

ART. IV.—*Geological Notes on the Gehi and Indi Rivers  
and Monaro Gap, Mount Kosciusko, N.S.W.*

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[Read 7th May, 1896.]

The portion of New South Wales referred to in this paper is comparatively little known, and therefore it may be advisable to make a few remarks on its topography before entering upon its geological features. By reference to the map submitted, which with certain alterations and additions is a copy of that published in 1881 by the Department of Lands and Survey of this Colony, it will be noticed that opposite the Bringeinbrong homestead the main stream receives a large tributary called the Little Murray, Swamp or Gehi River. From here to its source it is known as the Indi and on the east for some distance is flanked by the Youngal Range which runs to Mount Kosciusko and forms the divide between it and the Gehi; on the west by a range running to Mount Pinnibar in Victoria. On the east of the Gehi are many subsidiary spurs of the Dargal and Bogong Mountains, from which among others come its affluents, the Swampy Plain, Khancoban, Black and Gehi Creeks. Near its junction the river flows through the rich grassy flats of the Bringeinbrong and Khancoban Runs, but about ten miles higher up the valley rapidly narrows and the stream is more or less confined between steep gorges. The country between here and Groggin on the Indi, some thirty miles away, is uninhabited, but huts at Black Creek and Gehi River are used by drovers and travellers generally. Groggin has three inhabitants, the stockman of the run and two selectors on the Victorian side. From here the Kosciusko track crosses the Snowy and Leatherbarrel Creeks and their divides, which are spurs from the main peak, and branches off north at Monaro Gap, six miles from Mount Kosciusko, at an altitude of 5900 feet.

On the geological map of New South Wales, published in 1893, most of the country bordering on the Gehi and Indi Rivers is coloured as Silurian with a little granite some distance to the



east. As far as I have been able to discover, however, the geological features of the greater portion of the district have not yet been described. In his "Southern Gold Fields," p. 125, the late Rev. W. B. Clarke, M.A., F.G.S., etc., briefly speaks of the country between the Indi and the Muniong Range as granite and slate with dykes of porphyry from the subjacent granite, and near the summit the slate transmuted into an imperfect gneiss. The map published with the volume does not delineate the features of the country on the west of the Muniong Range and as the names of localities have since been changed it is exceedingly difficult to trace his course, but judging by the description given on p. 121, he appears to have followed the Snowy Creek up to the point opposite Leatherbarrel ford which is probably identical with his Woolayian, then along the present track to Burramungee (Monaro Gap?). Tangaruccan, spoken of on p. 138, may be the place now known as Tom Groggin or more commonly Groggin, and Piaderra also somewhere in the same locality. As regards that portion along the Groggin track the boundaries shown on the geological map will require a little variation since, with the exception of one limited portion, the whole area consists of various kinds of granite. In the following paper I shall endeavour to give a brief outline of the general geological features on this and the Kosciusko track as gathered during a hurried journey along it. Time forbade a careful examination of any particular locality, so the observations were necessarily general and there are several portions, more especially near the "Gehi Wall," that are highly interesting and worth careful study.

The Victorian township of Towong on the Murray River lies at the northern termination of the Mount Elliot Range consisting of granite and mica schist with highly auriferous quartz veins and reefs. A flat about a mile and a half wide separates this range from those in New South Wales and is a rich alluvium several feet deep with a sub-stratum of sand and gravel containing pebbles of granite, slates, mica schists, quartz, quartzite, etc. For some eight miles the track follows the valley of the Little Murray, then turns to the east to cross a low range forming the Khancoban—Black Creek Divide. The rock is a fine-grained, pinkish-grey granite with much orthoclase and quartz, but little



mica. It is greatly decomposed, forming a cold, poor soil of little depth, mainly of siliceous fragments with numerous pieces of rose quartz. The Black Creek contains granitic detritus only and from this point a plateau rises gently over a light grey biotite granite, with well-defined bosses here and there, to the "Gehi Wall," where the igneous rocks give place to vertical grey, yellow, brown and olive-green phyllites, argillaceous schists and slates. Many of them are exceedingly fissile, while others break into irregular, ragged-edged pieces. The boundary is plainly marked by a much more vigorous growth of timber on the "Wall" than on the plateau. The rocks have an almost due north and south strike, and so steep is the descent into Bain Creek at the foot that in a distance of some 350 yards the height comes from 2225 feet to 1400 feet.

Between Bain and Gehi Creeks the track crosses the point of a small spur where the rocks are similar to those in the "Wall." No outcrop occurs on this point, but in the bed of the Gehi Creek at the foot of the spur a striking example of contact metamorphism may be noticed. The original slates having a S. 50° W. dip of 61° have been transmuted into white, black, brown and grey porcellanite, lydianite and jasper, while on the southern bank a mass of grey granite outcrops at the water's edge, showing clearly that the stream at this point flows along the line of junction. The granite extends to the bank of the Gehi River near, and evidently the spur between the river and creek is composed of the same rock. The pebbles in both streams consist of the rock already mentioned as well as mica-schist, slate and quartzite, with glittering sand of white, yellow and black mica. In the river are large boulders of the local granite. At the "Wall" the stream enters a precipitous cañon and from its source to here is known as the Gehi.

At none of the three river fords close by is there any evidence of sedimentary rocks *in situ*, yet as the pebbles in the river above the creek junction include many of metamorphosed sedimentary origin it is highly probable that an outcrop of those rocks occurs in the neighbourhood. There is a marked absence of fossils in the "Wall," but judging by the great inclination and lithological characteristics of the rocks they are probably Lower Silurian.



Between the last-mentioned spur and the southern ridge there is a deposit of alluvium, twenty-five feet deep, showing the remains of old river terraces. The southern ridge is granite, some of it consisting of light-pink orthoclase, and pearly muscovite in about equal proportions with milky quartz, other portions of an exceedingly fine-grained, red, gneissose variety mainly composed of mica, highly decomposed and having a foliated appearance much like that of a mica schist.

From the end of this ridge the river valley bears straight towards Mount Kosciusko, through extremely rugged country hitherto found impracticable for horses and the track trends southwards to the Indi Valley. On leaving the river it follows the course of a large creek for some distance. In the gravels on the flat are several prospecting shafts from three to five feet deep. Between here and Scrubby Creek lies a low, granite spur of the Youngal Range whose highest point is some 2300 feet. The granite is a fine-grained muscovite variety of shades of grey, pink and red, the former prevailing on the Gehi slope and the latter on that into Scrubby Creek, where the rock decomposes into a rich, red loam of considerable depth. Granite of the same character occurs on the opposite slope, beyond which it changes to a greyish-white with little muscovite forming a poor soil. This is the main Youngal Range and has here an altitude of 2700 feet. After getting into the valley of the Indi no outcrop is visible till the river is reached. Between this point and Groggin the rock *in situ* may be seen in the bed of the stream, and also at the junction of Omeo Creek and again at Selk Creek, where it forms a bar almost across the river. It is a pretty, grey granite showing little decomposition, and is totally different from any met with south of the Gehi. It is evidently an intrusive one of more recent age, and comes in from the south through Groggin. The bed of the river contains several kinds of schists, slates, sandstones and granites. At Groggin the rock is of a much darker colour owing to an increase in the quantity of biotite.

Here the track leaves the Indi Valley and bears off for the Monaro Gap. As far as the Snowy Creek there is no appreciable change in the rock, and the stream contains the same kinds of



pebbles as the Indi. In the bank, however, there is a small outcrop of gneissose granite, much decomposed and overlain by two or three feet of gravels.

For some two miles the track ascends very rapidly up the range between the Snowy and Leatherbarrel Creeks over an interesting area of granite. In many places it is an amorphous or micro-crystalline felspar with a few small crystals of biotite and a little quartz; in others it has very much the appearance of a foliated granite; and again it is a typical granite with large crystals of white orthoclase and muscovite, with masses of grey opaque quartz. The orthoclase changes into various shades of pink, red and grey, and with the disappearance of the muscovite the rock becomes a pretty porphyritic aplite. Running through the granite with a general north and south strike are many dykes from five to twenty-five feet wide, some of a dense, hard, dark rock resembling diorite, much jointed and breaking into small blocks, others of a rock something like diabase. About four miles from Groggin the sedimentary rocks again become visible. No outcrop can be seen at the junction but small loose pieces of a red, very micaceous granite, much decomposed, appear on the granite side of the boundary. Some fifty yards further on the first outcrop of the stratified rocks occurs. It is a slightly contorted, white slate so much altered, broken and decomposed as to make it difficult to get an accurate dip. This, however, appears to be  $66^{\circ}$  to E. From here to the ford at the Leatherbarrel, over a mile away, the rocks gradually merge into the softer and less indurated slates and schists. Several outcrops convey the impression that those which now are much jointed, disintegrated and crumbling to a white clay were once very fissile, argillaceous slates. The strike of all varies from N. to N.E. with a dip of  $55^{\circ}$  to  $71^{\circ}$  E. to S.E. This western ridge has a height varying from 3300 to 3800 feet.

On the point overlooking the ford the rocks are talcose and argillaceous schists. Much jointed, yellowish-grey phyllites with a dip of  $85^{\circ}$  to  $87^{\circ}$  to E.N.E. outcrop in the bed of the creek which has here an altitude of about 3300 feet. On the steep eastern slope, however, the rocks can be seen to much better advantage, and observations taken are more accurate than on the opposite ridge where the outcrops are small. Argillaceous



schists and slates principally olive-green in colour are the prevailing rocks. They have a dip varying from  $57^{\circ}$  to  $73^{\circ}$  N.  $50^{\circ}$  E. to E.N.E.

Some of the slates are so exceedingly fissile that a good hand specimen cannot be obtained. They are also much jointed and slightly contorted. The joints run in many directions at high angles. Near the top of the cutting is a band of deep reddish-brown talc-schist intercalated between the slates. It presents a rough pitted surface and stands out in a well-marked ridge, affording a striking contrast to the soft, brittle and fissile slates on each side.

Veins of quartz from mere threads to reefs several inches wide intersect the strata on both sides of the creek, and at one place on the eastern ridge a reef nine inches to two feet wide crosses the track. The quartz is of a milky, vitreous nature, cellular, and highly charged with a green mineral which lines the walls of the cavities in minute hair-like crystals. These veins run more or less in the same direction as the strike of the rocks. The pebbles in the stream consist of schists, slates, and the foliated granite of the Kosciusko region, with many large sub-angular pieces of the local rocks. The gravel and sand is one glistening mass of brownish-yellow mica relieved by fragments of parti-coloured slates. The Leatherbarrel rocks resemble those at the "Gehi Wall" in many respects and probably belong to the same beds.

The top of the eastern ridge just above the creek is about 4000 feet high. From here no outcrop was noticed, still the character of the rocks indicates a transition similar to that on the western ridge. About two-and-a-half miles from the creek a highly siliceous granite makes its appearance. The junction is masked, but probably is at the point where the ridge meets the main divide. The quartz predominates greatly over the felspar and the crystals of mica are few and small. Rose quartz is plentiful and litters the bed of a small watercourse.

Nearer the Monaro Gap a distinctly foliated structure is apparent, and the rock partakes of the character of a siliceous gneiss. The foliations are finely marked and close together, the intervening felspar being removed for some little distance from the edge, giving the rock an interesting fretted appearance. The



pocket lens reveals a few minute flakes of pearly muscovite among the felspar bands. Later on biotite takes the place of muscovite though the rock is otherwise similar. This laminated characteristic occurs also in the rose quartz, many pieces having a distinctly banded appearance and occurring in certain definite shapes apparently indicating jointing. The joint planes run almost at right angles to the planes of lamination. Another feature of the rose quartz is a peculiar flecking of colourless quartz in a milky matrix to both of which the rose colour seems to be imparted.

The fretted fragments of gneiss and rose quartz persist to near the Monaro Gap where a grey, gneissose granite, appears. It is composed of quartz, medium crystals of light flesh-coloured orthoclase which weathers quite white, and small crystals of biotite, and is the prevailing rock on this part of the main divide.

I desire to express my thanks to Mr. A. W. Howitt, F.G.S., for generously undertaking to microscopically examine several of the rocks noticed; to Mr. T. S. Hall, M.A., for his kindness in revising this paper and suggesting several alterations which I have gratefully adopted; and to Mr. C. A. Robinson, for kindly preparing an enlargement of the maps before mentioned.

With the permission of the Society I hope at a future time to submit a few notes on the Geology of the country between Monaro Gap and Mount Kosciusko.

NOTE.—The distances and heights (aneroid) are to be taken as approximate only.

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