite time as well as in life-long acquaintance of great import: so to Milton he went early in 1848.

Life in Milton appears to have been very happy, as his neighbors were cordial and congenial and he was near enough to

Boston to enable him to continue the friendships that he had formed there. Of the Anniversary meetings in May he said:—"I attended none of them, for fear of their excitement. * * * It is a perfect Carnival of Benevolence, a sort of spiritually Bacchanalian orgie. Shawls and white cravats filled the city:" but he heard Emerson lecture, he dined with Wendell Phillips, and borrowed books from Theodore Parker; he "supped with John [M.] Forbes and discussed the new [California] gold fever, the British National debt, repudiation, Association and the theory of central heat; justice, temperance and coal mines." Whether "central heat" was theo- or geological does not appear explicitly, but "Association" was presumably that of the Congregational ministers of his county, with which he was not in harmony, although he insisted that he was as orthodox as his professors in Halle; indeed he could not at that time have been very heterodox, for at a still later date he prepared a lecture in which he referred "all ancient history back to the facts of the Noachian Deluge." But there was already much question as to his continuing to occupy the Milton pulpit: he did not like to take money for preaching, he refused to be pledged to any system, and would not conceal his views. "Here lies the whole difficulty. I do not wonder that they, some of them, feel afraid that in licensing me they encourage heresy, and in recognizing me afterwards they admit a firebrand." He was always positive in his beliefs, whatever stage he had reached in his religious progress; he was outspoken in expressing his convictions. He wrote:—"I am determined beyond all recalls, to sacrifice home and friends and name and life itself to what I believe to be the Truth, so help me God and all good angels. I have lived to learn that the fame of the world is a folly, and the comforts of life are worthless, and that nothing but Truth is worth living for, or dying for. Nor will I sacrifice an iota for any worldly consideration. * * * I have higher authority and a diviner power within me than that possessed by any human organization, however perfect. * * * I feel the strongest leaning to an open utterance of opinion, let the consequences be what they may;" and again:—"I always say what I think, at all times, on all subjects;" but his acts were not so uncompromising as his words; within the year he generously

accepted a caution from a minister for whom he preached not to touch moot points: "Of course I would not." It was perhaps as much from a half-conscious premonition of his later discontent with preaching, as from an ever-ready willingness to suffer martyrdom for the truth as he saw it, that he said:—"If I be excluded from all pulpits, I shall go to cabinet-making and serve God better there than as a time-serving Minister in a pulpit."

Engagement and Marriage, 1848-1849.—Among his friends was one Lyman, whom he had known in Halle four years before, and whom he seems now to have seen at the house of another Lyman in Milton, and whom he again met when he was in the Connecticut Valley for a short time in the summer of 1848. Regarding his stay there two items deserve mention. One is geological: he writes that the meadows of the valley "are not alluvion, made by river sediment; but are the last throw-down of the diluvial waves in their draining off, impeded by the great trap dykes thrown obliquely across the valley;" we shall later see how Lesley, when he returned to geology in Pennsylvania, again made use of the diluvial flood, and still later how he gave it up. The other item, found in a letter of August 6, is personal:—"I made some valuable friends at Northampton [Mass.]"; among them were the family of Mrs. Lyman, of whom much more is to be told. Later in the same month he wrote to his father of hearing the Phi Beta Kappa oration at Harvard, which gave him high delight. Another member of the audience was Miss Susan Inches Lyman, whom Lesley had met at her home in Northampton shortly before, where, as was afterwards confessed, they 'instantly felt * * * that they belonged to one another.' She also wrote in August:—"I enjoyed the Phi Beta unspeakably." If any historian be tempted to quote these phrases to the advantage of the orator, Dr. Bushnell of Hartford, he ought at the same time to recognize that the young writers were predisposed to enthusiasm, for their engagement was soon afterwards announced. Their daughter and biographer says that the lovers were "probably quite unconscious of each other's presence"; but the opposite hypothesis seems permissible, as Lesley knew of the oration before he became acquainted with the Lymans

in Northampton. He wrote to his father, October 9, 1848, announcing his engagement to "a very lovely woman," who "has neither health nor wealth at present," but who "is all that I can desire."

The Lyman Family.—The Lyman family with which Lesley thus became connected was indeed a notable one. The father, Joseph Lyman, son of a Northampton farmer, was born October 27, 1767. An accident in childhood was the cause of such delicate health that his parents decided to send him to college, instead of keeping him on the farm. He therefore went barefoot and in a homespun suit, to Yale College, where he graduated in 1783. After practicing law for a time in Worthington and Westfield, Mass., he returned to Northampton, where he came to be highly regarded, and as "Judge Lyman" became widely known and respected. He was 'a devoted friend, thoughtful, clear-sighted, reverent, a lover of religious liberty, a self-sacrificing philanthropist, an ardent patriot, diligent in business, a cheerful giver.' The mother of the family, Anne Jean (Robbins) Lyman, born in Milton, Mass., June 3, 1789, was a woman of rare character, who at twenty-two married, on October 30, 1811, a widower twice her age, and 'became at once his cordial companion in all his active work, the head of an already large household [five step-children], a power in the village life, a mover in social activities, and foremost in such reforms as the time demanded.' Their home was open for hospitality the year round. Mrs. Lyman's vigorous mind and remarkable character have been admirably set forth by her daughter, Mrs. Lesley, in a memoir, "Recollections of my Mother," referred to below.

The daughter, Susan, was born April 7, 1823, the fourth of five children, who were taught by their mother, among many other good precepts:—"It doesn't matter in the least what other people do to you, but it matters very much what you do to other people." Her parents had left the old church—the church of Jonathan Edwards at an earlier time—to become Unitarians, and Susan was brought up in that simple faith; this must have had much effect after her marriage in the further liberalizing of her husband. Indeed he had written her during their engagement:—"I am not only willing, but have

already begun to sacrifice my views and prejudices to smooth your way." During visits to New York in her girlhood, Susan Lyman had come to know Isaac T. Hopper, Sidney Howard Gay, Lydia Maria Child and others, whose names mean much to those familiar with the early anti-slavery movement: thus began her deep and long-continued interest in problems of poverty and distress. As a girl she was an active reader of good books in a family where reading was one of the recognized needs of life. She wrote in 1841 that her school friend, Lucretia Hale, had given her "Jemmy Lowell's poems; are not many of them perfect?" Her father died in 1847, her mother in 1867.

An incident illustrative of the simplicity of New England life at that time occurred while the Lymans, mother and daughter, were in Cambridge in 1848, on the occasion above alluded to. The daughter then wrote to a friend:—"I have enjoyed these two days highly from the fact that James Thayer and Chauncey Wright have entered Harvard, and James without a single condition. Mother is a little too happy. She spent this day in preparing his room—putting down a carpet"; for the daughter had seen her mother and her aunt set forth, arm in arm, with hammer and tacks, to fit up the freshman's quarters. Thayer was later an eminent professor in the Harvard Law School; his classmate, Wright, became a well-known mathematician, with a strong bent toward philosophy.

Peter and Susan Lesley.—It has been noted above that Susan Lyman had "neither health nor wealth" at the time of her engagement to Peter Lesley. He also was not strong and had no established means of supporting himself. Naturally, therefore, the engagement was opposed by prudently solicitous relatives and friends, but without avail. The young man, with all the confidence of inexperience, wrote to one of the remonstrants:—"It comes of the unnatural state of our social life that we consider it needful to begin married life with a provision of wealth held in reserve," and the improvident pair—he, a tall, awkward, ungainly fellow, careful and orderly in his work but impulsive in thought, brusque in manner, imaginative, witty, excitable, inclined to melancholy moods and delighting in change; she, a graceful girl, calm and beautiful, with much

social tact, patient and hopeful, unmethodical, loving a quiet life not too much broken by variety—were married, on February 13, 1849. Their engagement had lasted only three months. In spite of all proper predictions, they lived more than fifty years together in closely united happiness; for both were of deep and sincere feeling and absolutely trustful of the other, morally and intellectually honest and fearless, little mindful of material matters but caring greatly for spiritual things, full of exalted enthusiasms but without pretense, and always unselfishly devoted to good causes. Theirs was not the untried pleasure that may come from a life of assured wealth and ease and comfort, but the well-proved happiness that springs from mutual confidence and support in trials of body and mind—a happiness that was tested through years of hard work and narrow means before established position and simple competence were reached. Their life was one in which each demanded much and received much from the other, although as to which one of the two made the greater demands and which one the greater sacrifices, nothing need be said to those who know the ways of a husband devoted to his science and of a wife devoted to her husband.

A little story cheerfully told by Mrs. Lesley seven years later, when the pair were living very economically in Philadelphia, may be here introduced: "On Monday morning early [note the day of the week!] we were astonished by the sight of four gentlemen. * * * They were Professor Hall of Albany, Prof. Haldeman, Dr. Le Conte, and Dr. Henderson. They were all day in Peter's study, having great scientific sympathy and very animated conversation. At about twelve, Peter came down and said that they were all going to stay to dinner. I had been sick with a stiff neck and sore throat for three or four days, but I jumped up to calculate my resources. My woman was in the midst of her washing, and we had calculated on a very mean dinner of cold scraps. But Martha ran out and hired a cook, and bought an elegant pair of fowls; and to a confectioner's and got pies. And at two o'clock precisely came off one of the nicest of dinners, with Mary, all dressed and waiting on table, four kinds of vegetables, a bottle of sparkling Catawba and everything to match. Peter had not calculated

on anything so fine, and was all struck of a heap at the sight. * * * At five o'clock in the afternoon our friends left." But the same faithful wife also wrote, many years later:—"Do you know that on Friday, April 7th, is my birthday, and that I reach my threescore and ten years? What a happy life I have had, how blest in every way!"

Married Life in Milton, 1849–1850.—The young couple went to Milton, where they lived in the simplest manner. One said: "Our tastes click together like two clocks;" and yet how differently were they compensated! Before their marriage the young man had written to the young woman:—"You have long already discovered in me an inconstancy of feeling which may trouble you. But the changes are so rapid, that like the various impulses of the terrestrial magnetism, they practically hold the needle steady in the end. And in you I see what will be full compensation, a singular and admirable steadiness, which I know not how to praise or love enough;" and this was a true judgment. The young husband was happily right again in writing to his father soon after his marriage:—"I have a notion that in spite of all prophecies adverse thereunto, our destiny is to grow old together."

Lesley preached in his small church and was beloved by his flock; he eked out a slender salary by work of various kinds. In the winter he wrote magazine articles and lectured on such subjects as "The aboriginal settlement of Europe"—on which there must have been at that time free play for the imagination—but the supplement to his income thus secured was not large, for he tells:—"I have lectured twelve times this winter [1849-50] and it has brought me in $70." In the following summer he did odd surveying jobs for Rogers in Pennsylvania, on which he was away for weeks at a time, and in the winter of 1850-51 he gave much work to a map of Virginia, presumably for W. B. Rogers, brother of the Pennsylvania geologist. Books then and later afforded a favorite entertainment at home: Mrs. Lesley writes:—"We have been reading together a book that has delighted us much, 'Earth and Man', * * * it is by a Mr. Guyot, whom Peter has seen." Lesley wrote: "The scientific Association has been meeting all last week and this [Aug. 14, 1849] at Cambridge. Susan and I have there-

fore made our headquarters here at —— [in Medford] and I walk to Cambridge [three miles] every morning and back in the evening. The sessions have been of high interest. The walking has done me material benefit. I need more exercise than I get." His wife spent some time during an illness, later in the year, with friends in Cambridge; the husband writes that what with her being "ten miles off, beyond the city [Boston], and my sermons and lectures before Lyceums, and goings to and fro between Milton and Cambridge, and house-cleaning, furniture-seeking, and fixing up generally have made me a slave without manacles."

During all this time, Lesley had held no regularly sanctioned appointment in his Milton church. Early in 1850 the Association of Congregational ministers of his county having refused, at the instigation, it was said, of the Tract Society of Philadelphia, to ordain him, and his own church not feeling ready to take the matter into its own control, he withdrew and, followed by part of his flock, continued for a time to preach in the Town Hall. He published a statement of his position, 'but it apparently had hardly any circulation, for almost the whole edition was, he understood, bought and suppressed,' and he himself soon lost interest in the discussion. During the earlier progress of this question he had written to his future wife:—"The affair of the Association gives me no uneasiness and very little trouble, for I attend to it only when I go to town [Boston] on Mondays, and when I would not wish to study. As to its future consequences, I refuse absolutely to consider them. I have nothing to do with them." It was apparently of this affair that Lyell wrote:—"A young man of superior talent, with whom I was acquainted, who was employed as a geologist in the State survey of Pennsylvania, was desirous of becoming a minister of the Presbyterian Church. * * * He was unable to give satisfactory answers to questions respecting the plenary inspiration of Scripture, because he considered such a tenet, when applied to the first book of Genesis, inconsistent with the discoveries now universally admitted, respecting the high antiquity of the earth and the existence of living beings on the globe long anterior to man" (Second Visit to the United States, 1849, I, 218). Lesley heard of the story through

Rogers, who was then in London, and said that Lyell was quite wrong. "Who told Lyell I cannot imagine, unless it might be Sumner or G. Ticknor, and none of them knows anything about it," but there was some truth in the story.

Lesley's Hobby, "Arkism."—Mention may be made here of Lesley's lifelong hobby which he called Arkism, a curious sort of linguistic and symbolic investigation, possibly an outgrowth of his literal acceptance of the truth of the Bible acquired in boyhood during his assiduous attendance at church and Sunday school in Philadelphia. 'His view was that after the Noachian deluge, or whatever may have given rise to the myth, the Ark and its accompaniments, the mountain and the waters, became sacred objects that were made by the priests to recur symbolically in art, especially architecture, or in words, singly or variously combined, in a thousand different forms.' The pursuit of this mystical idea carried him into remote fields of ancient history and dead languages, and involved many speculations that now seem over-fanciful; but he had great pleasure in giving spare time to it and expressed himself with his usual enthusiasm and positiveness about his results. "I shall yet maintain my position," he wrote in 1849, "and prove that chess is a Druid game symbolic of the Deluge." In the following year, he said:—"For two days I have been hard at work upon two of the radicals in Medhurst's Chinese Dictionary, and have succeeded in exhuming materials by which I can finally demonstrate some very troublesome conjectures of mine upon certain things relating to the south and southwest of Asia and of Europe." Five years later:—"Did I tell you it struck me the other day that the political name Tory is a true Arkism, *Tori*, and equal to Dorian, Druid, etc.? Observe it is the mysterious name of the *High Church* party. Yesterday I was enchanted by lighting on a sentence in Harrison Ainsworth's 'St. James.' He describes the trial of Sacheverell, in Queen Anne's time, and says that the vast mob came with an 'Oak Leaf' in their hats, the distinguishing badge of the High Church party. You see how entirely this confirms my conjecture that the Tory party is the modern representative of the exclusive Arkite Clerical Aristocracy, the Druids of old." He compared his research in Arkism to that of a paleontologist, who had quarry

men collecting for him:—"This is precisely what I want so much to do in my own field. It is high time I had students or boys at work analyzing the different languages of the world. And if I can only pursue such a system ten or fifteen years, I shall attain wonderful results." Through his abundant reading Lesley had come to know so much more of Egyptian hieroglyphics, the Abyssinian calendar, the Sanscrit and other alphabets and various recondite subjects, that he could easily overwhelm any objection to his theories, and thus was in the dangerous position of having a difficult field pretty much to himself.

Return to Pennsylvania and Geology, 1851.—The spring of 1851 found Lesley once more in Pennsylvania, and as a result of his absence his little church in Milton languished and dissolved. He was set to work on private surveys under Rogers, mapping anthracite coal basins near Shamokin and Pottsville, congenial tasks into which he entered with his usual enthusiasm. "The sense of returning vigor, * * * the relief which my brain experiences, are unspeakable." He spent a day of rest and reading with an intense relish of liberty. Thus, with all his devotion to the ministry, geology came to the front; indeed, even while in Milton he had said that the facts of physical geology gave his soul its life. For part of the summer his wife was also at Pottsville, where Peter W. Shaefer, a mining engineer, the "Shaeferlein" of later years, became one of their close and lifelong friends. The season was further memorable for meeting two Swiss scientists. One was Desor, "who although born in the Jura and bred in the Alps, expressed unbounded astonishment and delight at the first fair sight he got of the erosion of our anticlinal valleys." Lesley found him most entertaining and invaluable as "company at meal times." Mrs. Lesley's remarks about him are not flattering to American geologists, for she described Desor as "entirely free from the usual vices of scientific men. He seems never to think of himself or of his own advancement, never makes any secret of his discoveries, is not afraid of other people at all; * * * we call him our sunshine." The other new friend was Lesquereux, the famous paleobotanist, a sweet and gentle spirit, who had had to give up his professorship at Stutt-

gart, where he was much honored and beloved, because of deafness, and who had come to America because Desor, who had the greatest affection and respect for him, advised that his five sons would have a better chance here than in Europe. Of Lesquereux also Mrs. Lesley writes in the light of contrast:—"He has all those lovely ways that one rarely meets with in our countrymen." Lesquereux did much work on fossil plants for the Pennsylvania survey, and Lesley later wrote an affectionate memoir of him which he read before the National Academy to the pleasure of his fellow Academicians.

The winter of 1851-52 was spent in Milton again, where Lesley and his wife always found fond relatives and warm friends; but in the following summer the beloved New England village was given up for Philadelphia. Lesley went there alone first, still loving to preach, and indeed preaching on the way at Northampton, but feeling that his work thenceforward must be in science. His relations with Rogers had by this time become strained, perhaps because they were 'temperamentally antagonistic: both were extremely nervous men, and probably suffered from the irritability common to such sensitive physiques.' Without the aid of his senior, the junior geologist found it difficult to find employment; he must have been hard put to it for a time, for in April he wrote to his wife:—"I wandered all day yesterday about the streets. * * * I sought out the objects of human woes among the crowds, stood and looked at the woe-worn apple-women, planted myself on the wharfs for an hour at a time * * * sympathizing with the seedy old gentlemen in scrimped coats. * * * A profound hopelessness and an exhaustive criticism of the instability and general unsoundness of all things blows upon me like an enervating sirocco from the deserts of No Faith." Many another has had times of despondency under like circumstances, though perhaps without Lesley's resource of being able to hold "gloominess in a very effective and wholesome check" by looking at woe-worn apple-women and seedy old gentlemen in scrimped coats. But it must be remembered that Lesley's impressionistic feelings and therefore his letters, which reflected his every mood, frequently changed their tone; he might be optimistic on one page and pessimistic on the next; but, sympa-

thizing with Emerson's opinion regarding the minds of those to whom consistency is a bugbear, he felt no need to justify either extreme, or the change from one to the other.

After some weeks' search, work was found as draftsman for the Pennsylvania Railroad at $100 a month. "I do nothing but draw, draw, draw, all day, and haven't an extra thought to throw to a dog." It is an amusing indication of the undeveloped technical education of those times, that this ex-preacher and would-be geologist was occupied in designing a railroad station, of which he said:—"I have devised a noble Egyptian front to my depot, and will have three artists work in inventing crowds of figures for the frieze to represent in stiff Egyptian style the handicraft, commerce, steam and telegraph of modern days. It's a bright thought, and worth trouble which I shall not spare. If I can induce enough taste in the men I deal with to accept my designs, I shall introduce a new style into our Architectural Art." What became of these designs is not known: drafting was fortunately soon given up for work on coal fields.

Late in the summer (1852) Mrs. Lesley joined her husband and Philadelphia then became their residence for nearly fifty years. Although she had previously said:—"I cannot help hoping that we may end our days in New England," as they did, she was ready to follow her husband faithfully, sure of being happy anywhere he might have to go, and fervently wishing for his advance, yet more in the way of heavenly treasures than of any others, for even before marriage she had told him:—"I have never believed in your having much outward success," and in this she was in large measure right: Lesley made only one business venture, a scheme for desulphurizing coal, and that failed.

Two daughters were born to Peter and Susan in Philadelphia:—Mary, their biographer, in November, 1853; Margaret, in May, 1857. Lesley's father died in March, 1855, and this prompted the son to reflections on immortality, with a hopeful faith in an existence that should laugh at limitations of space and matter. Such thoughts fired his imagination, yet he retained a critical discrimination as to the kind of immortal glory that appealed to him. "'To be glorified,' is too indefinitely

suggestive; 'to be with Christ,' is too technical and limited and hierarchical; 'to live again,' contains too large a savor of the death preliminary; 'to be among the saints and angels,' expresses much and well but not all, for the harps and trumpets are not satisfactory to all"; but it all left him grieving:—"There is no one now in the world who takes the same kind of interest in us." Evidently his theological interests were not extinct; indeed just as he had thought and written upon geology while preaching in Milton, so now he read in theology—Renan, Kuenen, Stanley—while working on coal fields: but matters of still deeper concern were found in the anti-slavery movement.

Anti-slavery Opinions, 1850.—The Fugitive Slave Law, enacted in 1850, brought forth Lesley's strongest condemnation. He wrote from Milton to his father of a "theme of real horror to many here, indeed I trust to all good people everywhere, I mean of course this new and dreadful law for returning the slaves." Soon after he said in a letter to a friend:—"I had to write a sermon against the Fugitive Slave Law last Sunday, and then had to allow it to be published in the 'Liberator,'" and later to his brother:—"We are all trembling upon the eve of an eruption, over a volcano just ready to break out. I never knew such a state of public feeling, so deep, so still, so fierce, so expectant." He returned to the subject the following year:—"I am ashamed of my American birth, and more shocked than grieved to find that in *New England*, the very sanctum and last refuge of liberty, the poor fugitive is as unsafe as elsewhere." Lesley took these matters seriously, like all others, and he was courageous and fearless in the expression of his convictions. He called three of his brothers to task for living in Delaware, a slave state, and for holding pro-slavery opinions. When he was returning from a visit to Washington through Maryland and Delaware in 1850 he wrote:—"I breathe freely now that I am (almost) off this accursed slave soil, and out of that dank and damnable atmosphere," and again, "That the world can last much longer with slavery as a protected thing is inconceivable." He seems to have been outspoken on this subject as on others, for a letter from the coal regions of Pennsylvania in 1851 said:—"I have just had a scuffle with my bottle-nosed

landlord, who swears that the country will never be safe until some of these abolitionists are swung by the neck." During a visit to Milton in 1852, he wrote to his father:—"I am no fanatic in my abolitionism; but it is my life, and goes to the extremities of all my politics and religion, as all life must." For a time the modest Milton home sheltered a fugitive slave as a housemaid: after the Lesleys moved to Philadelphia effort was made to buy the housemaid's slave-daughter from her owner in the south, and sums to them considerable were spent for this object but without success. Mrs. Lesley, having mentioned their effort to Mrs. Harriet Beecher Stowe, whom she met one summer in Cambridge, wrote to her husband that if other means do not suffice, Mrs. Stowe "has a friend in New York, who has succeeded in getting off hundreds [of fugitive slaves], and who never fails. I am almost afraid to write about it, but the great reason of his success is that he is in connection with a young slaveholder at the South, who has a perfect enthusiasm for running off slaves. He is afraid to be known as an Abolitionist, has an immense property in lands and slaves, but * * * knows that his game would be up in the South were he to avow his principles."

In view of these pronounced opinions, it was natural that, as before in Milton and Boston, where the Lesleys had been closely associated with active workers in the anti-slavery cause, so now in Philadelphia their acquaintance should be largely with liberals and radicals. Among the friends made in their new home were William H. Furness, the noted Unitarian divine, Lucretia Mott, the Quaker preacher, and Robert Collyer, the Yorkshireman who, from a Methodist and blacksmith in a village near Philadelphia, became a Unitarian minister in Chicago and New York. They met Sumner before and after he was assaulted in the Senate, and they were deeply moved by the tragic fate of John Brown. But scientific fellowship was not neglected; Lesley usually attended the annual meetings of the American Association, of which he had been a member since 1849, and in which he came to know well and to be well known by the leading naturalists of the time. In 1855 he was invited by James Hall to move to Albany and take up geological work there; the reasons that led him to decline this oppor-

tunity are not stated, but one may fairly suppose that the absence of coal from the Empire State had much to do with it.

Professional Work, its Pleasures and Pains, 1852–1856.—Lesley's eminence in his profession as coal expert was gained through years of difficulty and anxiety, and though his work gave him for a time, in the '60's and '70's, a fair competence, it never brought him large means. He was much away from home in the open season. In 1853 and 1854 he made a detailed study for the Pennsylvania Railroad of a district in western Pennsylvania; the resulting map was covered with contour lines, 'a marvel of topographical labor and skill'; it is said by Lesley's nephew, B. S. Lyman, to be the first application of contours to geological mapping. In 1855 and 1856 he undertook on his own account an elaborate survey in contours of the Broad Top coal field, in which he leveled 11,000 stations; he seems to have expected large profit from this work, but it did not come. He worked actively on these surveys, 'keeping the young chainmen on the run from seven in the morning, with a scant luncheon time, until about five. Then arriving at some log cabin to spend the night, he would fling himself on the floor, exhausted, and fall asleep' till supper time. In speaking afterwards of this period, he said he had a feeling of fatigue continuously for two years. His brother, Joseph Lesley, and his wife's nephew, B. S. Lyman, were his assistants in tasks of this kind.

Work in the forested hills of the plateau country was a joy to Lesley, except at night: he had a horror of the dark against which he strove to school himself. The strongly poetic element in his nature is revealed in a letter of 1852:—"The work is interesting, the weather fine, the scenery charming. * * * After my work was over with the party, I went along the river bank, far from any house, under a lovely alley of great trees extending for a quarter of a mile. The setting sun streamed through them, and slanting over the high bank under which I walked, struck full upon the red and yellow trees that crowd up the opposite slope and were reflected, every branch and tinted leaf, in the still mirror of the water. * * * I walked till the sun was long down, and thought with much grateful feeling how work is lightened to the laboring man. I can give

you no adequate conception of the surpassing loveliness of those scenes." He again wrote rejoicingly just after his thirty-fourth birthday:—"In such a wood as this, infinitely old, interminable and immutable as it seems, a whole world in itself of ancient and natural life, the man walks beneath its canopy, in its silence and over its floor in a perpetual reverie, in converse with the beginnings and meanings of things; not questioning, for all seems right; not doubting, for all is real; not hoping, for nothing other or new seems possible; nor fearing, for it is a world at peace, in order and evidently obedient to man's slightest wish; his will is the master, in this ancestral hall."

Letters of this period show his usual extravagance in their variety of topics; they are sometimes narrative, but often include discussions of large, universal problems. His comments illustrate in an amusing manner the reverse of the change that he had noted when going six years before from Pennsylvania to Boston:—"What is it in the difference of airs in New England and in Pennsylvania," he writes, "that makes a person radical there and conservative here? * * * One reason may be that here no topic of high morality is ever mentioned. If the traveller introduces a reforming thought, it lies down in a general silence, like a gazelle fawn dropped in the snows of Nova Zembla, and is instantly frozen to death." In speaking of thanking a friend for an essay, he said:—"I am in such a desert as to literature, that I cannot find him even a cactus flower to send." He continued his interest in language studies and wrote naïvely regarding the slang word "bully" then in vogue:—"I suppose this to be the vulgar English of *belle*, as jolly is of *jolie*. I have heard it used by many vulgar people, but especially by boys, which proves its great antiquity." His earnest democratic spirit is shown in a letter to his wife:—"When I am disposed to scoff at the half-done-up look of all things in these villages, from a dining fork to a church and its preacher, and sigh for the urbanity, arts, landscapes, ruins and associations of the old world, and lament that I am not wealthy enough to take you to England and France, to live and die—I am checked and satisfied again by the same wonder which fell upon Kossuth. Here is an embryonic world, a strong man-child of the future, born of a weak mother of the

past. * * * It is a goodly land, the best for freemen, the best for future men to live in, and I will not * * * go back into the luxurious feudalism of Europe, * * * to find a happiness unworthy of the manhood of a man whose youth was spent in young America."

He often expressed his respect for laboring men, and once exclaimed in gratitude that he was not born a gentleman; years later he said:—"I hate to make my boots shine, and would be miserable in a silk hat;" yet at times he had little patience with the present representatives of the future American freemen. While on a journey in Ohio during the presidential campaign of 1856, Lesley took his place one evening at supper in a restaurant or hotel, and soon found himself, the only anti-slavery man in the room, in an earnest discussion with his neighbors at table over the recent outrage in the Senate chamber at Washington. "They justified Brooks, or rather insulted Sumner in every sentence, and I defended him with my blood at boiling point. Roars of brutal laughter rang up and down the supper room. * * * After that for an hour I had to sit in the general room, surrounded by a loathsome crew, for whom I must confess my heart wept with the saddest pity." Some time later he wrote:—"It wearies me of existence, this ubiquitous debased democracy, without culture except from newspapers, without aspirations except for some indefinable political elevation."

"Coal and its Topography," 1856.—The most important matter of this decade, geologically considered, was the appearance in 1856 of Lesley's little book, "A Manual of Coal and its Topography," in the writing of which he had had much pleasure and satisfaction. It had been in his mind for two years, for in 1854 he had sketched its contents in a letter to a friend, when he truly exclaimed:—"In fact it is time for me to write." He said to another friend, on sending a copy of the book:—"It will no doubt be read by a good many young men and some old ones, and some men of science will find it trashy because it does not tell everything. * * * I have merely organized the subject in this edition, and reserve its development for the next, for I am self-confident enough to believe there will be a next. I hope to be allowed to issue an edition

every winter, and in a few years make it somewhat worthy of its themes;" but he was diverted from this hope by other tasks; perhaps also by learning from his publishers some years later that they still had 225 copies of the little book on hand! It has long since been out of print and is now a prized rarity. The dedication of the book is a touching tribute to two of his early fellow-workers on the Pennsylvania Survey, "now in distant parts of the world, men of infinite scope and love in science, poets by Divine right, pure-hearted, true to every duty, to whom, as master in youth and friend in middle age, the author has owed what it would be presumption to attempt in words, and American science what it has never yet had the opportunity to acknowledge." The names of these fellow-workers are here omitted, for although the second remained a constant friend to Lesley till his death, the first, even though afterwards succored in illness, forfeited the title of friend by his ungrateful behavior.

It was with a glowing enthusiasm that Lesley told in these pages of the work done by the early survey, and of the superb structures which were then deciphered. One paragraph, explaining the importance of topography in Pennsylvania, has already been quoted. Others are here cited. In the Appalachians from Pennsylvania to Tennessee "we recognize a country where, from the comparative deficiency of fossils and of coal, and from the repeated and elongated outcrops of a few valuable mineral deposits, the science of geology transforms itself into the science of topography. Nowhere else on the known earth is its counterpart for richness and definiteness of geographical detail. It is the very home of the picturesque in science as in scenery. Its landscapes on the Susquehanna, on the Juniata and Potomac are unrivalled of their kind in the world." The generalizations then formed "were so vast that to our eyes, familiar with rock curves ten and twenty miles in radius, underground or in the air, all that customary European local research which filled the proceedings of societies in lieu of new and larger matter seemed tedious and puerile. * * * Years of patient toil it cost us to unfold the mysteries of the Pennsylvanian and Virginian range—a tangled hank, to be untangled thread by thread and rearranged skein by skein—a

tracery more elaborate and intricate than Gothic or Arabesque—nature's primeval labyrinth, in which the minotaur was but a form of science cast in metal and sculptured in stone; a sphynx whose riddle has at length been read and written out by men like Henderson and Whelpley in what are now to be forever the hieroglyphics of geology. Their magnificent maps, executed under singular difficulties * * * have disappeared, but can never be forgotten."

Henderson's map of the Juniata district is described as "a *chef-d'œuvre* of geological acumen and constructive genius in field work, impossible to excel, and which, under any other organization of the Pennsylvania State Survey, would have made the name of him to whom we owe it, fifteen years ago, familiar to every scientific ear in Europe." He justly exclaims over the plunging anticlines of the Seven Mountains:—"This magnificent group of zigzags (studied out by Mr. Alex. McKinley) has probably no rival yet known upon the surface of the earth." This may seem unwarranted exaggeration to readers not acquainted with the Alleghenies of central Pennsylvania, but not so to appreciative students of that extraordinary district. Upon this point we may quote Sir Archibald Geikie, who wrote:—"Those who have travelled through the Carboniferous region of Pennsylvania, or have studied the excellent detailed maps of it which the State Surveys have published, will not wonder at the claim made by Lesley that 'topographical geology was born' in that State; nor will they fail to note how easily and irresistibly Lesley was led into that domain of geology where he became so pre-eminent a master. The contours of the surface depend so directly and clearly upon curvature and fracture of the terrestrial crust on the one hand, and upon the results of erosion on the other, that in few tracts of the earth's surface is this relationship so readily grasped, or appeals so powerfully to the imagination." (Quart. Journ. Geol. Soc., lx, 1904, xlix-lv.) Fine examples of ridges and valleys produced by the erosion of folded strata of unequal hardness have, since that earlier time, been mapped in northwestern India and in Algiers, but the landscapes of Pennsylvania are unrivalled still because of the occurrence there of three dominating sandstones in a great thickness of inter-

mediate weaker formations, the whole having been compressed into a remarkably systematic series of folds with gently pitching axes, and worn down during successive cycles of erosion into more extraordinary groups of zigzags than any others in the geologically known world.

Catastrophic Views, 1856.—Lesley's knowledge regarding the folded structure of the stratified Appalachians was minute, extensive and accurate. As to the origin of the folded structure, he doubted Rogers' explanation by huge earthquake waves, and preferred Elie de Beaumont's theory of lateral pressure. His knowledge of Appalachian topography and of the relation of form to structure was exceptionally full; but his theory regarding the demolition of the initially upfolded anticlines and the origin of the existing forms was fantastic; for he here followed Rogers' catastrophic ideas, to which he was perhaps inclined by his belief in the rapid supernatural processes that were associated with his early theological views. He maintained that Appalachian erosion had been performed by a vast ocean flood, rushing southward from the Arctic Ocean, and that the flood worked "with infinite force and speed, and ceased forever." He was very positive in the matter. For the field-worker, "the rush of an ocean over a continent * * * leads off the whole procession of his facts and is indispensable to the exercise of his sagacity at every turn." The evidence adduced in favor of this view is naturally inconclusive today:—"The crests of these mountains are more or less torn up, and notched or gaped according to their local exposure to the denuding agency; and the facts coming under this head are of themselves sufficient to prove that it could have been no other than a fluid, a vast body of water moving vehemently across the suffering edges of the strata. * * * The curved points and cones of Appalachian valleys are, therefore, so many monuments of sea currents moving over its surface while submerged, or of a deluge poured across it after it had risen into the air." The location of the Delaware wind gap, a half-depth notch in Kittatinny Mountain of northeastern Pennsylvania, "is at a shoulder where the rush of a supercontinental deluge would be at a maximum. It furnishes an unanswerable proof that no water now running made a gap;

in other words, it proves the cataclysmic origin of every mountain gorge in the land."

Soil-creep, 1856.—The attribution of so much work to a catastrophic flood was singular, in view of Lesley's clear recognition of the phenomenon now known as soil-creep, regarding which he wrote in the "Manual":—"The whole surface of all hills has been in slow but perpetual movement downward from the beginning;" he illustrated this important process by an excellent figure (p. 36) of the dragged soil on hillsides, a matter that was doubtless familiar to many of the boys who in those days collected minerals in the quarries around Philadelphia. It is now understood that the slow creep of soil has much to do with the demolition of mountains and with the development of subdued forms in the later stages of their degradation. Lesley, with his explicit text and expressive figure, was among the earliest observers to make clear statement of this process, though he is not mentioned in Götzinger's elaborate study of this simple phenomenon (Beiträge zur Entstehung der Bergrückenformen. Penck's Geogr. Abhandl., ix, 1907). Nevertheless in 1856 Lesley left little work for soil-creep to perform in his catastrophic explanation of Appalachian topography; but ten years later his views were modernized.

Lesley as a Draftsman.—The illustrations in "Coal and its Topography" are admirable. They were all carefully drawn on wood by Lesley himself, and, as he was a good draftsman, their lines express his meaning just as accurately as do the well-chosen words of his text. Many small cross-sections exhibit the close relation of structure and form which is so striking a feature of Pennsylvanian landscapes and which in 1856 was not a generally understood subject. The maps are even more valuable; they were expressively drawn in sketched contours, and brought out clearly for the first time the singular zigzag patterns of the Allegheny ridges and their dependent foothills. Lesley disliked hachures; they make "a hateful caterpillar-like topography, unnatural ranges of supposititious mountains, crawling hither and thither over the paper, not only teaching nothing, but suggesting falsehoods at every step. A few delicate contour lines would not only avoid all this, but would show what is actually known." This is too wholesale a

condemnation; it applies only to badly drawn hachures, for when hachures are well drawn they may be superior to contours in representing certain forms, such as low terraces in a sloping valley; contours, on the other hand, are superior to hachures in setting forth the long ridges of the Alleghanies; and it was in sketched contours that Lesley later prepared an admirable outline map of Pennsylvania, on which its remarkable features are strikingly shown.

Would that the above citations might lead American geologists and geographers to read Lesley's admirable little book and to carry it, along with his "Volume X" of the Second Survey, with them into the Susquehanna and Juniata districts, where they might see for themselves the marvels of structure and of form which Lesley so well describes, and which earth-students today too generally pass by for newer and less extraordinary fields! Would that visiting Europeans might at least pass through Pennsylvania by daylight with Lesley's books in hand—they could borrow them from a friend—and thus recognize the field in which great lessons were learned; better still if they would pause more than a day in the Alleghanies before too hastily pressing on to the novel West.

Personal Opinions, 1850-1863.—The same year in which "Coal and its Topography" appeared, Lesley was appointed Secretary of the Ironmasters Association, later called the American Iron Association, at a moderate salary; thus his attention was directed to ore beds and iron furnaces, as well as to coal fields and mines. He thereupon, from having previously advocated free trade on abstract principles, became heartily devoted to protecting iron on grounds of immediate practical expediency, and spent some time in Washington lobbying for a tariff bill. "I have been at it for a month," he writes, "erecting paper fortifications, tabulated bastions, formulistic curtains, newspaper articles for redoubts and covered ways, bomb proofs in the shape of private correspondence, and mines under the pamphlet lines of the enemy * * * I am pledged to protection, odd as it may seem; and all because I see that the prosperity of the country at a thousand points is half-involved in the success of innumerable furnaces, founderies, forges and rolling mills, scattered all over a dozen states, and

feeding half a million people, besides giving point and spirit to their intelligence and energy." He was called to task for this by a New England correspondent, and replied:—"The 'excellence of free trade' is a general law, including apparent exceptions, as every real current involves eddies. To offer a fictitious free trade in iron, is to ruin our iron-works, and give the English nobility a monopoly of the manufacture." The English nobility seem at no time to have inspired the regard of this ardent American!

The hard times of 1857 left Lesley for a time without work and without salary. He wrote fifty letters to secure engagements for lectures; they were all answered, and not one with encouragement; he was compelled to sell some of his few investments at a heavy loss to carry his family through the crisis. His wife made her sacrifice by taking boarders. Even in the following year it was a "hard scrabble with him to provide the bare necessities of life." He notes that he "went to see the Ravels [pantomimists]; the first quarter of a dollar I have dared spend in pleasure for a month." When he again secured field work the discomforts of travel troubled him:—"I write in a roofed desert called in America a Hotel—acres long and deep, without a comfort or a picture, or a reminiscence, in all its hundred rooms." When he stopped in the country he found the "houses are uncomfortable, roads vile, people rough but good natured, beds short and soft, bread hot and doughy, churches few and intermittent." On one occasion he casually states:—"We were obliged by a smash-up * * * to walk out five miles * * * and thereby had a chance to see a fight between a mob of negroes and three kidnappers." He was not favorably impressed with the new country on the way to St. Louis (1861):—"A wide flat desert, ornamented with occasional shanties, and not half of it yet cleared of its timber, stretches from the Beaver river in Pennsylvania to the Mississippi—a land of horror and silence to the poet and historian; a land of brutality now—what it is to be God knows, not I. * * * The utter cheerlessness and loneliness of this journey exceed all I ever experienced."

The extract already quoted about "a goodly land, the best for freemen," expresses Lesley's usual opinion about our coun-

try much better than this pessimistic view of the stretch from Ohio to Illinois, which may have been only a temporary misjudgment occasioned by personal discomfort; or perhaps it should be classed with a number of opinions that are found scattered through his letters, but not borne out by later events, for in many matters Lesley was not a prophet. Thus when his church affairs in Milton were approaching a crisis in 1848, he said, regarding certain critical difficulties:—"I have nothing to do with them. Nor do I think they will materially affect my plans;" yet the turn that the affairs soon took practically decided him to give up the ministry in Massachusetts and to take up geology in Pennsylvania. Again, in the midst of the acquaintance that he so greatly enjoyed with leaders of liberal thought in Boston, he wrote in 1848:—"Unitarianism * * * has done its work and had its day and is drying up and vanishing;" and two years later:—"I never come into close contact with Unitarians, but I am chilled and repelled:" yet he long prized the friendships of those earlier years, he occasionally preached in Unitarian churches, and a quarter century after leaving New England he saw with whole-hearted sympathy and satisfaction the vigorous growth of Unitarianism in Philadelphia; although he did not formally join that denomination, he frequently attended its religious services, and in 1884 he described himself to Dr. McCosh, president of Princeton University, as an "apostate Presbyterian." His close approach to Unitarianism may be judged by the following extract:—"What is Christianity but the enforcement of two or three ideas—that the Creator is incapable of imagining a hell—that Jesus may be imitated—that every man has as much right to all good things as I have—that the soul ought to be stronger than the body—that nothing but virtue is indispensable—that the more one loves the richer one becomes."

He wrote regarding American affairs in 1849:—"There may be a short collision between the infatuated South and the indifferent North;" and he thought with many another in 1861:—"The southern army must melt away, like snow before the sun's advance." He disliked the South while slavery lasted, but in 1871 he wrote from Norfolk:—"I love the backwardness of the South. It rests one who is weary with the

driving 'progress' of the North. So far as I can see, mankind scarcely better themselves with all their boasted railways, factories and forcing schools." After his conversion to the doctrine of protection, he said in 1857:—"Protection first, and free trade follows inevitably. * * * Let our iron works be protected five years longer, and no one will ask for a tariff;" yet he remained a protectionist all his life, and iron is still protected years after his death. During a summer in Europe, in 1863, his opinion was that "France is a *great* country; far greater than the United States. * * * And all Europe owns that France is mistress of Europe. She rules the world. * * * There is no unity possible for Germany. *Never* will Germany be a nation, Never. * * * Little Denmark pulls Germany's great nose with impunity." He compared French and German theaters: the first, "all tasty and trim, elegant diction, neat wit, courteous audience"; the second, "all dirty and crowded and gaudy, tawdry, fustian, brutal and coarse." Some years later, during the Franco-Prussian War, he wrote:—"Everybody has an instinctive belief in German veracity, probity, steadfastness and valor. * * * The French are so ignorant, illiterate, and ill-informed about the rest of Europe, that they must overrate their own strength."

The American Philosophical Society.—The American Philosophical Society in Philadelphia, founded by Franklin, and the oldest learned society in the United States, was fortunate in appointing Lesley, in 1858, at a moderate salary to the position of librarian, a post that he held with profit to the society and with much satisfaction to himself for twenty-six years. A little later he became one of its secretaries, and held this office until 1887, when he was elected a vice-president; in this position he continued for ten years and then declined re-election. As librarian he undertook to make a card catalogue of the valuable collection of books, a work in which he was later aided by his wife and his elder daughter; thus he spent many busy but tranquil hours in the quiet old rooms of the society on Independence Square. As secretary he was in charge of the society's publications for a considerable period; he contributed to them about sixty-five papers, and was a regular attendant at the meetings, where he was a frequent speaker.

The Iron Manufacturers' Guide, 1858.—As secretary to the American Iron Association, a position which he held till 1864, he published in 1858 the "Iron Manufacturers' Guide," a large octavo volume of nearly 800 pages. Brief notices of many iron works occupy one-third of the book, and a careful discussion of the geological occurrence of iron ores fills about half of the remainder. The collection of the material for the book, a task in which the author had two young assistants, required much travel over Pennsylvania and other states on visits to ore beds and iron furnaces. The most personal feature of this compendium is the preface, in which the author expressed in an outburst of unrestrained indignation his opinion of his former chief, H. D. Rogers, for the manner in which the work of the assistants of the State Survey, twenty years before, had been ignored in the final report, which after long delay was published in Edinburgh in 1858, while Rogers was professor of natural history at the University of Glasgow. There was truly much ground for indignation; for on the geological map of the state, "constructed from original surveys * * * under the superintendence of Henry D. Rogers, State geologist," the name of Lesley, who had so laboriously compiled and so carefully drawn and colored the original map ten years before, did not appear, and even in the preface to the first volume of text, where the preparation of the map is discussed at some length, Lesley is not mentioned in connection with it. But the outburst does not seem to have brought much relief. Lesley "suffered a great deal silently, about the awful business. It is no joke to be compelled to witness for the truth," and his wife "felt very uncertain about the wisdom and expedience of Peter's preface:" yet even the "sweet and gentle" Lesquereux wrote that what Lesley said was less than the truth; indeed others besides these two had found the director of the first survey a hard taskmaster, more interested in Pennsylvania and in himself than in his assistants.

It seems that a general acknowledgment of the work of his assistants in the preface to the first volume of the Final Report had satisfied Rogers, who there wrote:—"For full mention of the special parts performed by the individual members of the corps in the various successive stages of the Survey, I beg to

refer to the widely circulated Annual Reports of its progress. To attempt the precise history of the labors of each, in a field where their duties were so multifarious, would, besides being somewhat invidious, lead me into too minute and tedious a narrative." Lesley felt differently; he characterized the Final Report as "the most brilliant imposture and the most extensive scientific theft of the present age." The assistant, who had years before drawn the map, was naturally exasperated to find that "his own name has been erased from the map of Pennsylvania which he alone constructed and compiled, from the thirteen great sections across the State, the very style of which he was obliged to invent, from all the vertical sections of the coal measures which he was the first to propose and alone executed, from the hundreds of illustrations of the geology of the State which he re-drew. * * * And to add insult to injury, his name is attached * * * to the map of the Anthracite Coal region with which he had nothing whatever to do, never having seen it until it was published." But it was not only Lesley's work that was thus submerged; Whelpley, Henderson, and McKinley, on whose original field work Rogers' results were based, were like the map-draftsman named only in the preface and not at all in the text. Lesley resolved to make amends for such neglect; hence in the numerous extracts from the Final Report which were presented in the "Iron Manufacturers' Guide," "in all cases where the memory of the writer would serve him, the authority quoted was that of the geologist who did the work, invented the illustration, dared the conjecture, gave the explanation—and not that of the geologist who after the survey had been launched like a ship from the stocks would have wrecked it on every reef but for the ability of its crew, and who has, now that it is at last come into port, appropriated all the cargo."

A later Estimate of Rogers, 1876.—Rather than quote further from these violent expressions, the more temperate statements of twenty years' later may be at once introduced; for there Lesley almost returned to the high estimate of Rogers that he had earlier held. At the time of apprenticeship on the First Survey, he was only a young fellow of twenty, full of enthusiasm for his leader; he was a striving man of nearly forty

when he excitedly wrote the preface to the Iron Manufacturers' Guide; he had gained secure position and was well towards sixty when, as State Geologist of the Second Survey of Pennsylvania, his deliberate judgment was calmly stated; for he then wrote that Rogers "had always shared with his old assistants the two prime elements of a successful scientific career: love of geology as a science, and personal ambition as a geologist. In their case the first greatly predominated over the second. With him the two were more equally balanced. * * * The delay [in publication of the First Report] had indeed benefited him in this respect, that it left him to stand alone in the sunshine of this great work; for most of his assistants had dispersed to seek avocations of a different kind, and none of their contributions to * * * Appalachian geology had appeared, or now could ever appear over their own names, or redound to their credit. But for the long delay of such publication the Legislature was alone to blame. * * * Let any one read the special memoirs with which he [Rogers] closes the second volume of the Final Report, and there can be no sentiment but one of admiration for the breadth of his views, and the clearness, force and elegance of his delineations" (Second Geol. Survey Penn., Vol. A, 1876, 122, 127).

Personal Items, 1862-1863.—The period following the publication of the "Iron Manufacturers' Guide" was one of increasing professional activity, which resulted in making Lesley the most noted coal expert of his time. His competence was unquestioned and his honesty was unimpeachable; his services were constantly in demand. His work soon extended far outside of Pennsylvania. He was called to Montreal in 1862 to discuss Taconic problems with Dawson, Logan and Hunt, and while there "had a glimpse of the English nobility; it is on the whole no more attractive than the professional, the mercantile, or the mechanic worlds." He was sent to examine coal beds and iron ores all along the Appalachians, from the British provinces in the northeast to Tennessee on the southwest: he was so hard pressed with work that he said he was like a ship "carrying studding-sails in a gale, and every spar creaks." Many of his reports contained matter of scientific importance in addition to their technical details. Some of his professional studies

were published in scientific journals, his "Section of Coal Measures on the Cape Breton Coast" (Proc. Amer. Phil. Soc., ix, 1865, 93-109, 167-170) being a good example of this kind.

Small wonder that the little coterie of five or six men, who gathered in Washington in 1863 and took upon themselves the selection of the fifty incorporators of the National Academy of Sciences should have included Lesley's name in the list. His wife writes of his gratification on receiving the official invitation:—"This was a very great surprise to Peter, a thing entirely unsought and unsolicited, and gives him pleasure," but she adds:—"He says he is quite mortified at himself, that he can be so tickled with a straw." His account of the first meeting, held in New York in March, 1883, is amusing in its revelation of certain discussions regarding which, by general consent, no record was to be made in the secretary's minutes. The following summer, when Lesley was in London, he was invited to attend a dinner of the Royal Society Club, where he gave an account of the formation of our National Academy, "upon which great laughter arose" among his gracious hosts, perhaps because it seemed to them so absurd that a scientific academy should be founded in a raw wilderness: however, a member of the Royal Society came fifty years later as an invited guest when our Academy observed its semi-centennial celebration in 1913, and seemed at that time to value his election as one of our foreign associates.

In the meantime Lesley's other interests were as active as ever. Just as he had been intensely moved by the fate of John Brown, so he was alternately excited and depressed by the fluctuating struggle in the War of the Rebellion. He was still vehement in his likes and dislikes, extravagant in praise and violent in condemnation. He found restful entertainment in the theater, and greatly enjoyed the weekly gatherings of scientific and literary men in Philadelphia, first brought together by Dr. John Frazer, later by Fairman Rogers. He continued to be an active reader of many books, and he thought very seriously, in 1859, of undertaking the publication of a "half-scientific, half-literary weekly * * * devoted to geology. It seems to be wanted and must soon be had; the space is vacant and I am the man for it; it only requires energy to start it, to

make it go. I should like to devote the residue of my mortal career to establish such a magazine of science here as should last after I had gone." He was constantly drawn aside from geology by the breadth of his sympathies and interests; thus in the history of the Lehigh valley he found "superabundant materials for an admirable romance," such as he had long had in mind to write. "How beautifully a year might be spent at such a romance, which might blend the sweetest love scenes, and the wildest adventure, with the most enduring and varied religious enthusiasm." At about the same time he exclaimed:—"I long earnestly to preach in New England. * * * I would jump for joy at a fairly involuntary 'Call.'" He recognized the distraction due to his versatility and said:—"It seems to me strange that I cannot settle to one vocation like other men."

In the latter part of 1863 Lesley went to Europe to examine for the Pennsylvania Railroad the method of making rails and the then new Bessemer process of producing steel; and thus had occasion to visit many furnaces and mills as far as Austria, as well as to meet many men of science. On the steamer he met Sir Henry and Lady Holland, who entertained him in London; on hearing of this his wife was in a panic at home, fearing for his social mishaps. He noted that "the anxiety of the English to make the impression that they are quite impartial and just [regarding the North and South] shows a conscience ill at ease." He met Percy, the metallurgist, Owen, Darwin, and Hooker; Ramsay, Murchison, Selwyn, and Lyell; at the house of the latter he played "blind postman" at a boy's birthday party, and enjoyed seeing "funny old Sir Charles, with a handkerchief round his head, dancing about to catch us." On crossing to France he saw Elie de Beaumont, Verneuil, Delesse, Gaudry, and Mortillet in Paris. He visited St. Etienne and found it "as mean and dirty as Pottsville." He went to Abbeville to see Boucher de Perthes, and was as much interested in the relics of ancient man as in iron manufacture. On reaching Germany he was impressed with the contrast between French taste and German roughness. He looked up his old friends at Halle, and on passing through the Porta Westphalica, noted that the Weser "breaks through a ridge like our Sharp or Blue mountains." Returning to London in January, 1864,

he dined as chief guest with the Geological Society Club, of which Ramsay was then president, with Forbes, Murchison, Selwyn, Lyell, Bigsby, and Falconer at table.

Lowell Institute Lectures, 1865, 1866.—During the summer of 1865 and the following winter, Lesley greatly enjoyed his visits to Boston when preparing and delivering a course of lectures at the Lowell Institute. He had written seven years before regarding New England:—"I live the year round in the hope of a week there," and a few years later had described that corner of our country as "the land of energy and fidelity, the land of piety and charity, the blessing of the earth, from which streams of intelligence and high-mindedness have gone forth to make green the West." The subject of his lectures was not geological, as one might have expected it to be, but a matter of even larger interest, namely, "Man's Origin and Destiny," and he treated it as only a man of his erudition and temperament could. He was "terribly frightened" on beginning the first lecture, but "got through just within the limits of the hour, by hurrying the last three pages. * * * It was a very nice audience,—consisting chiefly of men. But there were a few women knitting." His hearers were flatteringly attentive: "you would hear a pin drop from the beginning to the end," and their quality led him to say:—"I couldn't get such an audience anywhere else in the United States," but he was vexed once when his hearers laughed at the wrong place. His lectures overran the usual number of twelve, and the course was extended by two more. Of the last lecture, he wrote:—"I gave the audience my Arkism. They were as patient as lambs under the infliction." When it was proposed by a friend that he should repeat the lectures in Philadelphia, he wrote to his wife:—"I assure you, my love, we can't get up an audience for them in Philadelphia which will hold together six nights. There was never got together in Philadelphia such an audience as I had last Wednesday evening here in Boston."

One of the pleasant features of this Boston episode was the freedom of mind that came from having but one thing to attend to; another was the great enjoyment that Lesley had from the men he met there. He did not see so much of his relatives and old neighbors, for he was in the hands of a new set. He

had a charming little breakfast with some friends, "only the people keep me talking, talking, and I can't get enough to satisfy my hunger." He describes a meeting of the American Academy at Theodore Lyman's, when five members read papers, as an uncommonly rich evening; he couldn't sleep after it and read till four in the morning. He was invited by Dr. B. A. Gould to go to a "Warren party," later known as the "Thursday Evening Club," and said that it "has impressed upon the educated merchants' class of Boston a love for * * * science, not as means, but as end, such as none of our machinery in Philadelphia is capable of stamping." He had the pleasure of dining at Shady Hill, Charles Eliot Norton's residence in Cambridge, where he walked one evening in the snow. "What a grand old place it is! What a splendid library parlor it is! * * * Soon came Dr. Palfrey, Longfellow, Gray, Lovering, Jeffries Wyman, C. [W.] Eliot, C. Wright, and somebody else who knew me very well, but I couldn't make him out. My evening was charming in every respect." He exclaims:—"What an ocean of life breaks on these rocks of Boston society! * * * It is heaven upon earth here, with nothing to do but read, and talk, and think." Everything satisfied him, when viewed under these favorable conditions:—"Such a wife! such children! such friends! * * * such a nice science to work in and for! such an age to be born in! such a Country to call one's own!"

Man's Origin and Destiny.—Just as the "Manual of Coal and its Topography" exhibited Lesley at his best as a landscape artist in the description of the ridges and valleys of Pennsylvania, so the book embodying his Lowell Institute lectures exhibits most completely his other side, as a wide reader and an adventurous thinker in all the sciences. The preface describes the book as "merely a series of familiar conversations upon the current topics of interest in the scientific world * * * a general sketch of the present bearings of science upon the vexed question of the origin and earliest history of man. * * * Views are stated, therefore, in round terms. Nothing is closely reasoned out. Much is left to the logical instinct, and more to the literary education of the reader." The lectures were originally written in the summer of 1865 at a dis-

tance from the author's notes and library; hence the paucity of references to sources; but the subject was so rich and the writer's memory was so well stored that each lecture overran its time and was read only in part, for the rules of the Lowell Institute judiciously hold the audience only an hour, however long the lecture may be. The treatment of the subject was extraordinarily free and discursive in the way of introducing instances and illustrations from an endless variety of sources, and delightfully compelling in its unhesitatingly assertive style; no wonder the audience sat entranced; and besides this, those who knew the man will understand that the lectures were delivered with an absorbed enthusiasm, sufficient to hold the attention of any audience to any theme. It may not be easy to see just how some of the freely introduced incidents bear on the problem under consideration, but they are interesting all the same, as a few examples will show. The sixth lecture on the early social life of man contains the following story:—"No race has ever yet consented to work for nothing cheerfully. All the sense of justice man has comes from resistance to that attempt. If the reconstruction of Southern society is to be a success, it can be so only on condition that the white man share the soil, the shop, the schoolroom and the forum with the black. * * * To show you how delicate a test of justice work can be, I will tell you a story, which a friend of mine, an engineer upon a Southern railroad, told to me. A railroad was projected through the swamp-lands of Florida. Slaves were hired from the planters of Georgia to do the work. A day's task for every man was measured with a ten-foot pole. The slaves rose early and by working diligently could complete their tale of work by two or three o'clock, and have the rest of the day for their amusement. * * * The avaricious contractors made new poles, 13 inches instead of 12 to the foot. The day's task was unaccountably lengthened by an hour or more. The blacks could offer no explanation, and made no resistance, for the work was still within the range of cheerful diligence. Another month passed by and a third set of poles were distributed. The foot had now become 14 inches long, and the day's task lasted until sunset. The defrauded labourers, seeing that there was no use struggling with an

unjust despotism, returned to planation-habits, shirked all the work they could, lost heart, and fell back into that barbarism, the essence of which consists in giving up the soul a prey to the forces of nature."

Similarly the eighth lecture, on the origin of architecture, tells of a visit to the roof of the Sainte Chapelle in Paris in company with the architect in charge of its restoration:—"I occupied myself with the bits of carving which surround the pinnacles of the buttresses, and which are entirely invisible to persons in the street—hundreds of leaves and flowers, and delicate morsels of fretwork, which no eye had seen for centuries, even since the stone-cutters had hoisted the blocks unchiselled to their places, and yet as nicely wrought as if they were intended for the doorway of the porch. And I could not help asking myself the question, When will our architects get such a conscience as those old masons had? And I wondered also when the time would come for a public taste impatient of our meretricious sham shop-fronts on Chestnut-street or Broadway, showing their ragged edges and unfinished cornice-ends, and soft brick side walls, up and down the street as shamelessly as harlots in the evening flaunt their tawdry." But the body of the discourses is made up of scientific matter, on such subjects as the anatomy of apes and of man, the conditions of primitive life revealed by the Swiss lake dwellings, the lessons of Egyptian architecture, the origin of the alphabet, and the structure of language.

The lectures were published (1868, 2d ed., 1881) and found to be suggestive and stimulating by many readers: Lesley's own comment upon them is judicious:—"It is very encouraging, I confess, to get *hearty* commendations from competent judges; and yet I can't help entertaining and acting upon the conviction that no one is so good a judge of one's mistakes and one's leanness as one's own self. I am extremely dissatisfied with these performances. They treat the subjects concerned with an appearance of profundity, but real superficiality. They are the result of years of reading and reflection; yet are after all mere outline sketches."

Lesley as a Philologist.—One reason for Lesley's unusual breadth of information as shown in his lectures was his ac-

quaintance with many languages. He had already as a boy made a beginning with four languages—Latin, Greek, French and German. He tells, in 1889, that he found a fresh world for study in comparative philology while he was at Princeton nearly fifty years earlier: "How I dashed at Arabic, Armenian, Coptic, Persian, Sanskrit, as if I were at a football play! Then I went back to Greek and Latin with wide-opened eyes. When I had German as a vernacular I played with Danish, Swedish, Icelandic. * * * I devoured Welsh, Erse and Gaelic. * * * I spent months over the Basque and Zingari; got Hindu and Tamil lexicons and New Testaments. * * * I made comparative lexicons of the Polynesian dialects. I * * * plunged neck-deep into the Mandarin dialect, and then compared the Corean, Japanese and Malay. All this brought me back to my Hebrew studies, until at last I found myself like an ass tethered comfortably and permanently between the haystacks of Hebrew and Egyptian, where I have peaceably and pleasantly been munching and munching ever since." How far his etymological comparisons were safely grounded may be left to the determination of other philologists; but there can be no question that his conversational accounts of the derivation of words, as well as his lectures on this difficult subject, were fascinatingly interesting to many hearers.

"Five Types of Earth Surface," 1866.—It was during the period of Lesley's most active professional engagements on practical problems that he paused long enough to write, in explanation of some work that he had done, an article the scientific importance of which has not been generally enough recognized. He had attempted, as a result of a study prompted by T. E. Blackwell, managing director of the Grand Trunk Railway in Canada, to make a map of the "whole country" on which topographic form would be interpreted by its relation to geological structure; and he selected for publication a section of the map stretching from Cincinnati in its northwest corner southeastward beyond Raleigh, N. C., the accompanying article being entitled:—"Notes on a map intended to illustrate five types of earth-surface in the United States, between Cincinnati and the Atlantic seaboard" (Trans. Amer. Phil. Soc., xiii, 1866, 305-312).

The article is not only of value topographically, but it is of special interest because it was here that Lesley frankly announced his abandonment of the catastrophic theory of erosion. In describing his original map, he said its charm "lay in its unmistakable utterances respecting different topographical types of earth-surface or strongly contrasted systems of erosion, lying in masses, side by side, or running for long distances in parallel belts." He called especial attention to "the great Cumberland-Allegheny-Catskill plateau, with its horizontal geology and its quaquaversal, arborescent drainage-system, boldly contrasting with the Appalachian topography in front of it" as "settling the questions of mode and agency in favor of slow subaerial denudation. * * * The old cataclysmic doctrines cannot be upheld in the light of our present geological knowledge. Erosion by wind and rain, sunshine and frost, slow chemical solution, and spring and fall freshets, has done the whole work. * * *. I must now abandon wholly the idea to which I clung, with slowly relaxing grasp, so many years, that a complete erosion theory demanded some such forces as would have been supplied by the extra efficiency of an ocean translated across the upheaved surface through the air." Thus Lesley became a uniformitarian. It may be here noted that when Powell's report on the "Colorado River of the West" appeared about ten years later, a visitor, seeing it on Lesley's table, asked how Powell's ideas on erosion affected the problem of Appalachian topography; to which the author of "Coal and its Topography" replied:—"I used to think I knew all about erosion; but I was all wrong; didn't know anything about it at all." It is interesting to add that, as a dweller on the margin of the glaciated area, Lesley naturally concluded that "ice had no hand in Appalachian erosion. All it has done has been done in the north, and its only action was to polish a surface already made."

The published map of the "five types" showed "what we have a right to expect when the United States, at peace once more among themselves, and free from the curse of slavery, thank God, shall take up in earnest the work of studying and expressing to the eye the character of the countries which they possess in common." It is singular, in view of this opinion,

that Lesley did not give more attention, when he became director of the Second Geological Survey of Pennsylvania, eight years later, to securing a good topographical base for his county maps; but he had at least, in his later years, the pleasure of seeing a beginning of the realization, in the topographical maps of the United States Geological Survey, of what he had said we had a right to expect; just as Loomis had at a somewhat earlier time the satisfaction of seeing in the tri-daily weather maps of the "Signal Service"—now the Weather Bureau—the actual attainment of what he had hoped for as a dream some twenty years before.

Two Years Abroad.—Whether from Boston excitement or from Philadelphia overwork, Lesley fell ill in the spring of 1866, and in the autumn of that year went abroad with his wife for a long absence, until May, 1868. Mrs. Lesley spent the first winter in Paris, while Lesley traveled in Spain and Italy. His letters reveal a whirl of changing thoughts, with abundant superlatives, and more attention to history, art and architecture than to geology, thus disclosing a side of his nature worth recording. Between Genoa and Leghorn he enjoyed meeting a mixed lot of commercial travelers, regarding whom his pen seems to have taken the ink into its own nibs and let it run away, for he says his companions were "the best company in the world, educated, polite, polished, witty, full of fun, knowing everything, yet not pretentious nor obtrusive, and evidently honest and high-minded. * * * Any one of them is worth twenty times his weight in English 'gentlemen,' and a hundredfold his weight in English 'officers', who are brutal, ignorant, conceited, afraid of everybody and dissatisfied with everything, unable to protect themselves and ready to bully the world."

In Florence he recalls the centuries of violence and fraud in the Middle Ages; in Rome, he would rather have built the baths of Caracalla than St. Peters, and says that if he had come as far as Rome in 1845, no power on earth would have prevailed to prevent him from becoming a sculptor—instead of a colporteur. He is surprised that Rome does not awaken a single Christian sentiment in his soul, and thinks, as others have, that it is because the sights there are so essentially pagan. In Naples he pities the "sweltering mass of human beings,

packed into narrower, darker, filthier quarters than in any city this side of Edinburgh, * * * how blessed is our lot across the water!" At Sorrento, he relaxes completely and becomes "utterly indifferent * * * to all the ordinary topics of physical inquiry." He wrote:—"I live in this sensuous absorption of the visible. * * * As for causes and methods of production, I feel no interest in them any more. I know that these rocks are Oolite—but they might just as well be Silurian, for all I care. I see that anticlinals cross the peninsula [a daring generalization], * * * but I feel no desire to make a study of its topography." This is not a revulsion of feeling due to illness, but holiday exuberance caused by convalescence and recovery, for in a letter to his wife, who was spending the winter alone in Pau amid somewhat uncongenial surroundings, he exclaims:—"I feel so well when I get up! I eat such huge breakfasts! I am ready for anything! And I am so funny all the time!! I keep the breakfast and dinner table in a roar. I am so excessively witty!!! I say so many hundreds of good things! You wouldn't know your stupid old Peter." In Venice, he explains his theory that the name comes "not from the Veneti, but from Venus; and that the Doge's palace represents an ark floating upon the water, the waves of which are symbolized in its arches;" in Milan, he spends hours in the Cathedral, where he says of the vast number of piers, "the Allegheny forest is not more imposing." Unhappily the benefit of the Italian winter did not last; he fell ill again on the way northward, and reached France in the spring little better than when he had gone south the autumn before.

He passed some uncomfortable months in Paris as Commissioner to the Exposition of 1867, and then went to Switzerland, where Mrs. Lesley spent the summer at Vevey more pleasantly than the previous winter at Pau, while Lesley roamed about. One of the most notable events of this period was his visit to Combe Varin in the Jura to see Desor, for whom he felt a strong affection. He writes that on his way there, in July, 1867, "I addressed in French a young man, to know if he could put me upon the foot-path up the cliffs. * * * In honest American English he replied—'Why I know you; you are Professor Lesley.' 'And you,' I asked. 'I am Mr. Shaler, of

Cambridge. I am studying the Jura.' 'Come up with me then, to see Desor,' I said. 'I will,' he replied; 'Agassiz told me I must see Desor.'" Shaler was with a young English geologist who knew the Jura strata and their fossils, and all three went up the cliff together. "What a charming time we had! I became a humble scholar, and they taught me Velangian and Neocomian * * * and gave me fossils, which my old bleared eyes [he was then 48] could no longer detect." On reaching Desor's chalet, hid behind a little ridge and commanding a glorious mountain basin, they had jolly times. The approach was through an avenue bordered with tall trees, on which the names of many distinguished visitors were carved. Lesley's tree had quivering leaves, which seemed 'appropriate to his sensitive and alert nature.' A class of young men came for a lesson. Desor "expounded the distinction between *vallon* and *vallée, cluse* and *combe*, showed the order of the rocks, * * * and the structure of the region."

In the autumn of 1867 a delightful opportunity was opened by an invitation from Miss Lucretia Hale of Boston, an intimate schoolday friend of Mrs. Lesley, and her brother, Charles, who was on his way to Cairo as American Consul General, to spend the winter with them in Egypt and make a month's trip up the Nile in one of the Viceroy's steam yachts. The party crossed from Marseilles to Alexandria by steamer, where among the passengers was Mariette Bey, whose works in Egypt Lesley had carefully studied; Daniele Camboni, an apostolic missionary to central Africa, who knew all the great African travelers; and also a traveler with whom Lesley had many walks and talks on deck, "a man of quiet, gentle mien, but a clear eye and determined aspect, rather small and slight of build, poorly dressed, but a perfect gentleman. In the last days of the voyage he assumed a red shirt, a Kossuth hat, * * * his name was Rolfe. * * * He had been in all *nine* years in Africa. * * * Now he is on his way to join the new British Expedition to Abyssinia." Rolfe's high estimate of the negro races was a surprise to Lesley, but on arriving in Egypt the estimate was better understood. In Cairo he was grieved on seeing the oppression of the native Egyptians by the Turks. He discovered everywhere the original pattern of many of the

most characteristic parts of Gothic architecture, the transfer of which to Europe he ascribed to the "hundreds of thousands of priests, poets, artists, architects and noblemen" among the Crusaders, who imitated and improved on what they had seen in the Orient, when they returned to their western homes.

On the Nile the party met Mr. James Lawrence and his family, the Lawrence who that same year had generously provided means for Alexander Agassiz to visit Europe when he was making his famous "Revision of the Echini." Mrs. Lesley's journal of this excursion is illustrated with sketches by her friend, Miss Hale, in a style familiar to the memory of some now mature Americans from their early reading of the "Peterkin Papers," of which Miss Hale was author and artist, and in which Mrs. Lesley figures as the wise "Lady from Philadelphia." Some Europeans long resident in Egypt would not approve the behavior of the Hale-Lesley party, inasmuch as the lady members remained present at native receptions, in which the chief entertainment was provided by dancing girls, whose performance began "just as soon as Mr. Hogg, the missionary, had disappeared," and whose "motions it is impossible to describe." The Lesleys were interested to learn that it was "at Karnak, on the roof overlooking this strange country, that the elder John Lowell made the codicil to his will, in which he left the fund establishing the Lowell lectures." Lesley must have been in his element among ancient Egyptian monuments and hieroglyphics, but he seems to have been resting and left letter writing mostly to his wife.

The return from this most enjoyable journey was made rapidly through Italy and France to England, where April, 1868, was spent. At Oxford they saw Phillips; from Salisbury they visited Stonehenge, and there Mrs. Lesley, with more discrimination than her husband had shown in his letter from the Genoa-Leghorn sea trip, wrote:—"Nothing can exceed the politeness of all these literary and scientific English gentlemen. They are full of enthusiasm, as communicative as can be, and we have yet to see the first instance of what is called English coldness."

More Personal Items, 1868–1870.—The summer of 1868 was spent quietly in New England; the following winter in Phila-

delphia, where in 1869 the family moved to 1008 Clinton street, which was then their home for twenty-five years. Work was taken up slowly; at first as librarian and secretary of the American Philosophical Society, but during the summer in New England Lesley avowed "a strong desire to take up the topography of the Connecticut Valley, from Northampton northward, as a job of pure science for one, two or three summer seasons." A very little reading in geology was too much, so he kept to novels, newspapers and hieroglyphics. He wrote a dedication hymn for a new church in Keene, N. H., with Emersonian preference for pertinent meaning over purity of rhyme; surely "enough" and "love," or "porch" and "couch" go as well together as "squirrel" and "quarrel." He was asked to deliver an oration at the Humboldt Centennial at Philadelphia in September, 1869, but declined, and Louis Agassiz was chosen instead. The recreation of an afternoon game of billiards at the Union League Club began at this time, and was continued a regular habit for many years. Lesley declined a call to Cornell University as professor of geology, in 1868, because he dreaded entering into "new and perhaps awkward relations, with incessant daily work, great responsibility and competition with younger and better trained teachers. I should teach without having been trained to teach, make my illustrations when I ought to be asleep, read late at night, under anxieties about the next day's lecture, be called upon to visit and receive visits frequently, have my sympathies drained by young people, and get no holiday in the year, except during a month or two of the hottest weather." He enjoyed being master of his own time, "with no necessity for more than two or three geological excursions through the entire year," yet the following winter (January, 1869), apropos of some lectures in Baltimore which he described as "too pragmatic ever to be popular," he wrote:—"I was made for a teacher. * * * I should like to lecture an hour a day regularly, for a semester, to a class of honest, earnest, young students," and a few years later he gratified this wish, as well as the authorities of the University of Pennsylvania, by accepting a professorship there, whereupon he seems to have done with pleasure many of the things that he declined to venture upon at Cornell.

In 1869 he took the position of editor of a weekly folio, the U. S. Railroad and Mining Register, which he held for four years and in which he seems to have freely indulged his discursive inclinations: indeed his manner of conducting this task, which interested him intensely, must have sometimes astonished as well as instructed the business men whose interests the Register was supposed to serve, for his articles are described by a competent critic as "fresh, breezy, cheery, clear-cut, picturesquely flower-bestrewn, spicy, authoritative, editorial comments on railroad, mining, surveying, geological, scientific, philosophical, theological, political, politico-economical, American or European subjects of the day; in short, on things of every kind, and some others." Evidently it would be a curious world if we were all Lesleys, and a dull one if none of us ever had his extravagances and enthusiasms. It was apparently one of these articles, in which the Coast Survey was the theme, that called forth from Benjamin Pierce, then Superintendent, "a letter of overflowing thanks."

For a time after the long absence in Europe, Lesley did not undertake field-work; it was a year before he again entered upon the professional duties of a geological expert; even then it taxed his strength heavily. In July, 1869, he said:—"I wrote a whole report, and drew a map yesterday morning, and got a hundred dollars for it today. But it knocked me up a little." His correspondence grew to be large and varied; offers of large salaries were made for work that he was unable to accept, even though long experience had given him the power to see quickly and execute rapidly. In the summer of 1869 he was asked by "Tom Scott" of the Pennsylvania Railroad if he would entertain a proposition to go with a party to examine a million or two acres of coal, iron, gold and silver, in the Raton Pass country, Colorado, one week out, three weeks there, one week back; but he feared to undertake it. "It would be steady railroad to the west line of Kansas, two days' stage then southwest to Raton Pass. Camp life. Soldiers' escort. Horseback exercise all the time," and he wisely declined this too large opportunity.

In the early '70's Lesley made a number of visits to Virginia, Tennessee and North Carolina, and partly overcame his

earlier dislike of the Southern States. "I love the backwardness of the South. It rests one who is weary with the driving 'progress' of the North. * * * To plunge into the 'long-leaf pine belt,' as I shall tomorrow, is like taking a dip into the sea of the past." Yet he found the country desolate:—"Swamp, prairie, forest, log huts, negro shanties, here and there at long intervals an impoverished farmhouse * * * the landscape * * * flat, and vast, and worthless as its history. * * * The climate is superb. The people might be a mighty race." The hilly country of East Tennessee was more enjoyed. His host there met him with "two good saddle horses. * * * The Nolichuckee flows between fertile bottoms, at the foot of precipitous mountain walls. * * * The exceeding rare beauty of this scene cannot be described." His letters to his wife contain, at this time, occasional outbursts of satisfaction and pleasure over his own work;—"Congratulate me. I have accomplished one of the prettiest maps you ever saw, and did it all since breakfast today. It is now five P. M., and I am not at all tired. It is an Indian ink bird's-eye view of the valley of the Castleman's river, with all the coal and limestone beds running around the hill slopes. It is a beauty. I didn't know I was such a genuine artist. And I work more rapidly than I ever did in my life. Tomorrow I shall write my report, and get the whole affair off my hands and mind." It is gratifying to know that he recognized the excellence of his work and thus expressed his appreciation of it in private, though we may be sure he would have never done so in public.

A Characteristic Incident.—An incident of which Lesley told his wife and which she described to her younger daughter is so characteristic of the man that it deserves statement in full:—During one of his field surveys (1873) he spent the night in the hotel of an interior town:—"After tea, the bar-room looked comfortless, so he wandered up the street to see what he could see. At last he came to a lighted hall, and he walked in, and found about 30 young men seated on benches, but all very silent. He asked what the meeting was, and they told him it was the Young Men's Christian Association. He waited awhile, and no one spoke, so he rose and told them he was a stranger there, and not a *young* man, and perhaps he had no

right to speak in their meeting, but he should like to very much. Several said, 'Oh, yes, do.' So he preached to them for a whole hour, without a pause. He gave them the history of the associations that existed before the time of Christ, and those that had existed since; the objects and aims that had animated them, the causes of their rise, and their successes, the reasons why they had ever failed. And he ended with an affectionate exhortation to them to work for the salvation of other souls, rather than their own. Then he quietly left the hall. But they followed him in a body, thanked him in the most heartfelt way, begged to know his name and occupation, and what church he belonged to, and grieved that he would be going off in the early morning train. The minister insisted on his going home with him, and talked till midnight, parting from him in the most cordial and heartfelt way. He said the whole time was most interesting and carried him back to his old Colporteur days."

Many another geologist has found the bar-room of a village hotel comfortless, not to say repulsive; but how few have gone from it to preach for an hour, to the satisfaction of a village audience, on the history of religious associations through the last two thousand years.

A few years later a similar episode occurred, this time in the oil region, to be recorded by Lesley himself. When it was known that there was to be a lecture, "men and women flocked from all quarters and I was introduced * * * to three hundred of every age, sex, and condition, as 'Mr. Lesley, who would lecture on Geology.' Of course I couldn't. It was absurd. * * * But I talked for an hour; told them stories of the Challenger, and fish teeth in birds' bills; gave them a commentary of the Psalm, 'The heavens declare'; told them what rules my father taught me when a boy, to live by; described the Christian geologist as a 'barrel of oil'; passed an eulogium on science and solitude; and in a word held men, women and children in silent attention the whole hour, and received a vote of thanks at the close." This was before the days of moving pictures; it might be taken as a scientific precursor of the modern vaudeville.

Theoretical Views in Professional Reports.—Lesley's active

interest in theoretical geology as well as his discursive habit in writing naturally led him to include many discussions of a very hypothetical nature in his professional reports on coal and iron properties, a collection of which was bound together for private distribution in 1874. One of these reports is on the brown hematite iron-ore banks of Nittany Valley, near its crossing by the Juniata River at Tyrone, in central Pennsylvania, and is illustrated by a characteristic map in shaded 20-foot contours of Lesley's own drawing from Platt's field-work. It contains also two sections northward across the valley as far as Bald Eagle Mountain, which consists of vertical "No. IV" (Medina sandstone), along the southern base of which a great fault is shown, with the Lower Silurian limestone strata of the valley riding up over the younger vertical strata at an angle of 54°. A diagram section follows, in which a graphic construction, made on the basis of the observed dips of the less inclined strata north of the mountain, "results in giving a slope of 50° to 54° to the bassett edges of the broken mass" (north of the fault); and from this the conclusion is drawn that "it is evident that the upslide of the other [southern] section of the broken mass has conformed to this slope, and that the uniform dip of 54° observable for miles along the * * * foot of Bald Eagle Mountain * * * is perfectly explained by the diagram. This is the first time, I believe," Lesley remarks, "a solution of this difficult problem in structural geology has been reached; and its bearing upon similar phenomena attending upthrow-faults and broken anticlinals in other regions will be noticed by geologists. The theoretical deductions from this solution are important. It proves that the original fault was in a vertical plain, and not on a slant. It proves that the lower Silurian limestone mass has ridden upon this slope to a considerable height, probably several miles, in the air above the present surface. It illustrates the great erosion of the country, amounting to thousands of cubic miles of earth crust. * * *"

This extract may be regarded not only as an example of Lesley's method of work, but as an example of a method of work that was characteristic of the earlier generation of self-taught American geologists and that is today very generally replaced by a more rigorously logical method. It warrants the

characterization that in temperament Lesley 'was strongly poetic and artistic, often thinking, reasoning and talking as a poet and seeing as an artist; embellishing with poetic imagery the vigorous originality of his writings and accenting with artistic touches the individuality which marks the maps and sketches with which he profusely illustrated his reports.' Lesley's graphic construction is full of patent assumptions for which it would be difficult to find justification; but they seemed reasonable to him, so he adopted them without further inquiry. The first one of his "theoretical deductions" is not obligatory unless various alternative constructions, which do not seem to have been considered, are left out of account; thus confident assertion replaces demonstration. The case is similar to one in which Lesley, when discussing with some friends the geology of a difficult region, full of complicated problems that he had hardly studied at all in the field, exclaimed with enthusiasm:—"Paleozoic strata once stretched all over New England. I'll believe that," he added, striking the table beside him with his fist, "till I die." The entrance of so much vehement opinion into geological exposition during those earlier years naturally led to many personalities in discussion; temporary tenacity of opinion sometimes made the meetings of "Section E" of the American Association more exciting than edifying. The modern meetings of the Geological Society of America are tame in comparison; indeed, many papers now presented there are so carefully and objectively prepared that discussion is discouraged; for when distinction is made between what geologists call certainties and what even geologists recognize as doubts, there is little ground for diversity of opinion.

The deficiency of the older method was not because logic was not then studied, but because it was studied in too formal and abstract a manner, and by students who were too young to carry it into application. Hence an investigator could then adopt as a verity any pleasing hypothetical explanation that he invented, without demanding that it should do more than explain the things that it was made to explain, and without searching for alternative explanations. Today formal logic is probably less studied than it was then, but geology as well as science in general is better taught; indeed, it is sometimes taught so well

in the more advanced courses that many principles of logic may, to the student's great advantage, be there learned inductively; and as a result vehemence of assertion and tenacity of partizanship are now very generally replaced in scientific meetings and writings by calm and well-balanced exposition, at the close of which the conclusion does not need to be held up, as if gripped in the clenched hand, but rests as if on the open palm, without need of protection, safe in its own stability. Thus geology has advanced in discipline as well as in content; but it must not be forgotten that the advance has been made by successive approaches closer and closer to the truth, and that among those who have contributed immensely to the advance was the vehement Pennsylvanian who so easily demonstrated that a fault-plane, which he "proved" by a series of convenient assumptions to stand now at an angle of 50°, was vertical when it was originally formed.

The University of Pennsylvania, 1872-1883.—Lesley's service as Professor in the University of Pennsylvania was an episode that gave him much pleasure. He had been nominally Professor of Mining there since 1859, but in 1872, when the University moved from its old buildings in the heart of Philadelphia into larger quarters beyond the Schuylkill, in the western part of the city, larger responsibility was placed upon him; he became Professor of Geology and Mining, and not long afterward (1875) was appointed Dean of the new Towne Scientific School, positions that he held eight years. He plunged at once into the work of teaching and of organization, and made hurried visits (1872) to New York and Boston to get ideas regarding equipment. He loved to impart knowledge and held the attention of his hearers by his whole-hearted enthusiasm and his unconscious absorption in his subject, rather than by authority or disciplinary devices. His generous disposition made him think well of his students, "all of them so bright and interested;" and they must have been amused at his peculiarities and extravagances; but they recognized his perfect candor and fairness, as well as his immense learning and his unselfish devotion to his work, and they respected him. He had his schemes at the beginning, of course:—for example, "I shall make my boys report my lectures and print them in facsimile to

spur them on;" but it does not appear that he exacted so heavy a labor. His real success must have come more from the revelations of his enthusiastic and affectionate personality than from systematic teaching.

On one occasion he wrote:—"I greatly enjoyed my lectures to the Sophomores today, on the contrast between God's immutability and the infinite variety of change in the geologic history of the earth; they sat like one great eye and ear, for an hour;" and again:—"I had a lovely hour with a select ten of my Seniors this morning, over the history of the geology of New Hampshire; and I told them anecdotes of Charles T. Jackson, Josiah D. Whitney, the Braintree trilobite, etc., and gave them lots of moral advice against impatience, envy and all uncharitableness; and their fine unspoiled young faces beamed intelligent sympathy with all I said. * * * A few such opportunities sanctify a term, and pay for all the fatigues and anxieties of a course of lectures." And once more:—"I got another chance this morning to urge my Seniors to be thinkers, and not 'scientists' (and here this odious word comes pat),—gentlemen to boot—in fine, Christians. * * * It was on the occasion of my definition of the geological structure of Southern Virginia, after I had shown them in colors the difference between 'rich' and 'poor' valleys; in those, wealth and slavery, in these poverty, freedom, love of the Union." Human geology of that sort always holds students' attention better than the most learned lists of formations or of fossils; but human geology can be taught only after experience of humanity and by a man of sympathetic learning. Beginners in a science, few of whom are likely to follow it far, do not care for it in the concentrated form which pleases the devotee; and they care less for a systematic than for a discursive presentation, which Lesley could give to perfection. Lesley's wife wrote that her husband had "literally to drive the students away when hours are over, and now they are clamoring to work afternoons. He stood lecturing yesterday four consecutive hours, without a moment's let up, and strained his lungs so that he could not speak aloud all the evening. Peter says his boys are all angels, * * * but I know better. * * * He isn't reliable." Curiously enough, this experience in pre-

senting the principles of geology to young students did not confirm Lesley's belief in evolution. He had at first been inclined to accept Darwin's ideas, when they were fighting their way in the sixties; but twenty years later, when evolution was established, he turned against it, and would sometimes express complete disapproval of it.

Proof-reading, 1872.—During part of this professional period, Lesley still acted as librarian and secretary of the American Philosophical Society and as editor of the Railroad and Mining Register. As no sufficient aid was provided him by the Society, he had much drudgery in way of proof-reading for the Proceedings; indeed, the early habit of doing his own work later prevented his utilizing assistants as fully as he should have done. No wonder that he wrote in 1872:—"I am as busy as a bee, writing and reading for my *R. R. Register,* and my future lectures. I am very ignorant in Paleontology, and am coaching up out of Pictet. I am also publishing my survey of S. W. Virginia, with a map, and 20 wood-cuts. All the first edition of our No. 88 Proceedings of the American Philosophical Society was burnt up * * * and I have had to get out a second edition. Proof-reading of genera and species of fossils is *der Teufel.* But proof-reading Mr. Price's metaphysics is worse, for want of interest; and proof-reading of Chase's and Kirkwood's Astronomical Calculations is *der teuflest* of all. What a lot of rubbish I have shot into my soul first and last! But the Good Lord will not be hard on me, seeing I did not hanker after it, and would gladly have escaped it. * * * Yesterday I worked hard all day from 8 o'clock to 5. You know it is my only leisure day. Nobody interrupted me. I read proof of seven papers of Cope. He has discovered *wonderful* animals in the Rocky Mountain rocks, a hog got up with exceptional teeth to live on turtles."

It is doubtful whether Lesley was consciously sarcastic in speaking of that yesterday with its long hours of work on proof-reading as his "only leisure day." With all these wearing duties it was to his Egyptian books that he turned for relaxation. He could forget all care in the society of his beloved cartouches and the long procession of the dynastic kings. Thus he tells that in the dog-days of the summer of 1872:—

"In sheer desperation last week at the intolerable heat, and over-press of this sort of trash work [proof-reading as above], I laid everything aside, and got down into the parlor my Egyptian books. Three days I worked away, and late at night. * * * It didn't hurt me a bit. * * * I have got down now in my MSS. to section 431; or to Reneferareka, 4th King of the Vth Dynasty. I have several kings of the Vth, and the whole of the VIth to do. It will take me another year or two, for oftentimes months pass without my being able to look at it." Yet all this was for himself: "I do *not* bore the world with my private amusements and recreations."

The "Second Survey," 1874–1894.—Lesley's service for twenty years, 1874–1894, as head of the Second Geological Survey of Pennsylvania, was the culmination of his life work. He was indisputably the man for the place; his previous work for the First Survey in field and office, his abundant experience as geological expert, and his extraordinary familiarity from direct personal observation with all parts of the State placed him above competition. When appointed, he entered upon his duties with enthusiasm, although his salary as State Geologist was small compared to what the private practice of his profession would bring, and the responsibility was heavy and unceasing. But he knew his opportunity and seized it eagerly, for he had these many years been anxious that a thorough survey should be made of his well-beloved Pennsylvania, so richly endowed with useful minerals and so abounding in geological problems of high theoretical interest and enormous practical importance. He had, previous to its establishment, advocated the organization of the Survey in and address in which he outlined its object as economic rather than scientific, and proposed the policy, later adopted, of giving full independence and prompt recognition to the work of assistants by the immediate printing of their results in reports of progress. He had already insisted on this point in "Coal and its Topography," in which he said:—"No primary report should receive the touch of any hand but that of the first observer" (p. 212). This was an evident reaction from the opposite policy of the First Survey under Rogers, which he had so violently condemned, and like most reactions, it was carried to an extreme.

It was based upon the excellent theoretical principle of individual responsibility, but it did not sufficiently recognize the importance of discussion and concentration before official publication; hence it led to the printing of voluminous original notes, minutely detailed and frequently undigested, made for the most part by assistants who had had little previous training in geological field-work and less in writing geological reports, and who were nevertheless left practically to their own devices in the field.

As a matter of fact, the original records fortunately received a great deal of conscientious editorial work from the Director in order to make the published reports of progress intelligible and methodical; indeed, the records were, in the opinion of some of the assistants, practically written over again. These young men frequently discovered parenthetical comments or argumentative footnotes that had been added in proof by the Director and that they felt were not in every case edifying; but Lesley knew the State so well that when the 'assistants arrived at conclusions contrary to his own, he felt compelled to present what he believed to be the more accurate conceptions.' Indeed the Director 'could never forget during the early years of the Survey that his assistants were inexperienced, and his constant anxiety was to prevent that lack of experience from doing injury either to them or to the State.' There is little question that the changes and corrections he introduced were for the most part well grounded, but it would have been better if all such differences of opinion had been argued out to agreement, as some of them were, instead of disclosing them to the world by publication. The Director was indeed severely criticized by some of his assistants for revising their reports; but the real fault lay not in thus violating the principle of independent responsibility, but in the principle that was thus violated, even by the Director who had proposed it. A geologist may, of course, independently publish his peculiar individual ideas, which run counter to the views of his colleagues, in the proceedings of learned societies, but it is quite another matter to publish them in the reports of an official survey.

It was not only that the Director frequently found it necessary to rewrite large portions of these manuscripts; he actually

drew or redrew a large proportion of innumerable maps, sections and illustrations; thus he himself, apparently unconscious of the way in which his remarks showed that he not only supplemented but supplanted the reports of his untrained assistants, told of imaginary whispering from some one behind him about the work he had to do:—"Have you finished Carll's drainage map? Bien [the lithographer] is waiting for Frazer's Susquehanna section, which nobody but you can do!" Any one familiar with his excellent literary style and his admirable graphic skill must feel confident that improvement was made in such cases, and must therefore rejoice that the crudities of his young assistants and the unwise principle of their independent responsibility in official surveys were both sacrificed for the good of geology and the advantage of the people of Pennsylvania.

The Drudgery of Survey Work.—The Survey work cost Lesley dear in time, fortune, position and strength; it absorbed all his working hours, it prevented his accepting much more lucrative work, it compelled his abandonment of university duties, and it broke down his health; but it was his pride and his glory, and the sacrifices that it demanded were willingly made. "I never wish for wealth when I am in my own house, but I never fail to long to be wealthy when I am in a place free to the public. It is so noble a vocation to serve the commonwealth; to distribute delight and instruction to the multitude. * * * All I ask now is to spend or be spent for the good of my kind." Yet the sacrifices were in one sense unnecessary, for they resulted in large measure from his unfortunate habit, probably acquired when he was striving single-handed in earlier years, of charging himself with details that ought to have been done by his subordinates. That he should have had to justify the continuation of the Survey and secure biennial appropriations for its support, and that he should have read all his assistants' reports and prepared summaries of them in the form of prefaces, was admirable; but that he should have exhausted himself with writing innumerable letters, preparing indexes, "waxing models," reading proof and drawing diagrams, keeping track of drafts, vouchers and checks, is regrettable, even though he performed all these petty duties excellently well.

'Every page of the one hundred and twenty bulky volumes published in these twenty years passed not once merely, but many times under his careful eye * * * he took personal charge of every step in the publication,—from the choice of author to the finished volume on the shelf.' The work wore him out and prevented the full accomplishment of larger tasks which he alone was competent to perform. This he saw clearly:—"I long to be called upon to express some grand old thoughts once more. But for this, one must be emancipated from petty routine labors. * * * I am trying therefore to make the Survey automatic, so that I may be freer for the more difficult and delicate functions. * * * If I do all the drudgery, I become incapable of investigating, reflecting and expressing in a large way, the results of the Survey." But he seems to have been unable to reform his habits, and was always overwhelmed with work.

Lesley was sometimes amused at his own distracted condition. He wrote after a spell of hot weather in the summer of 1875, when his work held him in Philadelphia:—"My wife is gone, my children have gone, my knife is gone, my pen is gone, my spirits have gone, and everything but myself is gone, but I cannot go. * * * Oh, how hot it has been. * * * Some day there will be an advertisement in the *Ledger:* 'If any one can give any information as to the whereabouts of a State Geologist, his afflicted corps, printers, artists, and well-wishers will be duly thankful.'" A few years later:—"You don't know how hard it is for me to write a letter, when at every paragraph a voice behind me whispers: 'How about that roll of proofs?' * * * 'What do you think about the risk of letting those two hundred pages of [an assistant's report] go to press without rewriting them?' 'Have you examined that pile of * * * MSS. sent in by F. P. day before yesterday? You know the sections must all be arranged by you * * * or he will get them wrong,'" thus again revealing a practical interpretation of his theoretical views regarding the independent publication of assistants' reports! Sometimes he was pitifully discouraged, and even at the end of the first year of the Survey thought the burden too heavy to carry any further. A hard day's work made him exclaim:—"I get so tired of the dry facts

and tedious statements of my science, this restless wheel of publication round the year, which never stops."

But between amusement and discouragement caused by his overworked condition, there were many expressions of high satisfaction. Thus after several years of Survey duty, he wrote:—"My organization of the Survey is bearing an incredible harvest, so copious and excellent that I am amazed at it. The animus of the corps is of the finest order, and is as good-humored as it is zealous. * * * I thought I should never have opportunity, nor means, nor time, nor strength, to publish my researches; but, on the contrary, fifty people have suddenly rushed up to me and surrounded me, offering with zeal and intelligence all and more than all the aid that I require. In fact, I am embarrassed with the abundance of opportunities, and the wealth of means. * * * It is no light thing to be the virtual owner of $50,000 a year, to expend as you please, without let or hindrance, for the realization of a noble idea. Such is my good luck. * * * If the Legislature pleases to continue the Survey, our volumes of reports will number fifty. * * * They are not fancy work; they are full of solid and well-digested facts. You can imagine my hen-like clucking over each of them."

Satisfaction is sometimes lost in the overpress of drudgery; thus in April, 1884:—"The moment I got through with [a certain report] I rattled off three long-delayed pieces of work and expressed them to their respective places. Today I have made good headway with the Berks Co. map, which has been staring me in the face since February 1st. In a day or two that will be sent off. Then I tackle the deserted remnants of Delaware County; and then—well, I shall begin to print d'Invilliers' 400 pages, Claypole's 800, and White's 600--1800 pages MSS. to read proof of, preface and index, besides all the illustrations to lick into shape, before August." Two years later:—"I am excessively tired—have been so for several days—right elbow painful, arm like lead, too constant writing, too much Stromatopora bed in No. VI— * * * too many references to verify—too many drawings to hunt up—too much grinding of slices for the microscope—too much geology with too little comedy—in fact, too big a book on hand for one old brain and

one lame hand." The report on the Terminal Moraine (Volume Z) for some reason proved a "perfect nightmare, lasting six months."

If one must regret the time given to draftsman's work by the Director of a Survey, one cannot grudge him the joy he found in it:—"I bent over my map all this morning, thinking * * * of those ages on ages during which the mountains which I was coloring in were being deposited and the valleys being eroded. * * * As I laid in the colors, and brought them by a thousand patient touches to harmony, so by a thousand patient touches of the Divine hand we are gradually fashioned into what we shall be." Six years later:—"I have been drawing a topographical poem all the last week, and never enjoyed anything better. I alternate drawing and writing, to rest and refresh myself."

Distractions and Entertainments.—Lesley was at this time a tall and striking figure. In manner he was more awkward than graceful; his clothes hung upon him without close adjustment; his face was strong but not handsome; his smile was kindly and charming; his voice was pleasant and melodious. Thick glasses and long hair gave him an appropriate singularity of appearance. Even before the Survey work was begun, Lesley's family and friends were apprehensive for his health, and after it was undertaken they marveled that he could get through so much work without any worse consequences than temporary fatigue. In the first years of his directorship insecure health required him to live by rule; he usually gave six hours daily to concentrated labor and then closed his office; but later, when the completion of certain tasks within limited periods required haste, his day knew no measure, with the inevitable result of all work stopping before it was finished. Regular and temperate habits of living helped him for many years; he kept up his daily games of billiards at the Union League Club, and was a faithful attendant at the Sunday evening gatherings of Philadelphia intellect at Fairman Rogers' house. He believed that change of occupation gave rest, and thus excused some of the semi-mechanical "drudge-work" to which he turned when too fatigued to write; his Egyptian studies served a similar purpose; he tells:—"When I get tired of task work, I read my

'Neue Kambyses.' It is full of the most interesting things. * * * I have found accidentally this evening [1876] the explanation of our printers' *Vinculum* {. It is immensely old; in fact nothing but the —^— or extended arms which the Egyptian priests used to signify the *summation* of a set of kings' reigns." He seems to have been conscious that such an explanation made a leap over long periods of time, through which it ought to be traced—although he does not seem to have had a similar perception of the uncertainty of some of his etymologies, as in the case of Tory, cited above—for he later laments:—"I despair of ever finding that time and patience, that solitude and leisure, that physical and intellectual endurement, which I need to classify, criticise and explain my mass of notes. They will remain after me as a curious monument of wasted years."

Grief over the death of old friends and the ever-lessening number of the survivors is often expressed in these years of fatiguing work:—"I am already, at sixty-one, lonely in the world. Of my familiars, Hodge, Henderson, Whelpley, Jackson, Haldeman, Frazer, McKinley, Towne, are gone; of my elder intimates, Agassiz, Bache, Henry, Rogers, Trumbull, I never see; * * * my Boston friends are far off. * * * Desor alone remains in Europe. * * * How narrow a circle of real near dear friends any one can have! * * * Some of the young men love me; but what can they know of me?"

But fond as he was of his friends, formal observances, as of birthdays, did not interest him:—"I don't care for anniversaries myself; they mean nothing to me. * * * I suppose the sentiment was early eradicated from me, by my archæological studies, the investigation of secular eras, the comparison of immense confluent geological ages, and all that. The consequence has been *that all time* is to me confluent,—one grand unit. Past, present and future seem to me the same. What has been, is still, and will be again, a thousand times repeated:" but even in reading this outburst one half expects to see a contrary opinion stated with equal emphasis in another letter, written a little earlier or later in a different mood.

Lesley's reading still covered a wide range; in a single letter he refers to Gladstone's articles on the Olympian gods, Sir

Grant Duff's review of English change in opinion, and Mivart's defense of the Catholic attitude toward science. There was also much reading aloud in the family. The father was fond of fairy stories and had a bookcase full of them; he loved romance and "its wizard, Walter Scott. * * * How loudly the old heart can still beat at the story of the loves of two young people; * * * but alas! who can write a novel, now that Walter Scott is dead. * * * 'The Newcomes' have been a dead failure. * * * This is the second time I have tried to like, to endure Thackeray. * * * He is simply detestable. His Colonel won't save him. * * * So we have abandoned Thackeray, once and again, and forever." Lesley took time to write two religious articles; one was entitled "Shall we call Him Master?" and appeared in the "Forum" for January, 1888; he says that it contains "a fresh stream of thought; very suggestive for different kinds of readers, and perfectly unconventional;" of the other he tells that he advised the editor not to accept it, as it was not worth printing—but he was glad to receive $100 for it.

Even if intensely fatigued by his University and Survey duties, Lesley's life was greatly enriched by them and by the new relations into which they led him; and with this enlargement of activities came a change of heart regarding his native city, against which his residence of several years in and near Boston seems for a time to have turned him. During the early part of their residence in Philadelphia, both Lesley and his wife had a feeling of loneliness, and a craving for a return to New England. During a visit to New England in 1876, he exclaimed:—"This Boston world is so full! At last, however, I regard Philadelphia from a distance, and with something approaching a genuine affection;" thus recalling the regret with which both he and his wife had left Milton in the early '50's, and suggesting a long-delayed domestication in the Quaker City. In reply to a letter from a daughter in Boston, in 1878, he wrote:—"Nearly forty years ago I was writing from Boston home [to Philadelphia], such letters to a father who loved me entirely as I love you. With this difference, that he knew nothing of Boston but as a place of dangerous *isms,* and nothing of the people who lived there, but as Emersonians,

Parkerites, Garrisonites, *et id omne genus;* whereas I have lived and loved there, and believe both the place and people to be as nearly perfect as the age and the earth permit." A few years later he remarked:—"I can easily see that at last our many years of endurance in this *city of our exile* have ended in making it a true home;" and later still:—"I have always disliked my native city. But I have at length come to regard it as my true home, and become reconciled to the once hated idea that I shall always live in it, and die in it, and be buried in it." This feeling deepened in later years [1891], when he wrote:—"The country was in its prime of summer, but somehow not so beautiful to me as the little back alleys of Philadelphia, through which I am accustomed to saunter and dream on my way from 1008 Clinton street [his home] to the Union League house in Broad street. I love the little streets and little houses and little people living in them. * * * I was born in a little house."

Lesley at this time as always depended greatly on his wife, whom he recognized as "so sweet and uncomplaining," in his "injudicious and variable moods"; while she, without neglecting the cares of the household, found pleasure for many months in the task of reading, arranging and selecting her mother's letters, a labor of love into which she put her whole soul, and thus produced her volume, "Recollections of my Mother," at first privately printed (1876), but later issued in three larger editions (1886, 1889, 1899), which many critical readers have enjoyed, and of which Emerson said to her:—'I cannot tell you how many times I have read it over. * * * It is a unique picture of New England life, and of an individual character." Somewhat later, Mrs. Lesley took an active part in the Organized Charities and Children's Aid Society of Philadelphia, in which she was for a number of years a valued and influential worker. And yet her husband once wrote to his brother:—"Nobody to talk to. Not a soul in the world but you. Wives and children are nice, but they are not *men*. They are too dependent. They look *up*, not *down* on you. They are parasitic, not fundamental."

With all his occupations, Lesley maintained his exuberant interest in many matters apart from geology. He enjoyed

music and plays, novels and fairy stories. He underlines in a family letter the fact that:—"Dr. Draper has in fact discovered oxygen in the sun! and allows the A. P. S. to have the honor of first publication. Saturday morning all the telegraph wires of the world will announce Oxygen in the Sun." A little later he writes:—"The discovery of Mars' moons, so small and close and quick, distresses me, like a contraction of the forehead or chest." Attracted for a time by the theory of evolution, he now turned against it, repelled at least in part by Haeckel's extreme views; he called it "the prevalent epidemic scientific superstition of the day." He was not always serious; his letters contain not infrequent humorous, or would be humorous, lines:—"We elected Prime Minister Gladstone a member [of the American Philosophical Society]. Will he not be proud! My dear Society has its ludicrous aspects, like most old people, places and things." An address that he was to make at Smith College seemed in prospect "like a missionary's sermon on landing in a foreign country. I do not know Smith College or the Smith Family, and as they are all girls I shall make some great blunder." He turned many excellent phrases:—"Laws and generalizations get mighty tedious without facts. Facts are the little children in the Tuilleries garden; laws are their *bonnes*. What would a garden be full of *bonnes*, without the rollicking crowd of little babies about them?" * * * "Passing events of the most impressive character slip into oblivion—accidental details of no moment catch in cracks of the brain, and stick there to all time, like the boulder in the Flume of the White Mountains."

The American Association.—Lesley had sensible ideas about scientific gatherings: when he was president-elect of the American Association at Philadelphia in the summer of 1884 he held the meeting down to business:—"A most successful meeting it has been, a brilliant meeting, a harmonicum and melodium of a meeting, and everybody says so. The arrangements were laboriously and skilfully made. * * * There has been no fuss and no feathers, nothing tawdry, no noise, confusion, or crossing purposes,—little or no guzzling, no toadyism, and scarcely an ounce of padding in the list of papers."

It must have been the fatigue coming from the drudgery of

his work in editing the many reports of the Second Survey, a duty that he too faithfully performed, that led him to select for the chief topic of his address as retiring president of the American Association in 1885 the importance of what he called "Dead-work"; that is, the collection, comparison, and correction of data before the announcement of a result. Perhaps he felt that even his own impetuosity needed to be curbed, for though he loved the remembrance of his youth, he regretted its "dogmatic impertinences," and he deprecated the presumption of young recruits who rush into the thick of a discussion with their premature solutions of all its difficulties. One must, however, think it unfortunate that he could not have prepared an address upon a more live subject, especially as it appears that he had thought of discussing "the influence which anticlinals and synclinals *en echelon* have exerted in originally directing, and afterwards perpetually shifting, the systems of river-drainage, as the general surface became lower and lower through erosion"; thus recognizing in that problem a proper subject for serious study, and warranting the interpretation of "overwork" placed a few years later upon his fatigued reply to a request from a younger correspondent for information on certain points about Pennsylvania valleys:—"I am worked to death just now by the printers at Harrisburg, and cannot look up references, even if I could remember writing about valleys which I do not, except in the two publications you quote. Nothing *new* can be said of it which would be true, and nothing *true* which would be new. It is an exhausted subject, and very little to be said about it anyhow, for a valley is simply a hole dug in the ground." Lesley's real nature had abundant kindness and encouragement to younger men, as all knew who knew him: this discouraging ebullition on a postal card was fully explained by its first sentence.

Trips to Europe.—Rest and recreation during these ten years of hard work were found in repeated visits to Europe with one or another member of his family; the dates of these journeys are:—July, 1874; July, 1876; July, 1878; April, 1880; December, 1881; June, 1884; April, 1887; April, 1888. During the visit of 1876, he greatly enjoyed a stop of several days at Desor's home in the Jura, where he read the names on the

trees. "Alas, more have the fatal cross, even those which are newer than our visit in 1867: Lyell's for example." The old comrades felt their intimacy of twenty years before renew itself as they talked together; they discussed "Süss's new radical hypothesis of Moon bubbles on Earth. * * * He [Desor] agrees with me that such speculations are *not* geology. * * * The more I see of the geology of the day, the less I respect the so-called leaders and masters of the science."

During a walk to a Jura gorge, they had "a furious discussion over its construction; I maintaining that it was produced by erosion by the little river which rushed through it, he that it was a transverse break not at all eroded. * * * Desor is wholly wrong in his interpretation of these fine phenomena * * * the erosion * * * has been enormous, he considers it insignificant. * * * I burn now to spend a summer in the Jura. * * * The Swiss geologists * * * are twenty years behind us." These remarks are of interest as showing how rational Lesley had become since the earlier time of his cataclysmic theories.

Lesley's comments on the International Geological Congress at Paris in 1878 are amusing:—"Everybody talked all at once. Three sometimes spoke vehemently without listening to each other. Total absence of parliamentary rules. * * * [James] Hall opened the [afternoon] seance with an English speech. Nobody could understand it. I resolved then to speak in French myself. * * * There are no German geologists here and no English geologists. This fact is ruinous to the success of the Congress. * * * Still it is a fine thing to come face to face with all these men. There are three hundred, more or less, present. * * * I read my paper on the Permian of S. W. Pennsylvania, and was complimented by a great silence of the audience, by hand-shaking on the platform, by a little speech of the president Hébert, who said I had done another great service to the congress, in showing that while lithology remains the same, the palæontology may change completely."

During the voyage of 1880, Lesley was asked to lecture on shipboard:—"I gave them an account of the rise and fall of continental areas, the ages of the great mountain ranges, and the dynamics of faults. An hour and a half was very agree-

ably spent in questions and answers, and I heard the Captain's chuckle from the far end of the saloon." Reports to write and maps to draw were carried over on this journey, and the inveterate worker enjoyed his freedom from interruption during a month in Paris. He then made another visit to his old friend in the Jura, whom he loved so much. "There are moments when Desor's furrowed face is both beautiful and grand. He is now one of the most strikingly picturesque of men. He has great dignity of carriage and language, and is very charming in his deportment towards all; everybody in the street takes off the hat to him. * * * He made me give him a full account of Hayden, and King, and Pumpelly, and Newberry, and his old crony Whittlesey, and Powell, and Wheeler, and Shaler, etc., etc." The winter of 1881–82 was spent mostly in Paris, where the geologist transformed himself into the writer of a story about himself under the name of "Paul Dreyfuss," afterwards published; he seems to have enjoyed turning to this play from the "shamefully neglected geological description of Perry County. Damn Perry County!" He found the chimney pots of Paris delightfully inexhaustible objects of contemplation, and quite as interesting to draw as fossils. "They might be classified in at least twenty genera, and two hundred species." The last journey abroad was made with his wife in the spring of 1888; and extended as far as Florence, where his younger daughter and her husband were then living. On the return he stopped at Zürich and saw Heim and his "ravishingly beautiful" models, "before which ours are as archaic as Lombard statues to those of Donatello." What other American geologist would have made such a comparison!

It was while he was abroad in 1882 that Lesley wrote at Nice, in response to a request, an account of himself, from which the following extracts are made: "My chief service to American geologists has been my early adoption and gradual introduction of contour curves in geological field work; in my persistent advocacy of equal vertical and horizontal scales for geological sections, and my use of contour curves for mapping beds and veins beneath the surface. The only original ideas in geology for which I could venture to claim credit are, 1, the determinations of the present system of surface drainage by the

dimpled form of the plicated original surface, and 2, the production of all modern topography chiefly by the underground dissolution of limestone strata, of all ages. These fundamental ideas as I have long considered them to be, have not yet been discussed, and therefore not yet accepted, by geologists, and I must trust to the future for their justification." But he begins all this with a disclaimer:—"I have done nothing worthy of record in Science." The verdict of posterity will be otherwise; his life was one of great accomplishment. At another time he wrote: "I was never anything but an amateur except in topographical geology. In that indeed I have been a master, inventor and founder of a school, which has now many professors who have all been in one way or another my students."

Volume X.—The progress of the various Survey reports is reflected in family letters. Lesley tells his elder daughter about the invaluable "Volume X," containing gological maps of all the sixty-odd counties in Pennsylvania on a uniform scale of two miles to an inch and with uniform geological coloring, all preceded by a concise text for each map. He gives an amusing account of his work upon it:—"I had to turn to and color the little State map, which is a skeleton key to unlock all the various locks of the sixty-seven cells in that penitentiary of knowledge. * * * Then I had to write a geological preface to the little atlas, a concise description of the structure of the State—a sort of detailed forlorn hope, carefully picked from our entire army, for dangerous special service,—against the legislature. When that was sent to the printer at Harrisburg, an experiment had to be tried. I began with A Adams, A Alleghany, A Armstrong, B Beaver, etc., etc., and wrote a two or three or four page description of each in turn—as it were, sending out a stronger force to support the forlorn hope in the attack. Only seven battalions as yet have marched,—sixty more are waiting orders. * * * I am pleased to see that others are pleased with my method and manner. * * * At the rate of three per day and two pages apiece, the sixty counties to be described will cost *me* thirty days of hard, very hard, thinking and writing, and the *compositors* about twenty more pages of small type to add to my preface. But the little book will be a beauty and make a sensation," and in this estimate the author was cor-

rect, for few if any of the one hundred and twenty Survey reports has had greater use than this one. True, it ought now to be superseded by a new atlas in which topographical form as well as geological formations shall be shown; but as long as no such new atlas is issued, "Volume X" will be in demand. No American geologist ought to pass his thirtieth year without having made a journey across Pennsylvania with this report as his companion. It would then be understood why Lesley enjoyed preparing the prefatory text, and why he thought the maps "very pretty," as they certainly are; but some of them cannot be very accurate, for he wrote:—"Somerset [county] I have yet to do and it will be a difficult task; as I must * * * interpret as I best can from my old knowledge of the region, where Hodge and I camped in 1839,—forty-four years ago—think of that! Think of printing in from memory old camping-grounds after forty-four years!" But that seems to be the way in which maps have to be drawn, in the absence of surveys on which to base them! The pity is that no proper topographical base was prepared by the Second Survey for its geological maps. In any case the Director made the most of his resources, and if any one ever deserved commendation for work accomplished, he surely did; but he does not seem to have cared much for material rewards; he wrote in 1889:—"Everybody is congratulating me on the gold medal awarded me at Paris for 'original investigation,' as if I had made the survey, and as if I had invented a new 'monkey soap,' and wanted a medal for an advertisement."

The Dictionary of Fossils.—The preparation of the three-volume "Dictionary of Fossils"—Report P 4, issued in 1889-'90—was an arduous task, and like many such tasks demanded more time and patience than was expected when it was undertaken. It seems to have been begun in Florence during a trip abroad in the spring of 1888, when Lesley spent six or more hours a day on it; he later wrote:—"I am learning a lot of Palæontology which I should have had the mastery of by rights years and years ago. * * * I am buried in a beautiful hades of fossil forms, and wander among them like a poet in a flower garden. * * * How beautiful and curious they are!" Lesley seems to have had a great respect for paleontology, al-

though he was not a specialist in that subject; for he said:—"If Homer's Iliad is immortalized, James Hall's Palæontology of New York, a more sublime epic, will have a more genuine if not a longer immortality." And again:—"Among the ugly crowd [of the Second Survey Reports] one beauty walks. It is our dear old Lesquereux's masterpiece, the Fossil Flora of America, illuminated by seventy or eighty plates of all sorts of ferns, and leaves, and tree bark of the Coal Era." The Dictionary was prepared and written out almost wholly by Lesley himself; it required the making of a card catalog of Pennsylvania fossils from whatever source—except the fossil flora, which had been reported upon by Lesquereux and Fontaine—and arranging the cards in the alphabetical order of generic names, with a figure for nearly every species. He was greatly aided by a number of correspondents to whom he sent the Dictionary in successive batches of galley proof, which they returned with comment and corrections. Lesley was well satisfied with his work, and regarded it as a completely successful experiment. "The book * * * has evidently made a sensation, will bear good fruit, and is jolly nice work." It was in great demand, and must certainly have served to popularize a difficult subject, although the expert paleontologist would probably find imperfections in it.

Summary of Pennsylvania Geology.—Although the Commissioners, under which the conduct of the Survey was placed, were friendly to its director, their advice does not seem to have controlled the action of the State Legislature sufficiently to have assured the continuance of appropriations; hence there was a period of anxiety at a certain stage of each biennial session, when it was decided whether work should go on or stop. The uncertainty made it difficult to retain assistants on the Survey corps, who became valuable elsewhere as soon as they had been trained in their work; and besides the young men would get married and leave this precarious employment for permanent positions elsewhere. The difficulty increased in 1885, when the Governor of the State, who privately assured Lesley that he was a friend of the Survey, attacked it on account of the vast number of its publications. As the number of volumes increased, each dealing with some restricted area,

the need of a condensed statement of the results gained became pressingly apparent; and in response to this demand Lesley, a tired man, undertook in 1885 an overheavy task in the preparation of "A Summary Description of the Geology of Pennsylvania." He completed two of the three thick volumes, but broke down completely before finishing the third; his lamentations when the impossibility of finishing the work was recognized are pitiful. He proposed in a mood of preliminary enthusiasm to write the Summary in Saxon English, "for the use of the people of Pennsylvania, in whose vocabulary Norman English has never been domesticated, who greatly prefer before and after, or before and behind, to anterior and posterior, and overlaid and underlaid to superimposed and subjacent;" moreover, the Summary should be "almost wholly a practical description of facts * * * not at all influenced by geological theories;" but it is hardly necessary to say that neither of these good intentions was carried out. On the page immediately following the explicit statement about Saxon English the author wrote that he had been "precluded from inserting" something; and all through the volumes one constantly meets such non-Saxon words as sequence, submergence, sedimentary, speculation, metamorphism, phenomena, ornithologist, pachyderm and a host of other classic foreigners. And as to the attempted limitation of a Summary of Pennsylvania geology to a "practical description of facts," any one who has analyzed the content of this flighty science will know that such limitation is utterly impossible. Most of the so-called "facts" of geology began as questionable speculations and are now nothing more than well-supported and generally accepted inferences; for example, the progressive deposition of the layers of bedded rocks, the organic origin of fossils, the former continuity of faulted strata, and so on with nine-tenths or ninety-nine hundredths of the statements that are commonly encountered in geological treatises. Even the simple statement that the hills of western Pennsylvania consist of horizontal strata is an inference, for the facts that are really certified to by observation touch only the discontinuous outcrops of some of the more resistant strata on the hill slopes; the very existence of the intervening strata and their extension through the invisible

body of the hill are pure inferences. There is, of course, not the least objection to the acceptance of such inferences, nor to the brief form of statement in which they are commonly presented as if they were "facts;" but they are inferences all the same. But it is not only well certified inferences of this kind that abound in Lesley's Summary: there is not infrequent mention of evidently hypothetical matters, regarding which various shades of opinion may be entertained; for example, the "shape and size of the Appalachian sea at the close of the limestone age" is still a fine subject for speculation; and when it comes to the early condition of the earth, which "got itself encrusted with a rind of solid rock, which no longer shone with dull red light of its own," many a reader will agree with at least half of Lesley's rather flippant statement that this "is only known to God and Dr. Sterry Hunt."

Let it not, however, be imagined that the above captious comments are directed against the Summary which is presented in these indispensable volumes, for it is a most serviceable epitome of the results that are otherwise to be found only by searching through the one hundred and twenty or more separate volumes of Survey reports; the point of the comments is to make it clear that the execution of the Summary is much better than its plan; for it was visionary to imagine that a summary of this kind could possibly be written in Saxon English, or that it could be almost wholly limited to facts; geology is largely a speculative science and its language is largely non-Saxon, as the contents and the style of Summary abundantly prove. It is to be feared that even a third element in the plan of the Summary—namely, that it should be written "for the use of the people of Pennsylvania"—could not be realized; for although the Second Survey cost about $1,000,000, to which sum each voter contributed about three cents a year for some twenty years, it is to be doubted whether any large number of the comparatively few voters who received a copy of the three volumes of the Summary ever read them through. Geology is not only a speculative science, it is also a technical science, and apart from the merest outline of its results, which might go into a thin pamphlet, it cannot be presented to the people of a State in a form for their apprehension. The Summary De-

scription of the Geology of Pennsylvania is a monument to Lesley's profound knowledge of that grand subject; it is indispensable to geologists who are concerned with the study of the Keystone State; but it is not a popular book, and to one acquainted with the labor that it cost its pages are sad reading. It was begun with some pleasure:—"I am writing my summary slowly, but enjoyably, and with a quiet firm sort of confidence that it will be worthy of its subject"; but a year later fatigue and discouragement made him take a gloomy view:—he was "tired to death" of the work; "it is so frightfully monstrous, so unsatisfactory * * * of so little real use to anybody." Later on he says:—"I have safely explored and passed up through the Azoic Hell, the Cambrian Purgatory, and six lower heavens. I am now [1892] flying merrily through the Seventh Heaven, called the Oriskany; a crystal heaven, for it furnishes all the glass sand wanted at Pittsburg and elsewhere."

The book was harder to write because it was a work of compulsion:—"No gentleman can fail of his promise. I have pledged my honor to do a work in which my heart has no concern. I must finish my book. But how different is my interest in it from that which I once felt in every piece of scientific work which came under my hand." Disappointment overtakes him:—"I work and work and accomplish little. I work every day from nine to four, seven days in every week of the year. I have no holiday. I am buried in my big book. * * * I had to look over back pages of my Summary yesterday. Alas the style. Alas the *lacunæ*. Alas the prolixity, the needful revisions, the awful proof-readings, the multitudinous illustrations to be made." He worked when he should have rested. "It will be the chief failure of my life." "If all geologists would promise me personally not to read my Final Report, I should be in no distress of mind whatever; for I can teach the Laity." Yet it is precisely to geologists that his Summary has proved most useful. One of the Survey assistants writes regarding it:—"It sets a standard for governmental reports. Nowhere can be found a more lucid exposition of facts and principles, unmarred by the assertion of personal theories, unbiased, thorough and complete." Another assistant writes of it:—"He gives full credit to each member of his staff, while

important phenomena, observed by the assistants, received full discussion from the standpoints of his broad reading and his own field work. There is no attempt to evade anything, no inclination to undervalue the work of those disagreeing with him; on the contrary, there is a frank presentation of opposing views, and frequently a retraction of opinions long held very dear by him." These commendations were written after Lesley's death: but here is one which Lesley had the pleasure of reading in a letter from a master of good English, Sir Archibald Geikie:—"The introductory part of Volume I. [of the Summary] is capital reading and will, I am sure, carry many a reader onward, to explore the rest and more technical parts of the book. The vigorous writing especially delights me, for geologists, as a rule, never cultivate literature, but express themselves in the most slovenly way."

Recognition.—It has been said above that Lesley was one of the fifty original members of the National Academy of Sciences at the time of its organization in 1863, and that he received a gold medal from Paris for original investigation in 1889; further, that consistently with his habit of minimizing his own merits he made light of both these high honors. He was also a fellow of the American Association for the Advancement of Science and its president in 1884-'85; member, librarian, secretary and vice-president of the American Philosophical Society of Philadelphia; member of the Academy of Natural Sciences of the same city, of the Boston Society of Natural History, and of the American Oriental Society; original member of the Geological Society of America; honorary member of the American Institute of Mining Engineers; associate of the American Academy of Arts and Sciences at Boston; member of the Moscow Imperial Society of Naturalists, of the Sweden and the Neuchâtel Academies of Science, and of the Lille Academy of Natural Science; associate member of the Geological Society of the North at Lille, and foreign member of the Geological Society of London. In 1878 the degree of LL. D. was conferred upon him by Trinity College, Dublin.

Lesley in his Old Age.—Apart from the depression that resulted from overwork, Lesley carried much comfort into his old age. Enthusiasm for his science remained undimin-

ished; his eager interest in many other subjects continued unabated. New happiness came to him in the birth of his daughters' children, while the happiness of his own home life went on undimmed. He could reply, when his juniors thought him old:—"Yes, but you young people do not know what old age is." "It is a mistake," he wrote when nearly threescore and ten, "to say that poetry is married to youth," for he knew that "the true poet is the old man, who has seen everything, tried everything, felt every emotion, drunk the wine of many vintages, travelled through many valleys and stood on many peaks, until the beauties of heat and cold, light and darkness, land and sea, have photographed themselves in the album of his memory, and arranged the full score of a divine opera for the whole orchestra of his nature. Every commonplace fact has been sublimated for him into a symbol. The universe resounds with concerted music. The difference between space and infinity, time and eternity, has vanished; yea, the difference between the real and the ideal, the material world and the great spirit which evoked it from his own thoughts. The poet is created when he sees God everywhere in everything. Man shall not be excused for growing old; his proper function is to grow poetical; and the very essence of the poetical is benevolence. It is beautiful to see in the lives of Emerson and Longfellow how lovely and lovable they grew as they became old. They ceased to write; but when their words fell away from them, it was like the shedding of the leaves in autumn, leaving the marvelously beautiful forms of the trees in full view against the evening sky."

There were times after his seventieth year when, for months together, he carried on his work steadily and with enjoyment, greatly cheered and supported by the approval with which the Survey reports were received. Even when his health was seriously failing, he was sometimes like his younger self, all smiles over some fine illustrations that he had drawn; but after 1893 his work decreased and his letters ceased; for some years there is no record: he was literally worn out.

Shortly before the end of the century Lesley left his Philadelphia home and went to Milton, the same Milton near Boston where he had preached fifty years before and which he loved

so much, and there, in a pleasant house that had been given to his wife by her relatives a few years before, tenderly cared for by children, grandchildren, and many friends, the devoted couple passed their last years together. Their lives of faithful work were over; they quietly waited and passed away—he on June 1, 1903, and she in January, 1904.

Lesley was in his prime from his thirty-fifth to his sixty-fifth year, or from about 1855 to 1885. At the beginning of this period he had, after an earlier time of changing occupations and narrow means, established himself by hard work as the leading geological expert of Pennsylvania; and as a result plenty of professional employment soon followed the hard times of '57. His further advance was assured and uninterrupted. He was chosen by the self-ordained *Parcæ Scientiæ* of that period one of the fifty original members of the National Academy of Sciences in 1863; during a stay in Boston to deliver a course of Lowell Institute lectures in 1866 he was welcomed by the leading literary and scientific men of that then intellectual city; he was made professor of Geology and Mining, and dean of Town Scientific School in the University of Pennsylvania in 1872 and '75; in 1874 came the crowning event of his life: his appointment as director of the Second Geological Survey of his State, in the establishment of which he had been a leading actor, and for the leadership of which he had no competitor. But his constitution, never robust, had already weakened; not long after he was placed in charge of the Survey his health began a long decline. In 1883 he withdrew from University duties, and thereafter remained engrossed in Survey affairs until they overwhelmed him. He retired from all work in 1893.

How curious was the play of circumstance before Lesley definitely made geology his career! As a devout young student, intending to prepare for the Presbyterian ministry, his first acquaintance with geology was formed when a search for better health led him, altogether untrained in the science, to undertake field-work in the anthracite coal region as assistant to H. D. Rogers in the first Geological Survey of Pennsylvania.

Strengthened by two years out doors (1839-'40) he entered upon his chosen study of theology, but with an undercurrent of geology, for three years at Princeton (1841-'44) and one year in Germany; and then, having been licensed to preach, he spent two summers (1845-'46) in the forest counties of Pennsylvania, distributing tracts and exhorting the country folk in their secluded villages. Had his strength allowed him to continue in this dutiful task, at one time so dear that, while immersed in it, he felt that there was nothing else worth living for, he might naturally enough have found a mate in the household of one of the well-to-do farmers or ironmasters, who became so earnest and solemn when he laid down their duty, even though topics of high morality were not their usual subjects of conversation; and in that case the forest counties would have retained, for a time at least, his enthusiastic services, and the geology of the State would have had to wait for another master. But again his health was endangered and again a geological opportunity was opened by Rogers, this time (1846-'47) on Pennsylvania map work in Boston, where new associations in new surroundings, till then as unsought as unexpected, exercised a powerful influence on all his future. Once more, after his geological task was finished, he turned to preaching, now in a Congregational pulpit near Boston (1848-'50); and as a further result of his sojourn away from home he married a New England woman of rare quality, who gave him thenceforward devoted support and elevating companionship. With little delay his earnest, independent, uncompromising spirit was so far liberalized by the radical atmosphere in which he found himself, that the Association of his church refused (1850) to ordain him; thereupon, after preaching a short time longer, he for the third time turned to geology under Rogers and for a year (1851) worked on private surveys of anthracite coal lands in Pennsylvania. In the following year, after much discouragement, he secured employment for himself on coal-land surveys, and from this time forward geology was his life work; but religious matters always retained a strong hold on him.

His tasks were laborious; he plunged into them with wholesouled energy and soon developed remarkable expertness. The

mental exuberance of his earlier years continued into middle life. His versatile interests always provided him with happy distraction, whenever a spare hour allowed him to observe, to think, or to write. He became enormously informed by recklessly wide reading; and as his memory was extraordinarily retentive, his varied information was immediately ready for use; he was therefore always an interesting, even if sometimes a dominating, talker. Two habits formed in his early manhood still controlled him: one, a sententious habit of thought and expression, which must have come from his experience as a preacher; it led him to remain long afterwards on familiar terms with universals and unknowables, and to exalt and glorify the common events of life, with equally confident assertion in both cases; the other habit was that of doing all sorts of work himself, because as a young man he had been unable to engage any one else to work for him; a habit that he was loath to give up even when enlarged responsibilities and increased means should have prompted him to leave many tasks to his juniors; it was as if he could not bring himself to feel that they could do the work as well as he could. He was always a man of deep affections and reverent nature, strong opinions and extravagant enthusiasms, some of which, long persisted in, carried him to fantastic extremes. He was a genuine lover of all the greater fine arts, and well practiced in two smaller ones: clear, forcible writing and simple but effective drawing. His journals of 1844 in Europe were filled with sketches; his long family letters were not infrequently ornamented in the same way, though his usual avoidance of narrative and his indulgence in moral reflections and rhapsodies with his correspondents gave him when at home relatively small need of graphic aid. He was an untiring worker, frequently to the point of injuring, and at last to the extreme of ruining his health; indifferent to worldly success and social station, warmly sympathetic, unselfishly devoted to all good and generous causes; an outspoken advocate of the abolition of slavery even during the critical years just before the War of the Rebellion, when the avowal of such principles in Philadelphia placed a man close to ostracism by the orthodox. He was sometimes mistrustful of his powers, and often spoke and wrote with a turn towards melancholy,

especially in his later enfeebled years; yet when in good health he was a cheerful optimist. Depressed as he was repeatedly by contacts with rough Americans in the concrete, he always maintained their virtues in the abstract.

It is indeed curious to learn that this man, so marked an individual in his peculiarities, so complex in his interests and sympathies, so full of religious feeling, so largely an idealist, so ready to carry his deductions far beyond his facts, so deeply impressed by his momentary surroundings, so adventurously vehement in one opinion at one time and so insistent on its opposite at another, himself so mistrustful of business ventures and so free in expressing a scornful pity for those whose lives were given over to mere money-making, was nevertheless the trusted adviser of practical men. This must have been because the deeper currents of his thoughts ran on geology through all his maturer years, and because he held himself close to the truths of his science by repeated contacts with the facts of the field; and above all because of his laborious faithfulness to duty, his courageous independence, and his unswerving honesty. Should an inquiring traveller wish to know what Americans are like, he should be told that they are of too many diverse types to be generalized in one; but should he wish to know one of the types, let him study the life and work of Peter Lesley, a noble type represented by a single individual.