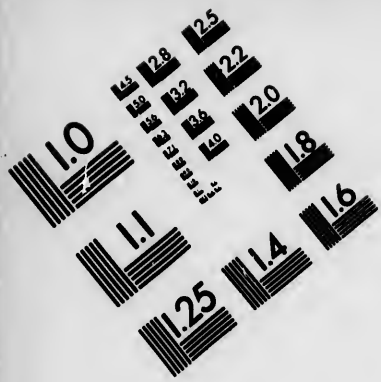

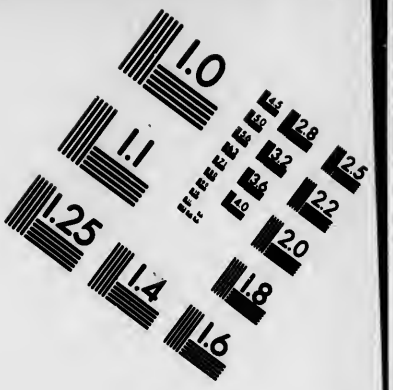

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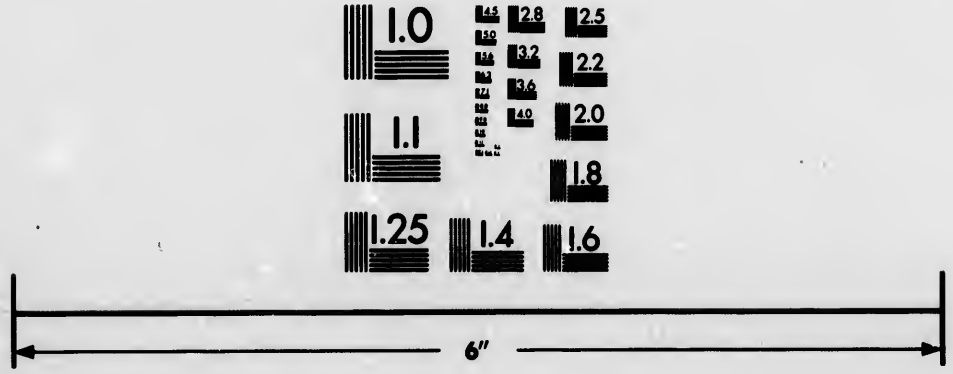

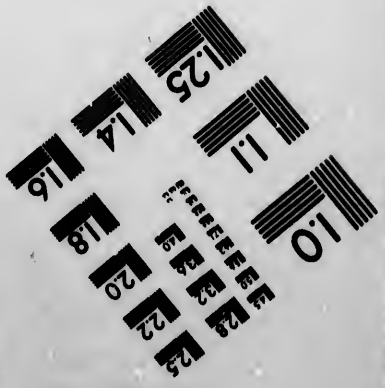

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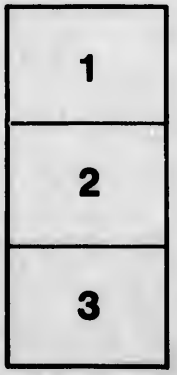

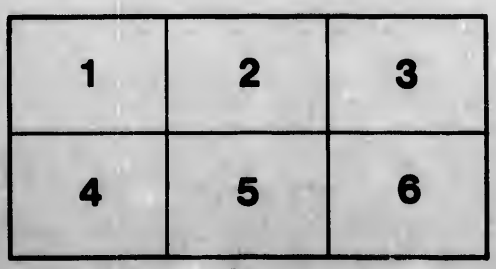

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the existing agencies generally commence their work. At the close of the post-pliocene period, and the scooping of the Annapolis Valley, the granite transporation may have been effected.

Art. VI.—The Limonite and Limestones of Pictou County, N. S.—By Edwin Gilpin, A. M., F. G. S.

(Read Feb. 10, 1879.)

I purpose this evening laying before you a few notes on the Limonite or Brown Iron ores of Pictou County, their source and relation to the associated Limestones; and, from the information at my disposal, to show that there is a possibility of these ores and their derivatives being much more widely spread than is generally considered to be the case; and in connection with the supposed sources of these ores, I will briefly draw your attention to the great dynamic changes in the district, which have generally been overlooked, and which have played an important part in the formation of the Limonite.

The most superficial student of Geology can hardly avoid a correct conjecture at the comparative ages of the strata he pases over in this county. Were the turf and wood removed from the ground, a bird's eye view would present each formation, colored by the hand of the Great Architect, and showing in its covering of soil the materials it is composed of.

The light sandy soil of the Upper, or (as it has been called), the Permo Carboniferous, the clays of the Coal measures, the reddish loam of the Lower Carboniferous, and the meagre boulder laden clays of the Silurian, all mark, with an interval of a few yards, the passage from one set of measures to another.

In an equal degree, the valley of the East River, above Springville, spreads before the traveller the distinctive landscape, marking the contact of two dissimilar rock systems. On the one hand the Silurian hills rise abruptly three or four hundred feet above the River, projecting here and there in bare, weather-worn knolls, or covered with a dense growth of gnarled birch and maple, and showing in places farms which have ill repaid the husbandman's labour. On the other hand, the Lower

Carboniferous measures rise to a lesser height, in gentle undulations, and present a pleasing succession of well cultivated fields, backed by the dark wall of the hemlock and spruce woods.

Between these two landscapes, so widely differing, runs the East River in graceful curves, presenting alike to each broad elm shaded intervale, as if desirous of hiding the fact that ages ago it must have cut its channel chiefly in the softer Carboniferous measures.

However, we must leave these lighter studies of the Geologist, and confine ourselves to the more prosaic subject of Iron ores and Limestones.

On entering the County of Pictou by the Intercolonial Railway, the Lower Carboniferous are met near Glengarry Station, and from that point their line of contact with the Silurian runs in a general N. E. course, towards the Gulf, with a long funnel-shaped arm following the valley of the east branch of the East River, towards the south.

The Lower Carboniferous measures of Pictou County, as met in the various natural exposures, are largely made up of highly arenaceous red shales, breaking with a conchoidal uneven fracture, and seldom holding fossils. These shales pass on one hand into massive bedded white and grey Sandstones, yielding many fragments of Carbonized plants, and on the other, into fine fissile clays, frequently calcareous, full of fossils, and holding nodular bands of impure Limestone. There are also beds of Gypsum, red and purple marls, and Limestones of various thickness and purity, and a few beds of black bituminous shales.

At one point these measures are penetrated by Diorite dykes, and in many places the traces of metamorphic action are shown by veins of specular ore.

Conglomerates are rare in the district more immediately under consideration, and one insensibly imagines that the beds belonging to the shores of the Lower Carboniferous ocean have all been in great measures swept off.

These measures rest unconformably on the edges of the Silurian strata, with a general dip varying from N. E. to N. W., or away from the older rocks. This inclination is preserved, with occa-

sional undulations, until they pass beneath the later members of the same group, in the vicinity of Stellarton and New Glasgow.

One is at once struck, when examining the sections of the Pictou Carboniferous, by the tremendous denudation they have been subjected to, which has dwarfed the Pictou Coal field to a tithe of its original dimensions, and in many places bared the Silurian rocks, which were once covered by thousands of feet of later formed strata. We find that the summits of anticlinals have been swept away, and that in places whole synclinal troughs have disappeared.

The two following instances of this denudation are presented as examples of what has been going on all over the county.

Thus, in the Pictou Coal field, we have in one section a breadth of outcrop corresponding to a thickness of strata not less than 3450 feet, which has disappeared.

Similarly, in the Lower Carboniferous under discussion, we have at Bridgeville a thickness of 2500 feet, which has been swept away. These great masses of matter have gone to form the millstone grit, the Coal measures, the Upper Coal measures, and perchance have swelled the volume of that new continent which the sounding lead has discovered beneath the waves of the Atlantic.

At first sight it may seem almost incredible that such enormous masses could be swept away by the agencies we now see in action around us; but from the surveys of Prof. Lesley, in Huntington and Centre Counties, Pennsylvania, it appears that Lower Silurian measures, formerly towering to a height of 30 or 40 thousand feet above the present sea level, are now but 2000 feet above it, and that they have yielded to denuding forces thousands of cubic miles of material which compose the cretaceous and tertiary deposits of New Jersey and Delaware.

We have now reached a point of importance, with regard to the origin of the Limonite ores, when we imagine that this great mass of Lower Carboniferous sediments, containing ferruginous shales and Limestones, formerly spread over a great part of the ground which now presents to our gaze strata of Silurian age.

Everywhere in the Carboniferous, at a distance varying from

50 to 500 yards from the Silurian slates, runs a bed or series of beds of Gypsum. This is prominently exposed at Glengarry, West Branch, Springville, McLellan's and Irish Mountains, and Sutherland's River. Between the Silurian and the Gypsum are numerous beds of Limestone, the thickest continuous one that I have seen being about 135 feet. The total thickness must be very much greater, as the section of denudation already referred to, at Bridgeville, appears to hold an almost unbroken series of Limestone beds.

The points of contact of these Limestones with the older slates afford many instructive sections bearing directly on the subject matter of this paper. One of them is as follows:—A bed of ferruginous Limestone rests on the Silurian slates, having at the point of contact a breccia of clay slate, cemented by a Calcareous paste. The fragments of slate are very close together in the immediate vicinity of the slates, but become more and more scattered until they disappear. Other beds of Limestone, shale and Gypsum complete the section.

In another section the ferruginous Limestone is replaced by a dark Carbonaceous one holding many fossils, followed by 100 feet of ordinary gray Limetone.

In another the pebbles appear rounded and the change to Limestone is quite abrupt. These Limestones are worn into caves and sink holes, frequently large enough to engulf good sized brooks for a portion of their course.

There is also another point to be considered in connection with this set of Limestones. Near Sutherland's River, in the same Lower Carboniferous horizon, is exposed a bed of Spathic ore, associated with Limestones and Gypsum, and only a few yards distant from the Silurian rocks. Fragments of Spathic ore occur in French River, one mile to the east. And on Sutherland's River McLellan's Mountain and Brook, East and West Rivers, fragments of Spathic ore are also found in connection with this set of Limestones and Gypsums; and at one point on the East River there is exposed a semi-spathose Limestone holding 24.1 p. c. of Carbonate of Iron. Eight analyses of the Limestones of this district, made by myself, gave on an average 3 p. c. of this mineral.

We are, perhaps, not fully informed in the processes involved in the formation of the beds of Spathic ore. The Iron may be conjectured to have been deposited during the growth of the Limestones, and as a ferrous salt, to have been Carbonated by means of the decomposing organic matter which must have been present at that time.

If now we imagine this great mass of ferruginous sediments formerly overlapping, more or less, the present exposures of Silurian slates of the district, we have a compound admirably calculated for the formation of the Limonite ores of the East River as they are now presented to our view.

The precise manner in which this Limonite was separated, either from the Limestone, in which it formed a Carbonate, or from the shales which held it, probably as an *Anhydrous* sesquioxide, and re-deposited, is perhaps not fully understood.

Were the old outlines of the district restored, we would almost undoubtedly find the Pictou Coal field extending over this portion of it. The Carbonic acid dissolved in its waters from the decomposition of the vast masses of vegetable matter collected for the formation of our Coal seams, would furnish a most powerful agent which, charged with Iron as Carbonate, would penetrate the underlying measures whenever access was allowed through faults, etc.

We need not, however, draw upon this source. The ordinary per-centages of Carbonic acid present in the waters of our globe are amply sufficient for the changes we are contemplating, when we consider the time allowed for its action.

The water, charged with Carbonic acid, would take up the Iron in the strata as Bicarbonate, and filtering downward through the faults and meridional planes of the measures, would part with a portion of its Carbonic acid when it met the Limestone, and then, depositing its insoluble Carbonate of Iron, would take up Limestone and pass away as Bicarbonate of Lime.

Some of the Bicarbonate of Iron would also be decomposed in the cavities and fissures of the strata, with loss of Carbonic acid, and the resulting insoluble Iron salt would be deposited. The Carbonates of Iron thus thrown down as a distinct deposit,

and as a substitute for the Limestone, would be gradually oxydised and hydrated, as the air and water obtained access to it; and the same action would also change the beds of Spathic ore.

The action being continuous, and extending over a long interval of time, the deposits would gradually assume proportions of economic importance, in spite of the large quantities which would be removed by the various physical changes the district has undergone. In places which were not so much broken by faults, or where the strata were more compact, the Spathic ore would escape the oxydizing process and remain to the present day as the Carbonate.

Gradually, as the erosion went on, these deposits would keep forming, and be more or less swept away. A large quantity of the ore would naturally rest on the comparatively dense Silurian slates and the edges of the Lower Carboniferous strata. Other bodies would become consolidated in the hollows formed in the Limestones. The beds of Spathose ore would become oxydised more or less generally, and the lines of fracture in the Silurian slates would also become receptacles for the ore.

Although as yet nothing beyond exploratory work has been done at these deposits, the sections attainable furnish instances of all the above effects, which we would theoretically expect. The oxydation of the Spathic deposits is shown by a section forming the counterpart of the one already referred to.

In this section we find a gore of argillaceous ochre or clay resting on the Silurian slates and replacing the breccia, and the Limonite replacing the ferruginous Limestone.

In another exploration a deposit of the Limonite was met under peculiar circumstances, which at first appeared to be discordant with the preceding sections and theories. It was, apparently, a bed in the Silurian clay states, but this idea could not long be entertained, as it was in a perpendicular position, while the neighboring slates had a uniform dip of about 50° and cut it obliquely in their strike. The deposit pursued a course parallel to that of the valley, and the enclosing slates were much fissured and filled with veins of Limonite and Calcspar.

It appeared to me that this was a fault which had perhaps for-

merly passed up into the Carboniferous Limestones which, as I have already shown, once covered this locality. In it the waters, charged with iron, would readily deposit their burden, now presented in the form of a cellular fibrous ore, very free from any mixture of clay, etc.

These deposits extend over a considerable extent of country, the width of the ore ground being in places 800 yards, but as yet they have been tested only near the points of contact of the two systems, which is owing to the facility thereby given for detecting them without much preliminary work.

At Whitehaven and Furness, and the Mendip Hills, in England, the Lower Carboniferous or Mari[illegible]o Limestones, are found occupying positions precisely sim[illegible]o those described above, and their sections will answer for thos[illegible] we are now considering. In these Limestones are immense deposits of ore, which are supposed to have been formed in the same way. They are largely mined and furnish an important supply of pure ore.

At several places in Pennsylvania the Lower Silurian Calciferous formation holds large deposits of Limonite. These ores are, by some, considered to have been deposited in a similar manner. The Limonites of Artzberg and the Thuringian Forest are believed to have been formed in the same way.

I have now detained you long enough with these dry details, but before closing, would briefly lay before you the important deductions which may justly be drawn from the facts I have been able to collect.

This is, that there probably exists in the Lower Carboniferous Limestones of this country important and extended deposits of Spathic ore, and that a proper and systematic search will probably show valuable deposits of Limonite in connection with them in other localities besides the East River Valley.

The Spathic ores are highly prized by Iron makers, and are very valuable as a flux when the per-centage of Carbonate of Iron present is too low for them to rank as ores.

The search is impeded by the perishable nature of both Limonite and Spathic ore, and by the heavy covering of soil which is met everywhere on the strata of this age.

This, however, would not prove a serious impediment were any demand to arise for iron ores: at present there is so little inducement held out, that there has been hardly any search made for them in this Province.

Art. VII.—On the Salmon of Nova Scotia.—By J. Bernard Gilpin, A. B., M. D., M. R. C. S.

(Read February 10, 1879.)

It is more than ten years since I read a paper before the Institute on the Salmonidæ of Nova Scotia. Since that time I have had greater opportunities of studying their habits, and my opinions are somewhat modified as regards the new facts I have obtained. Although this paper will be almost a repetition of what has been told, yet I have thought the importance of the subject may well allow it to be re-told—to be verified by personal observation, and to be put in proper order, and to be shown how this order is modified by the natural features of this Province. Thus this paper will be not upon the Salmon in general, but upon the Salmon of Nova Scotia.

If we examine the map of this Province we will find it a narrow peninsula scarce seventy miles wide, whose interior is filled by numerous lake basins of about four hundred feet elevation, from which flow the various salmon river streams to the ocean. Thus our Salmon in seeking their spawning grounds have only an elevation of four hundred feet to overcome, and at farthest scarce thirty miles to ascend. We know further, from personal observation, that they rarely ascend so high, or so far, but are often seen spawning four or five miles from the tide, and scarce fifty feet elevation. This fact is so important with me in modifying their habits that I shall verify it presently by formal statements and dates. We also recollect our climate is cold, and that our lakes are frozen towards the end of November, attaining a thickness of nearly four feet of ice, which is broken up and descends the streams by the middle of April. This is the general average, though varying in different seasons. Now compare these facts with the genial lakes of Eng-