NOTES ON A GEOLOGICAL RECONNAISSANCE OF THE LAKE ST. CLAIR DISTRICT.

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(With 1 Map and 8 Plates.)

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1. INTRODUCTION.

(a) General.

Through the courtesy of Messrs. F. B. Cane and G. L. Propsting, I was enabled to join them in an expedition to Lake St. Clair in the last week of 1923. The Lake St. Clair-Cradle Mt. Districts have recently been reserved as a Scenic Reserve, the lower and larger portion of which, extending from the Derwent Bridge in the south, to the Wallace River in the north, and comprising approximately 94,000 acres, has been placed under the control of the National Park Board, which has shown its fitness to take on the larger responsibility by the fine work it has already done in the Mt. Field area. Another party under the leadership of Mr. Clive Lord, Hon. Secretary of the National Park Board, and Mr. Rodway, another prominent member, were also camped at Cynthia Bay. Expeditions were undertaken to all places of interest in the vicinity, as time permitted. Much valuable information was obtained of the fauna, flora, and geology of the district, and those of us who were members of the Board were enabled to get a clear insight into its possibilities for tourist traffic.

Evidence to confirm certain theories brought forward in this paper will have to be obtained on some future expedition. A camp situated at the North-Western end of the lake would result in the collection of much valuable information. I would also suggest the obtaining of complete soundings of the lake, as all record of Mr. Charles Gould's work appears to have been lost.

(b) Geographical Position and Access.

Lake St. Clair lies about 120 miles from Hobart, at the source of the River Derwent, and among the outliers from the western edge of the Central Plateau. Mountains surround it on every side. The Traveller Plateau, Mount Ida, and the Du Cane Range lie to the east and north, to the north-west rise Mount Manfred, Mt. Cuvier, and Mt. Byron, whilst Mt. Olympus towers above it to the west. To the south-west and separated by the Vale of Cuvier from the latter lie Mt. Hugel and Mt. Rufus, to the east of which are Bedlam Walls and Mt. Charles. From the summit of Olympus a wonderful panorama is revealed. Behind the Du Cane Range appear the fretted uplands of the Pelion and Cradle Districts, to the west the varied forms of the West Coast mountains, with the smoke of Lyell visible some 30 miles away, to the south-west the never-to-be-forgotten Frenchman, with Mt. Gell and Gould's Sugarloaf for a foreground, and, behind Rufus, across the Navarre Plains, the King William Ranges with Wyld's Crag and Field West in the far distance to the south, across the Vale of Rasselas. The elevation of the lake, as given on the Mines Department Chart, is 2,409ft. (Hydro-Electric, 2,290ft.) Its length is about 11 miles, while the greatest breadth is about 2 miles. A depth of 590ft. has been recorded. Geoffrey Smith writes as follows: "Lake St. Clair is exceedingly "deep, in most places from forty to seventy fathoms, and in "some parts as much as ninety fathoms; the water is ab-"solutely pure, and, owing to the depth, very dark blue or "black, and of an icy coldness even in the height of sum-"mer."

The road to Lake St. Clair passes through Gretna, Hamilton, Ouse, Dee, and Bronte, crossing numerous tributaries of the Derwent, such as the Clyde, Ouse, Dee, Nive, Clarence, and Traveller. The mail car runs three times a week to the Dee, and once a week to Bronte, which is also in telegraphic communication with Hobart. The old Linda track passed along the site of the present road until crossing the Derwent Bridge about two miles from the lake. It there diverged, passing down the Charles and Navarre Plains to the Iron Store, under Mt. King William, before swinging to the west over Mt. Arrowsmith. The proposed West Coast-road, instead of diverging to the south, follows Scott's, Counsel's, and Paton's tracks, round the bottom of the lake, up the Cuvier Valley, and passes over the divide by Gould's Sugarloaf. Another old track follows the course of the Traveller River, and reaches the head of the lake by way of the Traveller Plateau.

The present road is fairly well formed, but needs attention from Bronte onwards. The expenditure of a few hundred pounds would make the track quite suitable for motor traffic to the lake, whose wondrous beauty warrants such an expenditure. The hut at Cynthia Bay is in a very unfinished condition, and needs to be enlarged. The boat is in very fair order, but the strong westerly winds, that seem to blow almost continuously down the lake, make boating without an auxiliary engine somewhat arduous.

(c) Previous Literature and Acknowledgments.

1. Col. W. V. Legge, R.A., F.G.S. (Proc. Roy. Soc., 1887), wrote a chatty account of the district, and of its beauties and wonders.

2. Graham Officer, B.Sc. (Proc. Roy. Soc., 1893), gives a general description of the Geology of the district. In it he states that he did not find any traces of early Palæozoic sediments in the Cuvier Valley or basalt at the mouth of the Derwent, as reported by R. M. Johnston, F.L.S. (Proc. Roy. Soc., 1893). He also devoted considerable space to giving his reasons for believing that there are no traces of glacial action in the district. His main argument is based on the non-appearance of glacial pavements or ice-scratched boulders, neglecting the appearance of the valleys, the moraines, and erratics so evident on every side. I can only account for this by supposing that the traces were hidden in scrub.

He does not attempt to suggest any theory for the formation of the lake, except a vague reference to earth-movements. He definitely states his opinion that the numerous lakes on the Traveller Plateau are due to sub-aerial erosion on an originally unequal surface.

3. R. M. Johnston (Proc. Roy. Soc., 1893) makes numerous references to traces of glaciation in the neighbourhood, including the Lakes Dixon and Undine, and the valley in which they lie, and the Cuvier Valley, but bases his theory of the formation of Lake St. Clair on a mythical flow of basalt damming the source of the Derwent.

4. Geoffrey Smith, M.A. ("A Naturalist in Tasmania," 1909), describes a short visit to Lake St. Clair, and his attempts at dredging in the lake, which he found very destitute of life.

I wish to acknowledge the help I received from my own and Mr. Lord's party, including Mr. Reynolds, who supplied me with notes on Mt. Rufus and Mt. Hugel, and the track to the south, Mr. F. B. Cane, whose magnificent photographs are so well known, and Mr. G. L. Propsting, who gave valuable assistance in map-making. I am also indebted to Messrs. A. N. Lewis, A. M. Reid, and A. McKay, for help and kindly criticism.

2. PHYSIOGRAPHICAL GEOLOGY.

(a) Present Topography.

The eastern boundary of the area in question is formed by the Traveller Plateau, which stretches away, without much alteration in altitude, to the Great Lake. The average altitude is from 3,000 to 3,500ft. above sea level. The surface, as viewed from Olympus, is covered with roche-moutonnées and small lakes and tarns, among which rise the Travellers' Rest, Nive, and Mersey Rivers. The rock faces are smoothed and rounded, and there appears to be little vegetation. The edge is steep and columnar in structure, overhanging the lake, and sweeps northward on its extreme western face, and is divided from the Pelion and Cradle Districts by the Forth and Mersey Gorges. Lying under the Travellers' about half-way along the lake, is Mt. Ida, a conically shaped mountain, crowned by diabase columns, and overshadowing Lake Laura. At the north of the lake, extending far back to the three-fold multiple cirques of the Du Cane Range, is a wide button-grass plain, down which flow the Narcissus and other rivers. To the south of the plain are a row of peaks, Manfred, Cuvier, and Byron, leading to mighty Olympus (4,680ft.), which towers over the south-western borders of the lake. Its base is covered by a magnificent beech forest, with leatherwood, waratah, celery-top, King Billy, tallow-wood, and other West Coast flora. Above rise cliffs of columnar diabase, 300ft. high. Behind Olympus is the Vale of Cuvier, 10 miles long, a button-grass plain crossed by moraines, and gradually rising from Cynthia Bay to beyond Lake Petrarch (about 500ft. above the lake). Down the Vale of Cuvier from Petrarch runs the Cuvier River. To the west of Petrarch is a circle of peaks, Byron, Coal Hill, and Gould's Sugarloaf, sweeping round till it meets Mts. Hugel and Rufus with the Hugel Creek Valley between them. Between Rufus and Mt. Gell, on the south-western boundary of the Scenic Reserve, is the upper valley of the Franklin River, with Lakes Undine and Dixon. The southern portion of Lake St. Clair widens out with Cynthia Bay on the west, and the mouth of the Derwent, and with the Derwent Lagoons on the east. Stretching to the south towards the King William Ranges are wide button-grass plains lying between Mts. Charles and Rufus, with the Bedlam Walls rising between. Another valley stretches under the southern edge of the Traveller Plateau towards the Clarence River, across which plateau flows the Travellers' Rest River, which joins the Derwent a little to the south of the Derwent Bridge.

(b) Development of Present Topography.

The present topography has been developed by fluviatile and glacial erosion subsequent to the intrusion of the Cretaceous, or at any rate Post-Jurassic, diabase. The outstanding features of the present topography are what may, for the present, be denoted as the intermediate and lower plateaux with residual mountains representing a former higher plateau. The intermediate plateau, the Traveller, is undoubtedly the western end of the Central Plateau. This has a comparatively level surface, with such immature drainage that the Nive and Mersey headwaters are so intermingled that instances of bifurcation are probably present. The rivers have not yet cut any deep gorges in its surface, probably on account of its massive structure, only the overlying sediments having been removed. It may possibly have been protected from erosion by an ice-cap during the periods of glaciation. The Traveller River has cut into it at one corner, perhaps where the sill structure begins, as has happened at Mt. Ida, where another small gorge has penetrated a short distance. The gorges of the Forth and Mersey, probably working along a fault plane, have separated it from the Pelion and Cradle districts to the north, scalloping it out into prominences.

The lower plateau, nearly 1,000ft. lower, includes the valley of the lake and the button-grass plains, and stretches away past Lake Echo. Here the erosive action is more apparent. The valley of the lake and the Derwent seems to have resulted from combined river and glacial action along a great fault-plane, an action which has been assisted by the comparatively small depth of the upper sill, covering soft sedimentary rocks. Once the upper crust, at high altitudes, had been pierced, the gorges developed rapidly, and now only residual mountains remain. The same may apply to the Cuvier Valley. This will be discussed in more detail in later sections of this paper. The wide valleys are due to the action of glaciers working along the previously eroded river beds, and the lakes have been formed behind the morainal dams. The lakes on the Traveller Plateau are probably due to the glacial "scooping" assisted by later nivation rather than to inequalities of the surface.

3. STRATIGRAPHICAL GEOLOGY.

(a) Pre-Cambrian.

These rocks, except as isolated pebbles in the Permo-Carboniferous glacial drifts, do not appear in the district under review, but approach close to it on the south, west, and north-west. They have been reported (Johnston) in the valley of the Franklin at Lake Dixon, behind Mt. Rufus, in the valleys of the Alma and Inkerman Rivers to the south of Gould's Sugarloaf, at Mt. Gell, the southern boundary of the Reserve, and to the west of the Du Cane Range. Mr. Gould states that they probably underlie Lake St. Clair, and its surroundings. R. M. Johnston (Proc. Roy. Soc., 1893) reports their occurrence on Mt. Hugel, Gould's Sugarloaf, and the Du Cane Range. I was not able to verify this, owing to lack of time. Graham Officer (Proc. Roy. Soc., 1893) states that he could not find any traces on Hugel.

(b) Early Palæozoic.

These rocks do not occur in the immediate vicinity, but are to be found on the Eldon and Loddon Ranges, and other localities to the west and south.

(c) Permo-Carboniferous and Trias-Jura.

These rocks dominate the whole district. Traces of the Permo-Carboniferous glaciation are to be found in the boulders of coarse conglomerate among the morainal material of the Cuvier Valley, and south of Cynthia Bay. These contain pebbles of quartzite, granite, and porphyroids of the earlier formations. Coarse pebbly sandstone beds were found near the water's edge at the Beech Forest, and possibly may occur in the Cuvier Valley below Mt. Hugel. The upper beds were represented by finer-grained felspathic sandstones standing out as cliffs high up on the slopes of Olympus, Ida, Hugel, and Rufus, and particularly noticeable on Coal Hill, where coal, probably one of the seams of the Upper (Jurassic) Measures, but perhaps of the same horizon as the Pelion coal, is found among the sandstones. Merging into these upper sandstones are fine-grained white to brown sandstones of Ross series, and shales highly coloured by the ferruginous content of the overlying diabase, and containing obscure plant remains (*Phœnicopteris?*).

The Upper Permo-Carboniferous sandstones and the Lower Trias-Jura are so alike in lithological characters, that it is hard to determine, without more evidence, where the dividing line may be taken. The lower slopes of the mountains are so covered by talus from the overlying diabase caps that it is difficult to see what the underlying rock is, and to build up a true stratigraphical series. No traces could be found of any Permo-Carboniferous limestones. A proper study of Coal Hill would probably give profitable results.

(d) Diabase Intrusions.

The diabase in this district appears to be in the nature of sills or intrusive sheets overlying the sandstones and shales mentioned in the previous section. This bears out the statement made in chapter IV. of Mineral Resources Paper No. 7, on the Coal Resources of Tasmania, which reads as follows:—"Only a few forms of typical laccolithic structure "have been located, but the greater portion of the diabase "of Tasmania, namely, that constituting the Central Plateau, "can be best described as an asymmetric transgressive igneous "mass of a general laccolithic type. The eastern and main "portion of this, to the greatest depth observed, shows no "sign of definite bottom, but its western extension shades "off gradually into a typical sill structure, the sills of Barn "Bluff, Pelion, and Eldon Range being portions of this "Central Plateau mass. It has been clearly demonstrated "that the mass rose upwards under the Plateau, lifting the "Permo-Carboniferous and Trias-Jura sediments bodily with "it. Concurrently the invading igneous mass discovered a "plane of weakness in the bedding-planes of the sediments "on the western edge, and travelled along it to form the "typical intrusive sheet. The overlying sediments present "during this intrusion have since been almost completely re-"moved by denudation."

This statement is borne out by the occurrences of the diabase as found in this district. At Mt. Ida, the Traveller Plateau is seen resting on the sandstones, and the columnar structure along the boundaries points to it being the edge of a sill ending at the lake. Except where a very steep face occurs, both here and on the sides of the mountains, the underlying strata cannot be seen on account of the masses of talus from the overlying sills which cover the hillsides. Farther eastward from the lake it is more massive in structure, and is part of the original diabase mass. Bedlam Walls and Mt. Charles appear to be subsidiary peaks, emanating from the mass of the Central Plateau. The diabase of the Bedlam Walls is different in texture from that found on Mt. Olympus, conforming more to the diabase of the Central Plateau. This would point to a different origin.

At the Derwent Bridge, close to Bedlam Walls, occurs a deposit of sandstone of Trias-Jura facies, through which the Derwent has cut a channel, and on which the bridge is resting. It is apparently part of the upper surface of the lower plateau which has escaped erosion on account of its position. There are no contour maps available to determine the extent of this plateau, or data yet to hand to account for its formation, but it appears to extend east of the Derwent Valley past Lake Echo, and has determined the base line of erosion for the plain stretching south from Lake St. Clair.

The appearance of the diabase as caps on the tops of the mountains to the west of the Derwent Valley, and in the Pelion and St. Clair districts, in the same line, and throughout at a much higher elevation (about 1,000ft.), has led me to the conclusion that it is the remnant of an immense plateau or sill extending from Cradle Mountain southwards, approximately along the line of the Cambro-Ordovician sediments. There is no evidence to show that this plateau was connected in any way with the Central Plateau, nor is it probable that each is a separate entity with its own feeding dyke. In fact, in several places, as at Coal Hill and Mt. Pelion East, the diabase has been entirely removed, and no

traces of feeding dykes are apparent. The strata beneath have not been disturbed or altered in any way, as would have been the case if such had occurred. Apparently the feeding dykes for this plateau have yet to be found. Lake St. Clair and the Valley of the Derwent have been eroded out along the junction of the two plateaux. Dr. Griffith Taylor ("Australian Environment") suggests that the Derwent flows in a Rift Valley, but gives no evidence for such an assumption. It appears more probable that the valley has been formed by erosion along a fault line.

The structure of the diabase varies considerably with the localities in which it is found. The normal diabase of the district is more finely grained than that usually met with in the vicinity of Hobart. This may be due to the comparatively shallow depth of the sills, with the consequent more speedy cooling. At the foot of the sill on Olympus, it is extremely fine grained and platey in structure. Above, it is formed of massive columns, which, where undermined, gradually lean over at greater and greater angles until they topple over, and pile up in a tangled mass of boulders below. The summit of the mountain is almost level, with a curious crevice, about fifty yards long, and closed at both ends, descending into the heart of the mountain. The sides are columnar, but the depth I could not determine, as it was filled with snow. It was probably caused by the subsidence of the underlying sediments. Near by, the diabase was of an entirely different structure, being almost a gabbro, and highly porphyritic, with large crystals, resembling hornblende in the hand specimens. The general structure of the rock showed that the mountain had been considerably higher and larger, the overlying rocks having been removed by erosion.

(e) Post-Diabase Sediments and Basalt.

These sediments consist almost entirely of glacial till, boulder-clay, and drift covering the glaciated piedmont. There are also a few examples of the deposition of river gravels and alluvium.

Among the boulders embedded in the moraine were found curious rounded blocks of mudstone of unknown age, of all sizes from that of a football to that of an egg. When exposed to the weather, expansion cracks appeared, and the rock was then easily broken with conchoidal fracture. It was difficult to determine how they were formed or where they came from. They certainly were not formed from the boulder clay.

Along the beaches were scattered large deposits of brightly coloured pebbles from the disintegrated conglomerates. Here, also, appeared quartz grains bound together by an iron matrix, probably due to organic action on the button-grass plains. The same action may be observed at Macquarie Plains, in the valley of the Styx, whose waters are highly coloured from the matter derived from the plains on which it rises.

No basalt was found nearer than Bronte, whose plain is covered and rendered fertile by the decomposed remains of a vast laval flow, through which the Nive has cut its deep channel.

R. M. Johnston (Proc. Roy. Soc., 1893) makes the following statement when discussing the formation of lakes in general: "2. By ponding back of streams by lava. Type, "Lake Ardat in Auvergne, and probably Lake St. Clair in "Tasmania." I cannot account for this statement, as no evidence of the occurrence of basalt was found in the vicinity.

4. GLACIAL GEOLOGY.

The Pleistocene glaciation was superimposed on an area already subjected to long ages of severe erosion, materially assisted by the high elevation and heavy precipitation. The river valleys, cut out along the lines of faults, were already formed. Without evidence of the inter-glacial periods, it is almost impossible to state definitely that Tasmania experienced four ice-ages in the Pleistocene as occurred in the Northern Hemisphere. All that can be done with the data at present to hand is to examine the work done by the glaciers, arrange it as nearly as possible in chronological order, and divide that up into sections according to the class of work and locality of operations. Each section may then be referred to in terms of the four northern ice-ages, and will be found to approximate very closely to them.

Taking this as a working basis, I shall endeavour, somewhat clumsily, to determine the order of sequence of the work of glaciation in this district. The great factor to be taken into consideration is that we have a hgher and one or more somewhat lower plateaux along the margins of which the rivers had already begun to carve their valleys. The higher plateau, owing to the elevation, thinness of sill, and softness of the underlying rock, had already become much dissected. The snow collected in deep masses on these plateaux. The intermediate plateau was protected from much erosion by an ice-cap which covered the whole surface, as evidenced by the lack of morainal matter. The work done here was in the form of disintegration of the rock beneath the ice, and its removal as fine detritus by water action. The general level surface would preclude any great movement unless due to the weight of ice pressing outwards. Most of the erosive work would be done on the higher plateau, where the streams had already carved valleys, down which the glaciers would flow, and soon huge broad valleys would be formed separating out the peaks which now appear, and completing the dissection of the plateau. Mr. Lewis, in his paper on the Mt. Anne district (1923), stated his opinion that either the Gunz glacial period did not occur, or that the Mindel had obliterated all traces of its action. I am of the opinion that the Gunz glacial period did occur, and that the preliminary work of dissecting this plateau and widening the great valleys could be referred to it, despite the absence of morainal material.

To the Mindel ice-age may be referred the more striking glacial phenomena observable at the present time, obliterating all traces of the Gunz glaciation. A huge glacier flowed across the site of Lake St. Clair from the Du Cane Range, below the summits of the mountains, as evidenced by the enormous amount of morainal material. It may possibly have been loaded by ice which fell over the cliffs from the Traveller Plateau. Receiving tributaries on the way it pushed southward past the King William Ranges, though evidences of morainal matter become slighter as you pass these mountains (Reynolds). The course taken would be between the Bedlam Walls and Mt. Rufus, the position of the moraines being easily seen, as they are covered with Eucalypts and light scrub, while the intervening out-wash has button-grass. The site of the lake may be an over-deepened valley, but still the depth of the terminal moraine must be 400 to 500ft. The morainal material was piled up against Bedlam Walls. The two main tributary glaciers near the lake, the Cuvier-Hugel and the Travellers' Rest, were modified by the larger glacier.

The Cuvier-Hugel glacier was much the larger, and was composed of two glaciers, one flowing from Gould's Sugarloaf, Coal Hill, and Byron, along beneath Olympus, and the other from between Hugel and Rufus. The valley of the former is now occupied by the Cuvier River coming from Lake Petrarch, and that of the latter by the Hugel Creek. Meeting the ice of the larger glacier, which was at a lower level, an immense moraine was built up, and a pressure ridge formed between the two glaciers. An appreciable quantity of the material was also spread along the lower slopes of Rufus, and helped to heighten the western portion of the terminal moraine of the St. Clair glacier, the general slope of which is from west to east. Retreating up the valley, it left behind row after row of moraines with steep downside faces, covered with Eucalypt scrub, and the intervening spaces again covered with button-grass. The last moraine near Lake Petrarch is particularly large with a wide outwash plain, through which a creek has wound its way, but into which it has not cut deeply. The Cuvier and Hugel Valleys may be termed "hanging valleys."

Mr. Reynolds has kindly furnished me with notes on the Hugel Creek Valley. "From the high ground above the present valley, down which the Hugel Creek flows, a glacier "has worked its way, cutting out a cirque, the top of which "is the ridge running from Mt. Hugel to Mt. Rufus, and "thence it has flowed down the valley, either joining the "Cuvier Valley glacier or flowing independently into what is "now the lower part of the lake. At least four moraines "have been left in the valley, forming three small lakes. From "probably the same source another glacier has flowed in a "northerly direction, presumably towards Lake Petrarch. It "has cut the other side of the Rufus-Hugel cirque, making it "a miniature example of the K. Col of National Park (Mt. "Field)."

The valley containing Lakes Undine and Dixon shows great evidences of glaciation. Mr. R. M. Johnston (Proc. Roy. Soc., 1893) describes the valley of Lake Dixon as "par "excellence, the ideal of a perfect glacial valley." It is extraordinary how he missed the signs so evident at Lake St. Clair.

The Travellers' Rest Valley contained two glaciers, one flowing from the region of the Clarence, and the other from the Traveller Plateau. These built a ridge at the eastern end of the lake, the most work being on the northern side of the valley. The glacier from the Clarence moved sluggishly down an almost level valley, base-lined by the St. Clair Glacier, and so did not cut down so deeply, as evidenced by the sandstone at the Derwent Bridge. It made its way down between Mt. Charles and Bedlam Walls.

The next glacial period (the Riss) was characterised by less intensive action, being confined to cirque action at the head of the valleys. This almost invariably took place on the eastern side of the ridges. The cutting back of the cirques, separated by cols, led to the formation of "horns" like Mt. Byron and Mt. Ida. To this time may be ascribed the formation of Lake Laura, fifty feet above the present level of Lake St. Clair, the Traveller Lake, the lakes beyond Lake Petrarch, the three-fold multiple cirque of the Du Cane Range, with the wide plain of the Narcissus and other rivers, and many other features, including the traces of ice action on the east of Bedlam Walls. At some time a large snow bank has lain between Olympus and the moraine which banks back Lake Petrarch, gradually removing the moraine by nivation, and forming a large outwash apron below.

The last period, the Würm, affected only the highest areas. The most noticeable feature attributable to this period are the small tarns under the summit of Olympus. They lie in a cirque overlooking the lake which has almost cut the top of the mountain into two equal areas. The upper tarn is perfectly circular, lying in a semi-circle of cliffs. The other tarn is almost rectangular, and appears deeper. Separating the two is a high, sharply defined pressure ridge running down from the mountain summit. It is probable that the divide at the south end of the great cliffs has been formed in some such way.

5. ECONOMIC POSSIBILITIES.

With the exception of the generation of electricity by water power, this district has few economic possibilities.

The proposed Hydro-Electric dam in the vicinity of Mt. Hobhouse would largely alter the district from a tourist point of view, and would hinder communication, not only with Lake St. Clair, but with the West.

There may be some prospect of coal in the vicinity of Coal Hill.

6. APPENDICES.

(a) Description of Plates

Plate XI.—Sketch Map of Vicinity of Lake St. Clair.

Plate XII., Fig. 1.—On Mount Olympus.

Fig. 2.—Arriving at Lake St. Clair, Christmas, 1923.

Plate XIII., Fig. 1.—Lake St. Clair.

Fig. 2.—Cuvier Valley and Mount Rufus.

Plate XIV., Fig. 1.—Lake St. Clair, Lake Laura, and Mount Ida, from Mount Olympus.

Fig. 2.—The Du Cane Range from Mount Olympus.

Plate XV., Fig. 1.—Mount Olympus from the Cuvier Valley.

Fig. 2.—Looking West from Mount Rufus.

Plate XVI., Fig. 1.—The Cuvier Valley from Mount Olympus.

Fig. 2.—Lake Petrarch from Mount Olympus.

Plate XVII., Fig. 1.—Mount Byron and Mount Olympus.

Fig. 2.—Lake Petrarch.

Plate XVIII., Fig. 1.—Cynthia Bay, Lake St. Clair.

Fig. 2.—View from Cynthia Bay, Mt. Olympus in distance.

Plate XIX., Fig. 1.—Mount Ida and Lake St. Clair from Eastern Slopes of Mount Olympus.

Fig. 2.—The Hut at Lake St. Clair.

(b) List of Works Referred To

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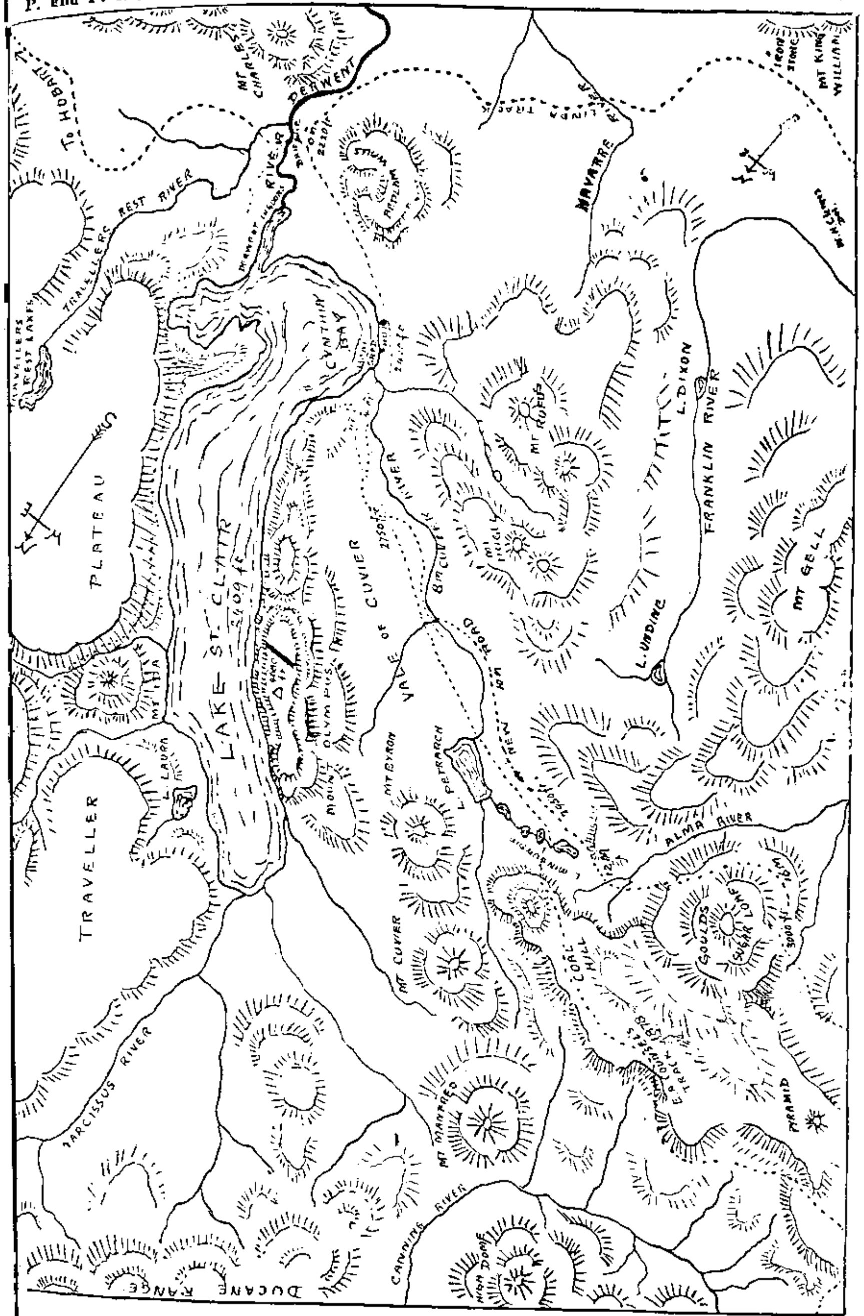

Sketch Map of Vicinity of Lake St. Clair.

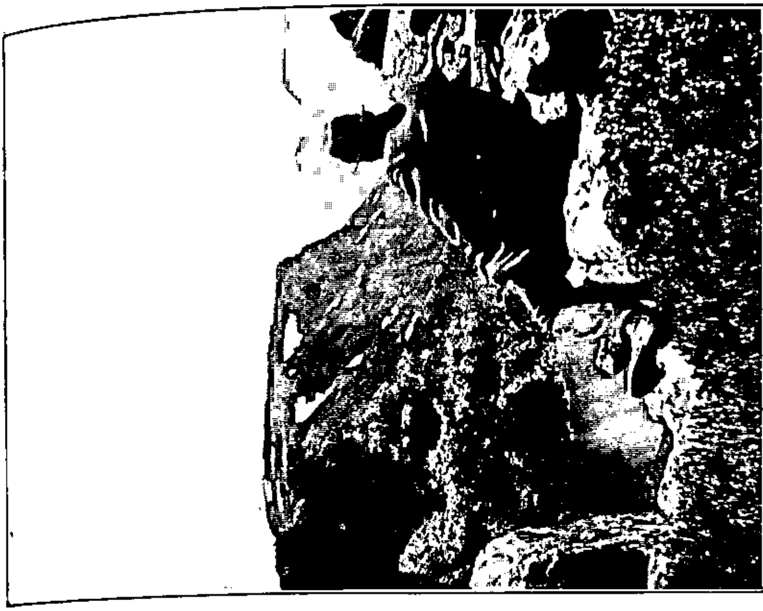

Fig. 1. On Mt. Olympus. Clive Lord, photo.

Fig. 2. Arriving at Lake St. Clair, Christmas, 1923.
Clive Lord, photo.

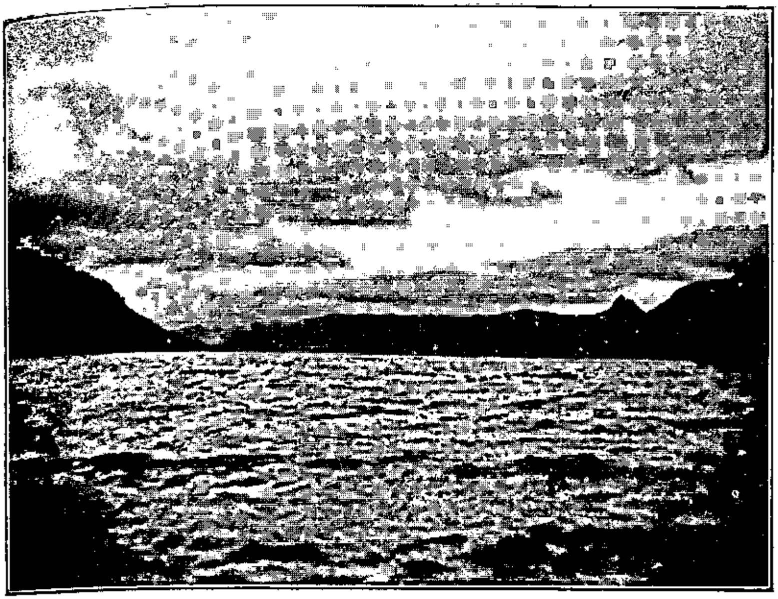

Fig. 1. Lake St. Clair.

Clive Lord, photo.

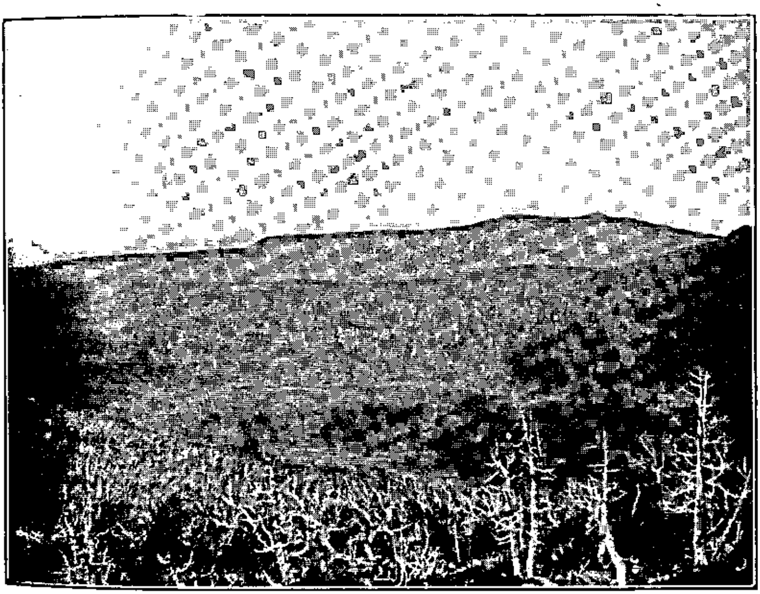

Fig. 2. Cuvier Valley and Mt. Rufus.

Clive Lord, photo.

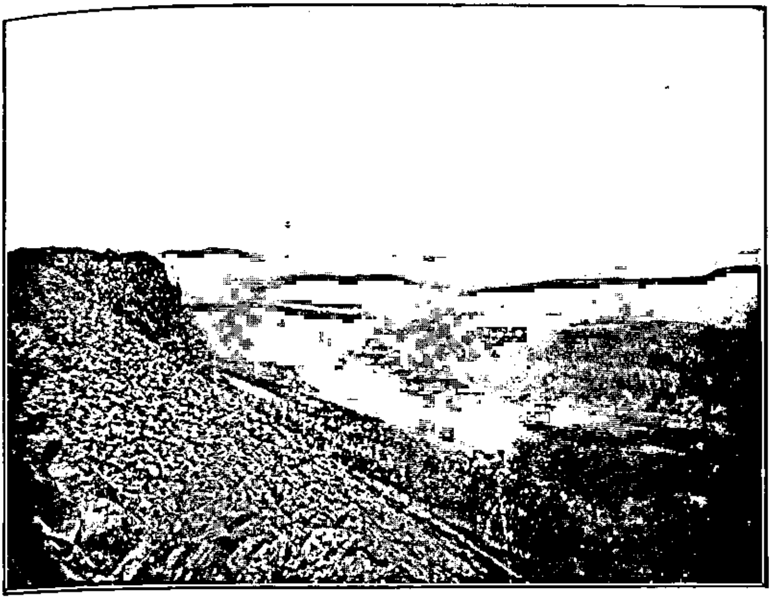

Fig. 1. The Cuvier Valley, from Mt. Olympus.
Clive Lord, photo.

Fig. 2. Lake Petrarch from Mt. Olympus.
Clive Lord, photo.

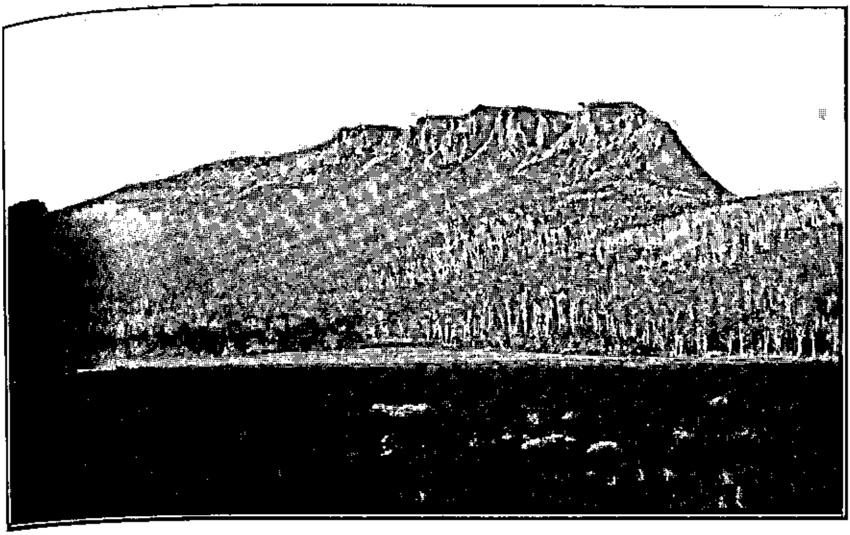

Fig. 1. Mt. Olympus from the Cuvier Valley.
R. C. Harvey, photo.

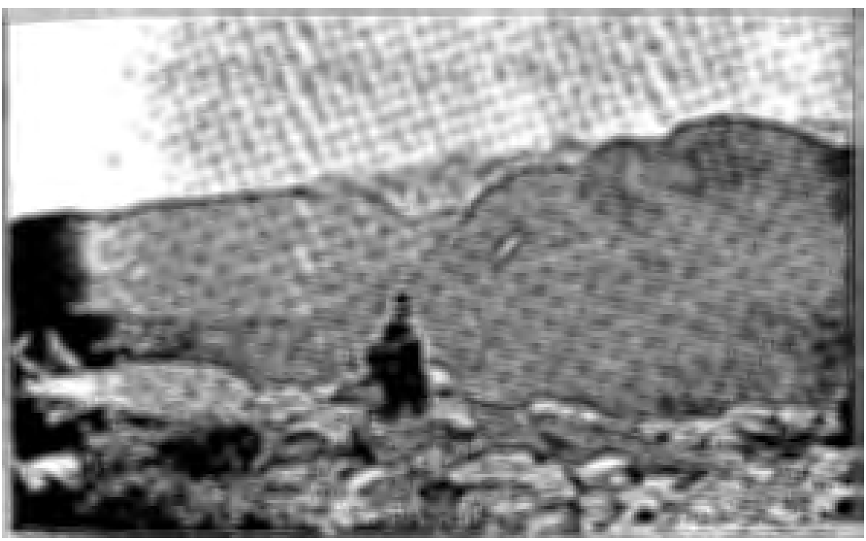

Fig. 2. Looking West from Mt. Rufus.
R. C. Harvey, photo.

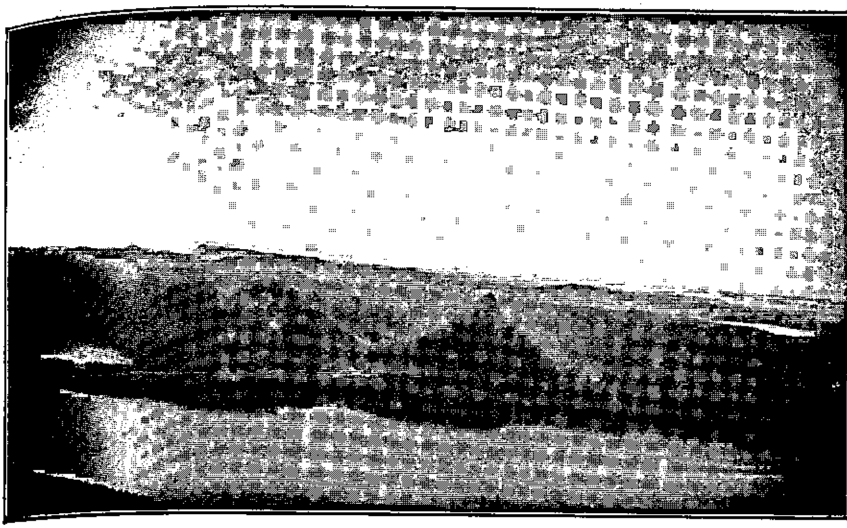

Fig. 1. Lake St. Clair, Lake Laura, and Mt. Ida, from Mt. Olympus.
F. B. Cane, photo.

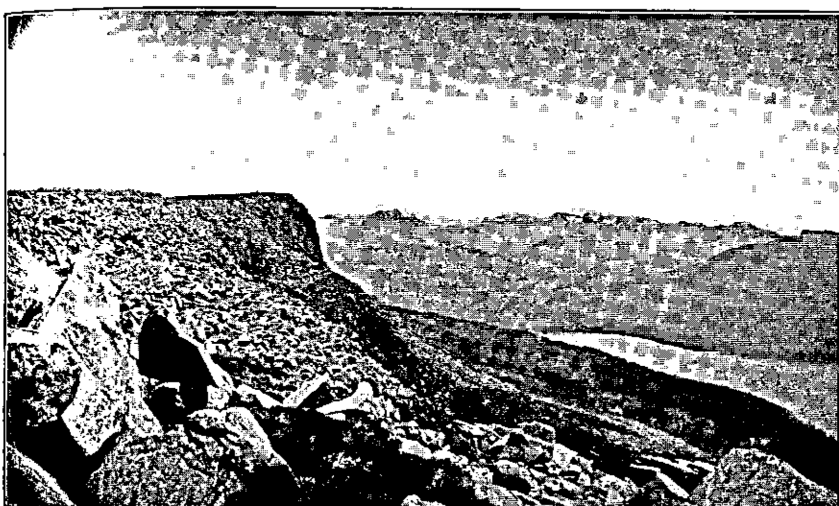

Fig. 2. The Du Cane Range from Mt. Olympus.
F. B. Cane, photo.

Fig. 1. Mt. Byron and Mt. Olympus.

F. B. Cane, photo.

Fig. 2. Lake Petrarch.

F. B. Cane, photo.

Fig. 1. Cynthia Bay, Lake St. Clair.
Clive Lord, photo.

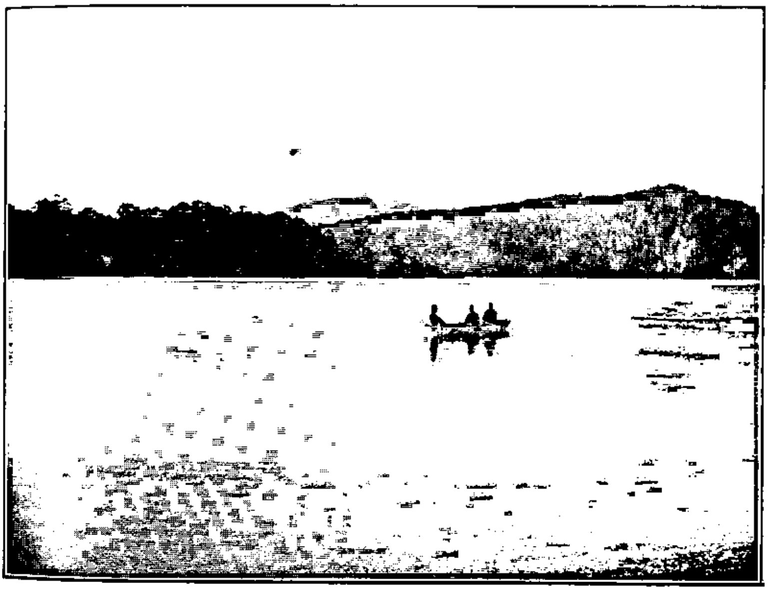

Fig. 2. View from Cynthia Bay, Mt. Olympus in distance.
Clive Lord, photo.

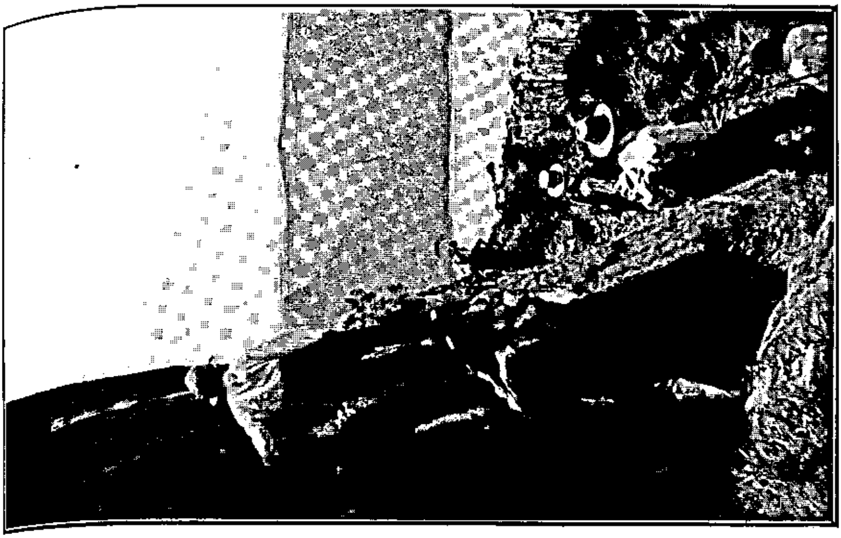

Fig. 1. Mt. Ida and Lake St. Clair from Eastern Slopes of Mt. Olympus.
R. C. Harvey, photo.

Fig. 2. The Hut at Lake St. Clair, Christmas, 1923.
R. C. Harvey, photo.