

ported on the six outer piles, the centre one being relieved of nearly all direct weight, and serving to take the thrust of the other through the bracing, when the building is subjected to high winds. The area of each screw is 8.38 feet, and 1.2 tons thus fall to be borne by each square foot of surface, an amount shown by the screwing force to be far within the limits of safety. The interiors of the piles are filled with good cement mortar, to preserve the iron from rust, and the heads and nuts of the joint bolts are imbedded in the same. Tubular cast iron braces, and the lower timber frame, three feet above high water, complete the foundation which has answered all expectations in the recent exceptionally stormy season.

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ART. XII.—*Work for Field Naturalists.* By P. THOMSON.

[*Read before the Otago Institute, 16th September, 1871.*]

It must be evident to all the members of our Institute, that in a district like this, with such a diversified surface, where mountain and valley, hill and dale, land and water, forest, scrub, flax, and grass, are to be found in almost every possible condition, there is a very extensive field for the study of nearly all the natural sciences, and more particularly those which require work in the field. In the vicinity of the town, and within the reach of an easy hour or two's walk, lie many scenes of considerable beauty and grandeur, while the views to be had from the various hill-tops are not to be surpassed anywhere. In laying the following remarks before you, it is my object to specify a few of the more interesting localities in our neighbourhood which present facilities for out-door study. Without making any pretence to exhaust the subject, I will merely mention a few of the things to be seen in the different places.

And first, as to the geology of the district. Some very fine sections have been opened along the line of the Port Chalmers railway, and the line of the Southern Trunk promises some very interesting cuttings through the Caversham and Lookout Point hills, as well as that more distant range the Chain hills. Some very curious sand deposits have been lately cut into at Anderson's Bay; and along the beach at Vauxhall, the igneous rocks have overlain the clay and turned it brick-red in the process. (This phenomenon may be seen in a small cutting in the Town Belt, nearly opposite the foot of Howe-street.) In the valley of the Leith there are many curious places. About two miles from town there is a long steep-sided mound, probably a terminal moraine, and about two miles further up, opposite the foot of Nichol's Creek, there is another very large accumulation of rolled stones, evidently the result of a similar cause. In the Town Belt, at the back of Royal Terrace, there are some very large peculiarly worn rocks, which look as if they had long been exposed to the wash

of water. About an hour's walk from Anderson's Bay, there is, right on the top of the hill at the righthand side of the road, an immense block of stone, the "Big Stone," from the flat top of which a magnificent view is had, worth all the labour of getting there. Then there are the various quarries in the neighbourhood of Caversham, in which fossil shells and sharks' teeth are occasionally found. Farther off is the grand section of the sandstone rock exhibited in the line of cliffs which bound the coast near Green Island, the cliffs themselves bounded in turn by the noble promontory of Green Island Peninsula, which shows, in a most beautiful way, the varied phenomena of basaltic pillars. In the same neighbourhood are the coal pits, and a little further out is the quartz reef at Christie's. Beyond Anderson's Bay is Lawyer's Head, with a fine cave under its northern face, and at Tomahawk Bluff there are several others, all of which can be visited at low water. The Green Island cliffs also boast of a cave; and on the estate of Lauriston, near Saddle Hill, there is a singular cave, in which a large number of moa bones were found some year or two ago. Underneath the trap rock of Bell Hill there is a bed of sand, which also underlies that bold rock face at the southern end of Princes-street, passing through to the Glen road. At the head of Pelichet Bay there is an extensive bed of pipe-clay, and another which contains singular concretions of ironstone, as well as small masses of a bright white substance which turns blue on exposure to the air. At Kempshell's quarry, up the North-east Valley, beautiful specimens of dendritic iron and manganese are plentiful. There are places farther off, such as Whare Flat, the Heads, Portobello, Blue-skin, etc., which are well worthy of a visit. But, to be brief, I have surely said enough to show that a wide field exists in our neighbourhood for the study of geology; although, at the same time, it is to be regretted that there are few fossiliferous localities near town.

Turning, now, to botany. Perhaps there is not in all New Zealand a town so favourably situated for the study of this science as Dunedin. The immense tracts of forest which extend to the east and north are now intersected in every direction with tolerably good roads, so that the student has little difficulty in penetrating with his field book to almost any given point. Most of the members of the Institute are aware, through our late vice-president, Mr. Webb, that the collection of flowering plants in the museum is deficient in a good many species, so that here is a capital chance for the Field Naturalists to supply those *desiderata*. At the same time, I must, as a caution not to be over sanguine, say that it is no easy matter going into the bush with a list of wants in one's hands and expect to come out of it again with more than one, or, may be, half-a-dozen. It is possible to traverse the bush for hours and not find a single example of the plant wanted, and yet it may be almost stumbled over in the first few yards. In addition to the flowering plants wanted, there are

extensive families of plants which are totally unrepresented in the museum—I mean the mosses, lichens, etc. Some of these are very interesting, and nearly all are very beautiful, and will well repay the trouble of collection. There is one thing in connection with our bush which not only the botanist but every lover of nature must regret, and that is the rapid rate at which it is disappearing. A few short years and the only forest left will be patches here and there in inaccessible places, where it would not pay to remove the trees. It is an interesting subject for speculation, too, as to what influence this clearing away of the forest may have on the climate of the country.

It is rather singular that here we have no native mammals to look for. In various places, rabbits, rats, and mice, and their natural enemy the cat, are not unfrequent; but for the aboriginal rodent, the Kiore, we may now look in vain. In the early day of the gold rush, they were not uncommon in the interior, and used to be caught and eaten by the diggers under the name of Maori rabbits; and if any yet exist, it can only be in the far away mountainous country of the south-west. The only mammals now to be found are marine—seals, porpoises, etc. Two species of seal are represented in the museum, specimens having been beautifully mounted by Mr. Purdie; but a couple of porpoises would be a decided acquisition, and now that whale fishing is revived on the coast, the skeleton of one of the smaller sorts would be valuable as a type of the rest. While I am on this head I may here allude to one of the most patent wants of the museum—neither the *Crustacea*, nor the *Mollusca* have a place there. There are a few shells—a *Pinna*, a *Turbo*, and *Haliotis*, and there is a small collection made by Dr. Buchanan, I think at Lyell's Bay, Wellington. *Crustaceans* abound on our coast. From the active and predatory crayfish down to a minute shrimp, there are many that sport a long tail; while the short-tailed ones, from a large solitary-living spider crab down to a little mite of a thing, no bigger than a pea, are abundant everywhere. The edible crab—the partan—so large and plentiful in the old country, is represented here by a little tasteless thing about three inches by two, but of precisely the same colour and habits. With regard to the *Mollusca*, the shells are neither so remarkable in colour or form as those found on the islands to the north; but nevertheless there are many beautiful species, and a collection for the museum should form one of our earliest attempts. It is a pity that there is always so much surf breaking on our shores, as by this means many of the finest shells are seldom got whole, being pounded to pieces in coming ashore. Still, after a storm, and the heavier the better, when there is a lot of kelp thrown up, there are always a few of the deep water shells to be got among the roots. There are also a few in the fresh waters of the district, and a rather fine lobster inhabits most of the streams. The museum contains only two specimens of *Radiata*—a sun-star and an *echinus*; there are many others to be got; while

of the hundred and odd fishes that inhabit the sea on our coast, there are only about a dozen specimens on the shelves.

I am afraid these details are rather dry and wearisome, but the importance of the subject must be pleaded as an excuse. Enough has been said to show the breadth of the field of study which lies before us; but one other thing I would like to enjoin, more particularly on those of our members who happen to live near the coast, and that is to keep a careful look out for those shoals of fish which every now and then come in on the beaches in such numbers. An effort should be made to get as perfect a specimen, or two if possible, as can be got, for preservation in spirits or otherwise. Every now and then, too, one hears of "odd fish" turning up, all of which should be secured for preservation or comparison. In short, all the members of the Institute ought to be Field Naturalists, and never lose an opportunity of securing specimens, whether for the museum or their own collections.

I have hitherto said nothing about the personal effect of such work on a man, both mentally and bodily; that is, I think, too obvious to need remark. I will bring these notes to a close by formally moving the establishment of a society, having for its objects work such as I have attempted to describe above, to be called The Dunedin Field Naturalist Club, to consist of all the members of the Institute who are willing to join. Their first meeting to take place—weather permitting—at the north end of George-street, at one o'clock on the afternoon of Saturday; the field for exploration to be the Leith Valley.

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ART. XIII.—*Description of a Simple Contrivance for Economising the Current of Large Rivers, for Gold-slucing, Town Supplies, and Mill-power.* By J. T. THOMSON, F.R.G.S.

[Read before the Otago Institute, 21st February, 1871.]

I CLAIM for my present little contrivance some indulgence from the members of this Society while I endeavour to explain its properties and probable uses. By way of preface, I may say that in my report to Government, dated 12th August, 1867, I find I wrote as follows:—

“Large sluicing operations would appear to be the ultimate great industry of the interior (of Otago), and that the mining portion of the population have been fully alive to this will be proved by the enumeration in those reports of their great and numerous water races.

“The principal sources of water are in the Snowy Ranges, and others, the Dunstan, Umbrella, Nevis, Richardson, Pisa, Hawkdun, Kakanui, Rock and Pillar, Lammermoor, etc., etc. But it appears to me that in the Golden