the straits during the last week of October, 1884, and that for all practical purposes of navigation the straits remained closed at this point till the early part of June in the present year. In June a good deal of open water was seen at different times, but the pack would close up again, and remain in that condition for several days at a time.

"From a consideration of these reports, I am of the opinion that it might have been possible to pass through the straits during the early part of this July. The same date of closing as shown by the observations last year would give a season of navigation rather less than four months for the individual season.

"It should, however, be stated, that the movements of ice this spring were evidently much later than those of last year; for in the month of August this year we met with vast quantities of heavy ice, and in the same month last year comparatively little was seen. On the Labrador coast and at Churchill the report was the same, — that the ice was unusually late in leaving this year.

"I was informed by a captain who had made a number of voyages through Hudson's Straits, that he had seen the straits clear of ice in June, but that it was a rare occurrence. The fact, however, that the straits had been clear at this time, shows that there is a great variability in the dates of the opening of navigation."

The above conclusions scarcely seem to justify the building of a railway from Winnipeg to Churchill, — a scheme so seriously contemplated, that one or more companies have been organized, an extensive preliminary survey made, proving the feasibility of the route, and the requisite capital actually promised; while one of the engineers has gone so far as to assert that the bay and strait were navigable for properly constructed vessels all the year round.

The observers at all the stations report that the huts were warm and comfortable, the food good and sufficient, and their health, except in the instances mentioned, excellent. The weather was not nearly so severe as expected, the thermometer never going so low as it often does in inhabited portions of the north-west.

THE PANAMA CANAL.

IT has been reported in the daily papers from time to time, during some months, that matters at the Isthmus of Panama were in a bad shape, that the funds previously subscribed and loaned were nearly exhausted, and that but a small portion of the necessary excavation had been completed. Apparently to counteract the impression made on the public mind by these statements, M. de Lesseps, on his brief visit of inspection of the work in progress on the canal, from which he has just sailed for France, was accompanied by delegates from various commercial cities of Europe and this country, and an engineer was also despatched by the French government to report upon the state of affairs, before a decision should be made in regard to the advisability of allowing a further sum of money to be raised and borrowed for the canal.

In the supplement to No. 148 of *Science* (vol. vi.) there appeared a notice of the recent book by J. C. Rodrigues, on the Panama canal, which, from his point of view, showed that the canal construction had been shamefully mismanaged from the start, and that failure and bankruptcy were imminent. There has just issued from the press another work[1] on the same subject, written by one who has had a large, if not the largest, share in the preliminary investigations, in the deliberations of the canal congress, and in obtaining the territorial and other concessions, and has had the best of opportunities for knowing about the progress of the work, — Commander Lucien N. B. Wyse. As will be inferred from the sub-title, the author aims to give an exhaustive account of the matter, from the very earliest explorations, through the discussion of the several proposed routes, a critical analysis of the points for and against the eleven most promising lines, an account of the political and business negotiations with other countries, the concessions secured, and the views and arguments of the United States authorities, down to the present state of the work (October, 1885), the money already expended and the future prospects. The admirable map which Commander Wyse gives, of that portion of Central America and the isthmus in which lie his several projected routes, is reproduced with this issue of *Science*, and the accompanying profiles show in metres the elevation of the ground over the different lines. The book contains also a plan of the Panama canal as it is to be when completed, and some ninety woodcuts of isthmian scenes and views of the canal-works.

The volume is very handsomely printed; and a person, whether interested or not in the canal, will find the opening portion, describing the scenery, the flora and fauna, the geological formations, the climate, the inhabitants, and the mode of life in that part of the world, very readable. Space will not permit the giving of an ab-

[1] *Le canal de Panama, l'isthme américain; explorations; comparison des traces étudiés; négociations; etat des travaux.* Par LUCIEN N. B. WYSE. Paris, *Hachette*, 1886. 8°.

stract of his account of the explorations, in which many parties were occupied for a long period and over a great extent of territory. Nor can more than mention be made of the eleven plans, by different explorers, discussed in detail : viz., —

1°. By Commodore Shufeldt and Mr. Fuertes, at Tehuantepec, 280 kilometres, all to be excavated, and 140 locks.

2°. By Childs, revised by Commandant Lull and Mr. Menocal, at Nicaragua, 292 kilometres, 195 of which are to be excavated, Lake Nicaragua and 21 locks.

3°. By Commandant Lull, at Panama, 72 kilometres, all to be excavated, with 25 locks and a canal-bridge over the Chagres River.

4°. By Wyse, Reclus, and Sosa, at Panama, 75 kilometres, all to be excavated, a sea-level canal, with or without a tunnel, and now under construction.

5°. By Wyse, Reclus, and de Lépinay, at Panama, 72 kilometres, 50 of which are to be excavated, with 11 locks and an artificial lake in valleys of Chagres and Rio Grande.

6°. By McDougal, Commandant Selfridge, Wyse, Reclus, and Sosa, at San Blas, 53 kilometres, 42 of which are to be excavated, level canal with tunnel of 15 kilometres.

7°. By Wyse, etc., at Darien, 125 kilometres, 74 of which are to be excavated, level canal with tunnel of 17 kilometres.

8°. By Wyse, etc., at Darien, 235 kilometres, 128 of which are to be excavated, with 22 locks and tunnel of 2 kilometres.

9°. By Trautwine, Kennish, Michler, etc., at Choco, 210 kilometres, 90 of which are to be excavated, level canal with 2 tunnels of 3 and 8 kilometres.

10°. By Commandant Selfridge and Mr. Collins, at Choco, 290 kilometres, 50 of which are to be excavated, with 22 locks and tunnel of 6 kilometres.

11°. By the same, the same, modified to 2 locks and tunnel of 6 kilometres.

It will be interesting to see how the author's opinions of the past conduct of the work on the canal, the present material and financial condition, and the future prospects for completion, compare with the views of Mr. Rodrigues, already referred to. But in weighing the statements it will be well to bear in mind that the author has written this book, as he states in his dedicatory letter, to establish the facts for his family's sake, that he was the originator of the plans and route adopted, and the negotiator of the concessions obtained, — facts which otherwise seemed likely to be obscured by the strong personality of de Lesseps. He desires also, by presenting his original plans, to absolve himself from blame for errors committed by others. He acknowledges that between the session of the Paris congress in 1879, and the organization of the canal company in 1880, a coldness sprang up between M. de Lesseps and himself, and that his appointment as director-general was withdrawn.

He states, that, in order to have some official acquainted with the business in hand, the place of superior agent at the isthmus, with duties but poorly defined, was given to his old friend and collaborator, M. Reclus, who initiated the enterprise in January, 1881, began the clearing, the final studies, the assembling of plant, buildings, etc., built a large landing at the north entrance, and erected a general hospital at Panama. He was succeeded in June, 1882, by M. Verbrugghe, and later by M. Richier, under whom was begun the first digging of the canal proper. This administration was not a success ; and when, in 1883, M. Dingler was appointed director, he abolished the office of superior agent. The oversight of the work, already too negligent, became quite inefficient ; and to-day, four years and a half from the beginning, matters are in a bad shape. The appointment of Engineer Hutin, first as subdirector and then as chief engineer, is not sufficient, despite the good-will which he brings to his position, to remedy the evil already done.

In October, 1885, the following was the state of affairs : there has been moved a total of from sixteen to seventeen million cubic metres of earth, twelve millions only being from the canal proper, and eighty-eight millions are still to be excavated. Besides, there have been prepared buildings and stables on an extravagant scale, farms and gardens at great expense around headquarters, railroad branches, field hospitals, and roads, three of which he says are of but little use except for pleasure-riding by idle employees. Considerable labor has been expended on the Atlantic side. The best organized works are at Emperador ; while at Culebra, a very important section, as will be seen by the profile, the reverse is the fact, and the amount already excavated is far out of proportion with the vast quantity which yet remains in place. On the Pacific slope the work is less advanced. He claims that at Culebra, by an injudicious deviation from his line, the management has increased the depth of cut from eighty metres to a hundred and nine metres. A vast quantity of tools, machinery, and materials, has been collected, and some fine workshops have been organized. Many of the excavators and dredges have caused trouble, delays, and breakdowns, while difficulties with the temporary tracks and cars for moving earth are frequent. The question of the protection of the canal from the dangerous floods of the Chagres River by means of a dam and large storage-reservoir has not been settled in the last three years. What he thinks of the present management may be inferred from his expression, *une administration méticuleusement paperassière.*

The company has received half of its capital stock, a hundred and fifty million francs, besides four hundred million, in round numbers, in obligations of three different types. It has on hand

something over sixty million francs, and the remaining half of its capital, with which to pay for the excavation of eighty-eight million cubic metres. From eighteen months to two years have been lost through lack of discipline and ill-directed efforts. If we judged only from the earth already moved, there would be required to complete the work four thousand million francs and thirty-six years. But the expense and time spent in getting ready, the acquisition of property, and the collection of materials, must be considered. There have been wasted in useless works, too high prices, and absurd contracts, a hundred and fifty million francs. The errors committed by the direction will amount, at the time of completion, to a loss of about three hundred and fifty million francs, to which ought to be added a large share of the ninety-four million francs paid for the Panama railroad, since the better terms he had negotiated with the railroad company were set aside.

He still adheres to and defends his original estimate of a hundred and five million cubic metres of earth as the quantity needful to be moved, provided the useless plans for the deviation of the Chagres, and the formation of a great interior port near Corrozal, are given up. The treatment he would apply to the river is that of one large dam and a number of smaller ones along its course. The earth has proved of good quality for retaining a slope, is deeper, and there is less rock and of a less hard nature than was anticipated. By a reformation of methods of administration and work, by the employment of experienced contractors, by carrying out no unnecessary projects, by push and energy, he estimates that it is possible to finish the canal in six years. The company must raise, for the eighty-eight million cubic metres of excavation, at five and a half francs per metre, four hundred and eighty-four million francs, and seventy-five millions for accessory works, and one hundred millions for discount, interest, etc., less certain savings which can be made; in all, about six hundred million francs. By proper and rigorous economy he believes that the total cost can be brought to twelve hundred million francs.

We find, further, that he calls attention anew to his alternative project at Panama, with ten or eleven locks, the fifth in the preceding enumeration, as offering a cheaper and a quicker solution of the problem in which the company is now engaged. Current rumor would seem to indicate that the company was leaning towards such a way of extricating itself from its present difficulties, even with an abandonment of the chief argument in favor of the Panama route, — that it would be a sea-level canal like the Suez canal, without locks.

He closes with a discussion of the mercantile advantages to be derived from the canal, and the revenue from which to repay the great outlay cited above.

LONDON LETTER.

IN the first of this series of letters, allusion was made to the frightfully unsanitary condition of the river Lea, in one of the London suburbs. From the upper part of this, water is still drawn for the metropolitan supply, while enormous quantities of sewage, etc., are allowed to drain into it lower down in its course. A few days ago a public meeting was held at the Mansion house, London, under the presidency of the lord mayor, in aid of the "National society to secure effective legislation against river-pollution." The attorney-general, Sir C. Russell, M.P., moved the following resolution: "That the speedy purification of our rivers would, in the opinion of this meeting, effect a great reform long urgently needed, and of vital importance to the general health and welfare of the community." There were two defects in the existing law: first, it was only permissive instead of compulsory; second, its powers could only be put in force by the sanitary authorities, who in some instances had been the main offenders. He would like to see the law so amended that no sewage-pollution should be allowed, under any circumstances, to enter any river, — at least, up to the point of its reaching the sea or a great estuary, — and he did not think the difficulty of making the law effective to that extent would prove very serious. Reform in the case of the river Lea would be a pioneer of reform in the case of other rivers; and, if the responsibility of dealing with sewage were placed on communities, the question would very soon be settled. From what came under the notice of the present writer during his recent visits to America, he thinks these weighty words should not be without due warning to various parts of the states and Canada.

The exceptional length and severity of the present winter are universal topics of conversation. For some days there has been skating in the London parks, — an event without precedent, for the second week in March. On the nights of Saturday and Sunday, March 6 and 7, the minimum temperature registered by screened thermometers (verified at Kew) near Stoke-on-Trent, in the midland districts of England, was 7° F. The next lowest temperature recorded in March was 13°, on March 13, 1845; and, according to Mr. Glaisher's Greenwich tables, that was the coldest