NATURE-STUDY.

A FIELD LESSON

AT

WERRIBEE GORGE, BACCHUS MARSH,

TO THE

PUPILS OF THE CONTINUATION SCHOOL

AND THE

STUDENTS OF THE TRAINING COLLEGE, EDUCATION DEPARTMENT, MELBOURNE.
NATURE-STUDY.

A LESSON IN PHYSIOGRAPHY.

AT THE WERRIBEE GORGE.

On Saturday morning, a special train, with two engines, took the pupils of the Continuation School and the Training College—numbering between 400 and 600—to a point between Bacchus Marsh and Ingliston to study physical geography. They alighted at a place described geologically as being part of the Ballarat lava plateau, which stretches beyond Portland, but which, to those unlearned in rocks and their story, seemed to be just good sheep pastures. The 400, or 600, as the case may be, were the boys and girls—some of a slightly larger growth—who are to be the teachers of the future, and who will teach a good deal less of what Attica was or was not, and a good deal of what Nature has to show to men and women in their immediate surroundings. Immediately upon leaving the train, Mr. J. A. Leach gave the pupils a lesson upon the broad geographical aspect, telling them that the ground upon which they stood was the third greatest lava plateau in the world—a fact that at once appealed to Australian patriotism and the passion for records. Mr. Leach described the lava plateau, and pointed out that they were upon the edge of the Melbourne basin—the lower lands between these and the Dandenongs—which was once the sea bottom, and out of which sea bottom volcanoes afterwards sprang, and are known as Mount Cotteril and Mount Misery. The pupils laughed at Mount Misery, not knowing, perhaps, that the early explorers who spent a miserable night in the lee of it without water regretted the foolish name given to it, and afterwards asked Governor La Trobe to rechristen it with his own name. But Misery it is—and Misery it will be.

Mr. Leach gave his lesson on the rocks, with little touches of humour that made it human, and little bits of other sciences that made for variety. He pointed out that the pines below them were the Murray pines that beautify northern sandhills, and that further down was a patch of real mallee, though how these things had detached themselves from their natural habitat and migrated so far south no one could conjecture. He pointed out that, in the Werribee pools under them, and in a quarry in the side of a green hill over against them, would be found proofs that this continent was once linked up by land with South America—and the proof was only little green minnows swimming in the water and the print of weirdly-named fern leaves left in the heart of the rocks. It seemed so little to prove so much, yet to the geological mind it was evidence more convincing than anything that has been sworn "upon the book" in a prosecution for Sunday-trading. He told them, as an aside, why Bacchus Marsh land sold as high as £1.30 per acre—because it was once the bed of a lake, until it broke out and emptied itself by another gorge below Parwan, but not until the springs oozing out below the plateau had carried down the potash and other chemicals that made
it so rich in plant life. "Do you know any other land," he said, "that sells for £100 an acre for agriculture?—£80? £60? £50?"—and at 50 an arm in a white muslin sleeve went up amongst that host of youngsters so depressed by the poverty of their homes. It was the arm of a girl from Bungaree.

Then, with the broad geological aspects of the position impressed on their minds, the 400 at least, or 600 at most, were taken down a hill a quarter of a mile steep into the wild Werribee Gorge to study its lessons in detail. To those who love the human elements in life, it was as strange a sight as the Werribee Gorge has ever seen. The boys were first—the boys are always first—down hill, and some, with a lively anticipation of favours to come, carried large boilers to make the tea for lunch. One round lunch-basket broke away, and went bouncing down the hills. The geologists, believing it to contain Cornish meat pasties from the cooking school, seized upon it as an illustration of glacial action—the progress of an irresistible body meeting things which believed themselves to be immovable. And after it had rolled down into the creek, it turned out to be not a pie, but a pine-apple.

The moraine of humanity, dribbling down the hill from crest to foot, was a picture—all young, all straight as the rushes in the Werribee underneath, all full of youth and zeal. If the spirit of the gorge could have so spoken—so wild a gorge must have its spirit—it would have said, "What is this that has come to me in the new century? I knew them long ago, the race that has gone, but they wore furs, and were not pink, and blue, and white. Then the geologists came, and discovered that I had one of the most interesting haunts in the world—so interesting that no geologists anywhere else would believe in my glaciers, that look like rocky plum pudding or haggis made of quartz, and granite, and basalt. When the geologists fell in the water and illustrated the laws of displacement and buoyancy, they only exclaimed gutturally—they were just mammals. But these are different; most of them shriek and make echoes that have slumbered ever since the glaciers shot the chute down here."

Looking down the Gorge.

A class is at station No. 8, on the left of the view. A class at station No. 7 is a little lower down.
In the bed of the river—on the bedrock of the continent—the hundreds were formed up into classes, and at ten different points—each telling its own physical facts in the conformity of a world—ten different teachers were stationed, and they pointed out the facts that geology had to show until all the classes had heard every teacher's story. Some were from the Field Naturalists, some from the schools, some local men, who had studied the wonderful gorge for a lifetime, and were just beginning to grasp all its story. Mr. C. C. Brittlebank, who has hands that can chop down trees, or milk, or paint in colours, and with most wonderful fidelity to nature, the most delicate of insects, the most beautiful of birds or apples, rich in the colour that autumn, the master-painter, gives to fruit, speculated as to the age of the gorge. It took about 1,200,000 years for the Werribee to wear its way down to its present bed. The odd 200,000 years did not seem to matter—the pupils were already outside the realm of their young imagination. Once, when Mr. Brittlebank was studying the rocks here, an old lady asked him what he was looking for. "For traces of ice glaciers," he said, "avalanches of ice." "It's no use," the good lady assured him, "I have been in the district for 40 years, and never saw any glaciers about here—the ice doesn't last a day." The teachers were Messrs. T. S. Hall, T. Brittlebank, G. B. Pritchard, A. O. Thiele, C. C. Brittlebank, D. McLennan, O. and J. W. Gray, R. Lidgett, and R. W. Armytage. They told how and why the gorge had been carved into its present fantastic outlines, and the evidences of glacial action were plain enough for all to see. They showed the tracks of the glaciers—how the tremendous mass of ancient ice, carrying stones and litter, had moved down over the bedrock, cutting its softer seams into deep-polished grooves, riding over and rounding off its harder ridges. They speculated as to the origin of these glaciers, which have left so few footprints in Australia. They had not come south from the great divide, then a greater divide, because the evidence of movement was all on the southern slope of the gorge. They had not drifted from the Antarctic and been cast up upon the shores of the old inland sea, which is now the Melbourne land basin, because there was no evidence that the Melbourne rock no marks of barnacles, or worms, or any of those sea animals which would have left their traces for ever upon submerged rock. So theory was reduced to the existence at one time of a mountain range further south than the present land, from which the glaciers slid into the Werribee Gorge. Where are those mountains now? The rock that formed the pinnacles is now ocean floor, the skate skates over it, and big-eyed cuttlefish see no glimmer of daylight in its depths.

It was both a picnic and a lesson in physiography, not the less valuable a lesson because it was associated with a picnic in one of the most interesting localities in Victoria. Most of the pupils brought their own luncheons, and, for some, a lunch was served from the kitchen of the Continuation School, where there are cookery classes. The lunch was as good as the appetite, and showed that the girls, at any rate, learn something beside geology. Before leaving the gorge, Mr. Frank Tate, the Director of Education, said how pleased he was with the results of the excursion, and thanked Mr. Hocking, Mr. Leach, and others of the staff, for the success of their organization, and the pupils for their attention. Cheers were given for the gentlemen who had so kindly given up the day to teach a lesson, which was fascinating because of its reality. The Werribee for that occasion was ever so much more interesting than either the Amazon or the Ganges, or maps. Professor Ewart, the new lecturer on botany at the University, was asked to speak. He said, "I have never seen anything like this before, or like that," as two boys with a boiler—which had obligingly rolled down hill, but refused to roll up again—all fell in the water together.

The residents of Bacchus Marsh are anxious that their famous gorge should be a national park. It is fit for nothing else than to be a picnic-place, a picturesque sanctuary for Nature, and a continuation school for the teaching of physical geography. Though not permanently devoted to this purpose, there is little chance of its being used for any other—the old-time glaciers have seen to that.

Donald Macdonald in The Argus.

A SCHOOL EXCURSION TO WERRIBE GORGE.

In the geography course at the Continuation School, a series of field lessons is included as the most important section of the work.

The pupils see things for themselves, and discover a meaning in the features and objects lying about them. They delight in this original investigation, and, although these excursions are voluntary, there is always a very large attendance.

For successful nature-study or geography work, the first requisite is to let a pupil see that there is something worth looking at, and worth thinking about, in his own country, and in his own surroundings. Then he will look and see for himself. This excursion was undertaken to enable the pupils to stand on classic ground, to wander where scientific leaders have worked. For the future, they cannot think of their intensely interesting country as being unworthy of study, and as containing nothing worth seeing.

Of course, if it became necessary to travel to the Werribee Gorge, and such distant places, to see something to interest us, nature-study would quite fail. We find abundance of good material in our school surroundings. An excursion such as this only deepens the desire to further examine our own district by letting the pupils see that their own land has something worthy of investigation by even the greatest scientists.

Before visiting this famous wonderland of the Werribee Gorge, fortnightly excursions had been taken nearer home. Sedimentary rocks had been studied on many outings, and their mode of formation determined. Evidence of a cooling, wrinkling earth had been obtained from the foldings of the older sedimentary rocks seen in the various cuttings and creek sections about Melbourne. Lava had been examined in quarries and creek cliffs; and river work at various stages studied on the Yarra, Saltwater, and on several creeks not far from the school, as well as in the school yard after heavy rain. Canyons had been seen in the making at Coburg, East Kew, and other places; coast features and the sand drift, together with the
formation of sand dunes noted at Port Melbourne; marine erosion at Beaumaris; coastal plains, old plains, young plains, flood plains, river terraces, lakes, and meanders, observed, so that geography has become a living subject closely related to the lives of the children—a subject in which knowledge is gained at first hand by the pupils themselves.

During the study of Victoria, the most important of all countries for us, many references were made to Bacchus Marsh, scientifically the most famous spot in Victoria or, indeed, in Australia. Many inquiries were made by the pupils as to why an excursion was not undertaken to give them the opportunity to see for themselves a famous place. Financial reasons and the difficulty of getting to the exact locality (five miles from Bacchus Marsh) without loss of time put it out of the question. However, this year the increase of the number of pupils to 400 rendered the chartering of a special train possible. The persuasive powers of the Principal, Mr. Hocking, secured permission from the Railway Department to detrain at the desired spot, so it was decided to leave the matter to the pupils. Not one in the school objected to paying half-a-crown for a geography lesson in the Werribee Gorge. Splendid autumn rains had clothed that beautiful district with green, and everything was favorable for a good field lesson.

It was intended to be an ordinary school excursion, the only difference being that the whole 400 pupils were to go, instead of the usual 200 taken at one time—the junior pupils, of course, having their excursions apart from the seniors. Also, on account of the large number and the difficulty of movement in the narrow, rock-strewn canyon, the pupils had to be divided into groups, as it was not possible for a large number to see properly in a small space. It was hence impossible for me to do the whole of the teaching myself. It was arranged that the school staff should accompany the excursion, and that geologists, and those interested in nature should be requested to assist by taking charge of the ten stations previously selected (as explained later).

Dr. Smyth, the lecturers, and the students of the Training College were then invited. It was arranged that Inspector Dean, several teachers, and a party of pupils from Ballarat should join us at Bacchus Marsh; and that a small party of pupils from the Burnley Horticultural Gardens, with their teacher, Mr. A. G. Campbell, should also accompany us. Many metropolitan teachers, as well as several parents and friends, brought the party to the large number of 550.

No. 1.—Murray pines growing on the edge of the lava plateau.
The boulder below the two sheoaks is at the site of the main introductory lesson.
Educationally, it was a strong party, comprising, as it did, the Director of Education; Mr. Fleming, M.A., Chief Inspector of Wellington, New Zealand; Mr. Hocking, B.A., principal of the Continuation School; Dr. Smyth, principal of the Training College; Inspectors Fussell, M.A., and Dean, M.A.; the lecturers of the Training College; the staff of the Continuation School, about 30 adult teachers; over 70 College students; 400 Continuation School pupils, mostly teachers in the making; and about 30 junior teachers.

Scientifically, it was equally strong, for it included many members of the Field Naturalists' Club; Dr. Ewart, Professor of Botany, Melbourne University; Messrs. T. S. Hall, M.A., lecturer in Biology, Melbourne University; Mr. Charles French, jun., Assistant Government Entomologist; Mr. G. B. Pritchard, F.G.S., lecturer in Geology, &c., Working Men's College; Mr. C. C. Brittlebank, the famous naturalist artist, geologist farmer of Myrniong; Mr. T. Brittlebank, brother of the above and an ornithologist of repute, also a naturalist farmer; Mr. A. D. Hardy, F.I.S., Lands Department; Mr. Donald Macdonald, whose Nature Notes are so much appreciated by all Victorian nature students; Mr. A. G. Campbell, Horticultural Gardens; Messrs. A. O. Thiele (East Brighton School), R. W. Armitage, and others.

Had the excursion been a week later, two trains would probably have been necessary to carry the large number who wished to go, as it grew so quickly from an ordinary school excursion into the biggest school journey yet attempted under the auspices of the Education Department. It is a matter for congratulation that men of scientific standing are recognising our efforts in this work, and are so ready to help us in getting it and keeping it in right channels.

By special arrangement, the train stopped on reaching the top of the plateau after its long climb up the great horse-shoe bend. Bacchus Marsh station is 343 feet above sea-level. Where the party detrained was 1,180 feet above sea-level. Work began immediately the empty train moved off. The substance of the four lessons on the plateau is included in the following notes.

On looking around, it was seen that the party was on a very level, but narrow tract of volcanic country—a lava plateau, the long lava flow from Mount Inglishton. In front lay the Werribee Gorge, behind was the Parwan Gorge.

In rainy weather, the country becomes a sheet of water which, overflowing, trickles down into the Bacchus Marsh Basin. Thus this area represents a young plain—the streams are narrow and steep-sided, and the water-shed is a swamp. The drainage water has not yet cut even a gutter or any water-course in the central part of its
almost level surface. Being composed of recent volcanic rocks, it is devoid of trees.

A very short walk, and the party stood in amazement as the beautiful view of this wild gorge burst on them. Below, far below, was the river. What a change from the dead level just behind us! A few yards up stream, the country was rangy and well timbered with eucalypts, &c. Here, on the plateau, there was no timber; but, on the side of the valley, could be seen trees of great interest. As seen in view No. 1, the Murray pine flourishes in this sheltered spot. It is not found south of the Divide at many other places. Also, in this same district, within a few miles, is a patch of wild mallee scrub. Most things of interest in Victoria seem to be represented at Bacchus Marsh.

A move to a prominent point enabled us to look either up or down the Gorge. Seats were quickly taken just below the two sheoaks shown on the point in view No. 1. This was a natural lecture theatre, the seats consisting of small columns of basalt at the edge of the lava flow. Here, the main introductory lesson to the whole party was given by Mr. Leach.

Looking up the Gorge, the hard bed rocks, consisting of very much folded shales and sandstone had withstood the weather, and given steep, almost vertical sides to the canyon. Still further up on the other side could be seen the level basalt (lava) plateau of Myrniang—a plateau similar to the one we were seated on. On the hill almost opposite our point, a small patch of lava could be seen capping the summit of the hill, and preventing its being worn away; since the lava cap is harder than the rocks around and under it.

Straight before us, there was no lava cap. Hence the country was much worn down, and had been dissected into a series of ridges and valleys, and stood at a much lower level (see view No. 3). Our side was protected by its lava cap. We were on a young plain. Opposite was an "old plain," and yet both were obviously of the same age; so "old" and "young" as used by geographers are seen to be adjectives of condition. That is, they do not refer to age in years. It is possible to get an "old" plain in soft rock actually younger in years than a "young plain" in hard rock. The plain opposite had its drainage perfect. Each watershed was a well-marked ridge, and no lake or swamp was on it. On the other hand, the right bank had no definite watershed, and...
it was a series of pools and small lakes in wet weather—a young plain.

Consider now the volcanic rocks we were on. They reached their present position in a liquid state, flowing here from Mount Ingliston. The question is then: "Why did they not flow on, and fill the deep Werribee Gorge so far below our feet?" Necessarily, that valley was not there at that time. It has been formed since. The query now is, "What formed the gorge?" There is but one answer—the river. The water running down from the plateau from an elevation of over 1,000 feet to the basin beneath acquires great velocity. It rolls and carries great quantities of stone, sand, mud, &c., along with it. You will see some of these rolled stones directly. With these, it file away and wears away its bed, constantly deepening it, until, at length, the bed will acquire a gentle grade downward. Thus the Werribee has worn out the gorge before us, and the Parwan the gorge behind us. Neither stream has yet deepened its bed to the desired grade, so each is, in this locality, doing the first stage of a river's work—deepening its bed. Further down the Werribee has, as you can see, passed that stage.

The little patch of lava seen opposite also adds further evidence that the river has cut this valley since the lava came; for that patch was once continuous with this lava. So was the top of Trig Hill which you see some distance down the valley (view No. 8). The river has cut between these two small portions and the main plateau, and they are left lying out from it. Hence they are called "outliers"—evidence of the former greater extent of the lava plateau.

But the great interest of this famous spot does not lie in the mere fact that it is a river canyon. The cutting down of the river has revealed the rocks beneath. Under the lava is seen a series of sands, clays, and gravels—old lake deposits. At the base of these is, as you can see, a tunnel put in by gold-miners to discover, if possible, an old river valley in the hope of finding gold in it. In many parts of Victoria, miners have discovered, under the lava cappings of the hills, that gold-bearing river gravels exist. The former hills at the side of the old valleys, down which the lavas flowed, have been removed as they were softer than the hard "bluestone" (lava). Thus we see a fulfillment of the prophecy that "every valley shall be exalted and every hill shall be brought low." Snowden, the highest mountain in England and Wales, is an old lava flow in an ancient river-valley. So are the Dargo High Plains, Mount Useful, the Kangaroo Grounds near Eltham, and many other Victorian mountains. All over Victoria, teachers will see lava flows ending suddenly on the side of a valley,
and they will know at once that the valley has been formed since the lava came there.

Under our feet at Bacchus Marsh, the old lake deposits rest on a peculiar series of clays and sandstones. These in, in many places, large boulders and angular stones are embedded in the fine clay. Evidently this is not a water deposit, for there is no sorting of the materials. Running water does not leave clay mixed with large boulders. On examining the boulders and stones, grooves and scratches are seen on them, and they are also ground into flat faces or facets. Often the edge bounded by two of these flat faces is keel-like. "Water-worn" stones are not faceted. They are rounded and smoothed, but not grooved or scratched. Thus, some other agent has formed these beds. Ice is the only agent known that could perform the work represented here.

At first, it was thought by some that floating marine ice—icebergs—was responsible, but the floors and sides of the valley where the ice passed over the old bed rock are grooved, rounded, and deeply scratched, where stones frozen into the bottom of the ice have been dragged across it. The stones are also scratched as they are forced over hard rocks in the floor of the valley. They are often knocked loose, turned over, and again frozen into the bottom of the glaciers, so another side is faceted and scratched. Further, there are no remains of marine organisms, worm tubes, &c., on the boulders, so it is evidently land ice that has performed the work.

As to where the ice came from, we cannot yet speak with certainty. Professor Gregory inclined to the view that it came from the Central Divide, and moved south. More evidence on this point is necessary, as the direction of the grooves and scratches points to a probable southern origin. It has been suggested by Mr. C. C. Brittlebank, who has examined these deposits very carefully, and has collected a mass of evidence, that the glaciers probably originated in the old land to the south of Western Victoria which has disappeared, for, in those days, and indeed long afterwards, Australia was much more extensive than at present. This is shown by the fact, amongst many others, all pointing in the same direction, that the little minnow or mountain trout sporting in the waters below is also found in the streams of South America. It is a fresh-water fish and does not go to sea. Also, the marsupials so common once about here, the possums found in those trees, the kangaroos, and bandicoots find, in South America, their nearest relations outside the Australian region. The evidence of l campreys, earthworms, frogs, &c., all point to an extension of Australia to the south. Evidence of other extensions will be given directly.

Interesting as it is to find evidence of glaciers in a country now quite free from permanent ice, it is the particular age of these rocks that lends such great interest to their presence. Of course, it is not possible to fix their age in years; but they were formed in the "dim distant past." Fortunately, there is conclusive evidence as to the period in which they were formed.

From where we are seated, you can see that rounded green hill, three or four miles away (view No. 3). It has a quarry on the side of it. In this quarry, in a fresh-water sandstone which is used for building stone (the old Treasury in Melbourne is built of stone from that hill) are found the impressions left by a fern-like plant Gangamopteris (Gr. pteris, a fern). These sandstone beds rest on the glacial rocks, and so are younger. The same fossils are found in New South Wales in rocks resting on beds of coal. Coal is also found above these fossil-bearing rocks. Hence this fossil belongs to the coal period. So here in Victoria, since we find glacial deposits below the fossil-bearing rocks and also above them, as Mr. C. C. Brittlebank assures me, these glacial rocks were formed in the coal period. This fossil—the remains of a land plant—is also found in India and in South Africa; so here is some evidence of other extensions of Australia, a north-westerly extension to India, and a westerly one to South Africa.

We have seen that Victoria had glaciers, and in the coal period. Now, to account for the presence of great deposits of coal in many widely-separated countries of the world, and all formed in this one period, some scientists assumed a universal tropical climate—hot and moist, in order to explain the luxuriant vegetable growths necessary for these enormous coal deposits. Bacchus Marsh supplied the death blow to that theory, as it was the first place in the world where glacial rocks of that age were discovered. Hence, outside Victoria, Bacchus Marsh is a very famous place. Victorians, needless to say, have hardly heard of it. "Distant fields look green," so America is the wonderful country. Fortunately, nature-study is removing that idea.

These glacial rocks are not the oldest rocks found here. The rocks seen in that steep part of the canyon are much older. They form the bed rock of the district. They consist of sands and clays—sediments deposited in the sea. long, long ago, in a very early period of the earth's history. As the earth's centre lost heat and contracted, the crust, being already cold, could not contract; hence the rocks forming the earth's crust must wrinkle. The original horizontal, or almost horizontal, layers of rock—strata—must fold up and down. The up folds—saddles—have the legs sloping against one another, hence they are called anticlines (anti, against; cline, a slope). The down folds have the layers sloping into one another, and are hence called synclines (syn, together). The wrinkling, pressing, and twisting has hardened and altered these old sediments, so that the sands have been altered into hard sandstones, and the clays into shales, and even into slates. You have seen some of these wrinkled and altered rocks before; but you will see them up in the canyon part of the gorge again directly.

Just to sum up the history of this spot. First, the old sediments deposited in a sea long, long ago. Then these were folded and wrinkled, when the true fold mountains of Victoria were formed. These were worn down by river action—the action of running water. Then great glaciers covered this part of the country, and left over 1,000 feet vertical thickness of the well-marked glacial drifts in the neighbourhood of Bacchus Marsh. They also occurred at Heathcote, in the Loddon Valley, and other places in Victoria. Long periods afterwards, a large lake covered this district, and thick deposits of sand, gravels, &c., were laid down on its floor. Then the lava flows, so common in Victoria (for Victoria is one of the great lava countries of the world), flooded the land, and the flow we are sitting on even kept on down the old cliff face, and reached the basin of Bacchus Marsh. Next, the surface waters flowing from the
plateau to the basin worked out the narrow gorge—a work that has not yet been completed.

To connect this romantic spot to our school life, a general view was now taken of the country around. Across the gorge, a little to the west, and some miles away, stands Mount Blackwood, 2,340 feet high. It is a fine volcanic cone, a few miles south of the Main Divide. A few miles along to the east is Mount Bullen­garook, a similar volcanic mountain. Next, on the Main Divide is the bold mass of Mount Macedon 3,300 feet, with the Camel’s Hump, probably the site of the old vent plugged with harder rock. It is said, by Professor Gregory, to be the base of an old volcano whose lavas, instead of spreading out in thin sheets like the lavas about us, formed an immense dome. The higher and softer parts of this have been removed by weathering until the base or stump of the old volcano has exposed. Further along are the Hume Ranges, and round to the east is Mount Dandenong, a similar volcanic mass to Mount Macedon. Between us and Mount Dandenong lies the low Melbourne Basin, most of the western half of which is covered by volcanic rocks discharged from numerous volcanoes. Several of these small volcanoes can be seen. Mount Cotteril is the square-topped one on the plain, and Mount Misery is a little north of it; its bare, brown lava-capped top showing distinctly.

That basin from here to Mount Dandenong was the floor of a sea, when the rocks in which we found the fossils at Royal Park, at Keilor, and Beaumaris, were being deposited, and this scarp was the southern coast of Australia. An uplift of the land has caused the sea to retreat, and this district below—a portion of the great valley of Victoria, has become dry land. To the south of us, the You Yangs can be seen—a solitary granitic mass rising from the plain. This mountain was ascended by Flinders, so that he could obtain a view of the country. To the west of that are the Anakies—the Three Sisters—and the Brisbane Ranges. This joins on to the plateau which continues to and beyond Ballarat; while the lava plain, with scarcely a break, sweeps on until it reaches away past Portland.

No. 5.—Looking up the Gorge.

This is near the beginning of the canyon part near station No. 6. Note the angular blocks broken off. An irrigation aqueduct is shown on the left.
Several questions were asked and answers suggested.

A move was now made down to the lunch ground in the bottom of the valley, where three coppers, transported by sturdy boys, were already boiling. The steep climb down was safely accomplished.

The hard climbing, the bracing air, and the glorious sunshine had developed a big appetite, so that lunch was vigorously attacked. For the visitors, a hamper had been prepared by the cookery students at the Continuation School, and, to judge from the way in which Cornish pasties, sausage rolls, sandwiches, cakes, &c., disappeared, the work there has reached a high standard of excellence. The lady teachers, prefects, and elder pupils worked with a will, and soon everyone was supplied with tea.

The lecturers for the ten carefully selected spots to be examined by the pupils as evidence of the mode of formation and structure of the Gorge and its "storied" rocks were then acquainted with the plan of campaign. Each was to point out the one or two features before him, explain them clearly and definitely, and finish exactly to time. The result was most satisfactory in every case, the attention of the pupils was secured, and highly profitable work done.

At No. 1, Mr. T. S. Hall showed a cliff of typical glacial rocks, contrasted these with water-formed rocks which had been studied elsewhere. The conclusion was irresistible as to the agent of formation—ice, and land ice necessarily. Glaciated stones were picked out of fine clay and examined.

At No. 2, Mr. D. McLennan, State School, Myrniong, dealt with the large boulders rolled down by the stream, contrasting river and glacial stones.

No. 6.—A class at station No. 7.

At their feet is the smoothed and grooved bed rock over which the glaciers passed.

No. 3 enabled Mr. A. O. Thiele, State School, Brighton East, to lead up to the formation of a big gorge from the study of a small lateral tributary.

At No. 4, Mr. Pritchard, F.G.S., a leading Victorian geologist and palaeontologist, showed large boulders of granite embedded in coarse glacial conglomerate (pud-
Some of these large boulders were well grooved and scratched. The essentially glacial character of these rocks was emphasised.

At No. 5, Mr. C. C. Brittlebank, who knows this famous gorge from end to end, pointed out the stratified character of some of the glacial drifts. He was also able to show evidence of the probable southern origin of these deposits.

At No. 6, Mr. T. Brittlebank, at the entrance to the canyon proper, showed how its different form was due to the marked difference in the structure of the rocks. The old folded rocks are traversed by well-marked, parallel cracks called joints (view No. 7). The angular blocks of rock break away (view No. 5) giving a very definite and characteristic outline to the gorge. The sides are now no longer sloping, and it is almost impossible to scale them. One face of 615 feet frowns down on the awe-inspired student. Nature is grand here, and man feels his puniness.

At No. 7 (views Nos. 4 and 6), Mr. J. W. Gray, Continuation School, showed that the floor of the valley is rounded, grooved, and striated. This is the famous "roche moutonnée," so called because, according to some, the sides of a valley, being rounded, look like sheep's backs (moutons). According to others, moutonnée means "curled," the resemblance being to the rounded curls in a lawyer's wig. Models of this roche moutonnée have been made and sent to different museums. It is a valuable bit of evidence, famous in the scientific world. The pupils are seeing material on which original work has been done.

At No. 8, the valley is wilder still, and the folded rocks are showing the severity of the enormous pressure they were subjected to when the crust of the earth wrinkled. Synclines (downfolds) and anticlines (saddles upfolds) follow one another rapidly here. A tributary creek falls into the main gorge over a fine example of a syncline, the gently-curved (concave) stratum of much hardened sandstone forming the creek bed. A few yards below this, the thick glacial deposits rest upon the side as well as on the floor of the ancient valley in which they were formed. Mr. R. Lidgett, a well-known local naturalist was in charge of this spot.

At No. 9 (view No. 7), Mr. Oliver Gray, mining geologist, from Wedderburn, pointed out a well-marked anticline, where the rocks had been strongly cleaved to form slate, due to the enormous lateral pressure. The almost vertical joints (the big parallel cracks) can be clearly seen in view No. 7, which also shows the planes of slaty cleavage at right angles to the joint planes, and across the divergent strata. These rocks would split into slates—the planes along which they would split are not the planes of the original bedding, but they are formed later by the great pressure.
No. 10 can be seen indistinctly in the centre of the same view. The river here rushes through a narrow "gut" in the older much-folded and crumpled rocks, and many of the party stood with one foot on either bank of the river. The water can just be seen rushing out at the foot of the "narrow." Mr. R. W. Armitage, Continuation School, was in charge of this—the furthest spot dealt with. Here also was a fine example of a pot hole worked out by the river in the hard slates by causing stones, &c., to revolve rapidly.

The plan of procedure adopted was that twelve minutes were allowed to a class at each station. On the first signal given by bugle, each class gathered round the class teacher. On the second, they set off for their appointed stations. The next signal set the ten lessons in full swing. At the end of twelve minutes, another signal stopped the work. Classes at stations 5 and 10 turned back to stations 1 and 6, respectively. The other classes moving up one, the lessons went on as before. Another twelve minutes sent the classes again from 5 and 10 back to 1 and 6, and the others moved up one as before.

After five lessons, the lower classes (1-5) changed to the canyon part of the gorge, while the other classes (6-10) went down to stations 1-5. The same programme being repeated, each pupil was able to visit the selected stations. After the ten lessons, the retreat was sounded, and all flocked back to the luncheon ground, where full justice was done to a second hearty meal. Each child had taken two meals and his own mug with him, so that the catering gave no trouble, other than the supplying of tea. Three large coppers were brought by train and carried by the boys down to the river and back up the precipitous scarp. One pair of boys showed particular grit in sticking to their heavy burden after it had rolled them over into the river. They carried it right up the bank, and over the plateau to the railway line.

Tea over, the bugle summoned all to gather; and view No. 8 shows the party being addressed by the Director, Mr. Tate. In a very happy speech, he expressed his pleasure at the great success of the day's outing, thanked Mr. Hocking, Dr. Smyth, Mr. Leach, and the staff of the school for their organization and the work done, and complimented the children on the great interest they had taken, and the fine attention they had paid. He
also thanked the gentlemen who had given up the after­
noon's enjoyment to take charge of a station, and repeat
their interesting lesson. He asked the pupils to show
their appreciation of the work of these gentlemen by
giving three hearty cheers. This they did with great
gusto.

Professor Ewart addressed a few well chosen remarks
to the company, eliciting further cheers. With many
wild attempts at a real Australian cooey, the party faced
the steep scarp that stood grim and seemingly vertical
between it and the railway line.

The behaviour and steadiness of the pupils elicited
remarks of warm approval from the visitors. From the
beginning, the behaviour on these field lessons, which is
but a reflex of the school discipline, has been excellent.
It has sometimes happened that I have been alone with
about 200 pupils, but they are interested and are out
for business, so that it is always a pleasure to take
them afield. Of course, more detailed and more thorough
work could be done with a smaller number, say, 20 or
25; but, taken even in classes, at least ten visits would
be necessary to let all see one locality. Under that plan,
it would not be possible for each to get more than two
or three lessons a year. It is preferable to let the pupils
see a large number of localities and go more often, al­
though they perhaps derive a little less benefit on each
single excursion.

The excellent organization for the safe transport of the
large party was the work of the principal of the Con­
tinuation School, Mr. Hocking, while the field arrange­
ments were, as usual, in the hands of the teacher of ge­
ography and nature-study. The Lady Principal, Miss
Robertson, and the other members of the school staff
did yeoman service in carrying out the details of transit
and refreshments, and in managing the classes under
circumstances far from normal. The gentlemen in
charge of the stations handled their interesting matter
in a thoroughly effective manner, adding much to
the profit derived from the outing, and to the knowledge
of the pupils. All passed off smoothly, and no accident
happened to mar the recollection of what undoubtedly was
to all a memorable day.

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