NATURAL HISTORY OF THE MT BUFFALO PLATEAU

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1908.

VICTORIA.

DEPARTMENT OF MINES.

MEMOIRS

OF THE

GEOLOGICAL SURVEY OF VICTORIA

(E. J. DUNN, F.G.S., DIRECTOR)

ISSUED BY

W. DICKSON, SECRETARY FOR MINES, UNDER THE AUTHORITY OF THE HON. D. McLEOD, M.P., MINISTER OF MINES.

No. 6.

THE BUFFALO MOUNTAINS

(WITH 53 PLATES, DIAGRAM, AND MAP),

BY

E. J. DUNN, F.G.S.

MAP OF THE MOUNTAINS, BY O. A. L. WHITELAW.

SECOND EDITION.

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23rd December, 1907.

SIR,

During the current year a geological and topographical survey of the Buffalo Mountains has been made, and my report on the area, illustrated by photographs, is now completed. The report, map, and plates should serve to bring into prominent notice the most wonderful mountain tract within this State—a true "Garden of the Gods"; and it is hoped that the marvels of this region will draw many tourists from all quarters, and thus turn a latent asset of great value into a most potent attraction.

Mr. O. A. L. Whitelaw has carried out the topographical survey in a careful and minute manner that does him much credit. He has bestowed the names of the Minister and some of the chief officers of the Department past and present on a few of the features, and has chosen names for some of the creeks, &c., that were unnamed.

Mr. Walcott, of the Government Printing Office, obtained most of the photographs; others were furnished by Messrs. Kenny and Caldwell of the Geological Survey, and Mr. Foxcroft of Bright. The final plate was kindly supplied by Mr. D. Le Souëf. Mr. Wilby has ably carried out the reproductions.

The granite of this region has been petrologically determined by Mr. Mahony, M.Sc., F.G.S., and an analysis has been made by Mr. P. G. W. Bayly, Assoc. S.A.S.M., of the laboratory.

I have the honour to be,

Your most obedient servant,

E. J. DUNN.

The Secretary for Mines.

THE BUFFALO MOUNTAINS.

POSITION, ETC.

This mountain range is in the N.E. Division of Victoria. It lies within the area bordered on the N. by the Ovens River, on the E. by the Buckland River, and on the W. by the Buffalo River. The position of the Trig. station on Mt. Buffalo is Lat. 36 deg. 46 min. 42 sec., Lon. 146 deg. 46 min. 12 sec. Eurobin, the nearest railway station, is 187¾ miles from Melbourne, and 827 feet above sea-level. From the railway line between Wangaratta and Glenrowan a magnificent view of the Buffalo Mountains is obtainable. To the top of the Buffalo plateau (4,500 feet above sea-level) the distance from Eurobin is about 6 miles. The Buffalo range occupies an isolated position, being about 12 miles N. of the Divide, and it towers up above the surrounding country. From N. to S. this range is 7 miles long, and from E. to W. about 4 miles across at its widest part. The area of the plateau is about 13½ square miles.

West Buffalo and North Buffalo are two offshoots that are joined to the main mass by a narrow neck. A deep valley, in which Buffalo Creek flows, divides North Buffalo from the Buffalo proper.

PHYSICAL ASPECTS.

The great granitic boss which forms the Buffalo range protrudes a couple of thousand feet above the tops of the surrounding slate and sandstone mountains (Plate 1), because the granite offers so much more resistance to denuding forces than the sedimentary rocks. At one period the highest portion of the granite mass was covered by sedimentary beds; in fact, unless there had been a considerable capping of such rocks, granite would not have been formed. These covering rocks have been removed and the granite mass itself stripped down for perhaps thousands of feet below its original surface, and as the sedimentary rocks were so much more easily affected by denuding influences the granite is left in its very conspicuous position.

The general surface of the plateau is remarkable for the abundance of the tors and granite blocks that are strewn over it (Plates 13, 14, 23, 26). For the most part the hills and slopes are extremely rocky, great and small masses abounding, and the granite blocks represent every stage of weathering, from where they have just been freed from the parent mass by the joints (Plate 24) to such finished examples of weathering as the Egg Rocks (Plate 50).

The plateau of the main mass inclines from the southern end where the Horn rises to 5,645* feet above sea-level towards The Gorge 4,270† feet above sea-level. Rocky hills rise for 300 to 400 feet above the general level, and in some cases to 600 feet (Plates 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17).

Isolated peaks (Plates 7, 8, 14, 15, 16, 17) and ridges strewn with tors and loose blocks (Plate 23) are quite a feature, and the general surface is extremely rugged. Eucalypts, usually Snow Gums (*Eucalyptus coriacea*) grow on the plateau and right up to the highest points. At the lower levels these trees range up to 50 and 60 feet in height (Plate 6), but become more stunted as altitude is gained or the position is more exposed, until in some sites the Snow Gums are not more than 6 to 8 feet high (Plate 13).

Between the rocky hills are narrow plains that are bare of trees and remarkably free from granite blocks. There is a sharp contrast between the rock-strewn hills and slopes (Plate 7) and the smooth, treeless, rockless flats (Plates 5 and 6). Where tors are found on the plains it is evident that they have rolled down from the hills at a comparatively recent period.

The creeks and water-courses exhibit certain features that are noteworthy. For the most part they flow along the courses of the two sets of joints.

From the edge of the plateau the mountain descends rapidly. The eastern side of the range is far more precipitous than the western slope.

The Gorge (Plates 3 and 4) is a prominent feature, and it has resulted from the development of some of the N.E. and S.W. joints by denudation. The N. side of The Gorge exhibits a wall of granite up to 800 feet high and half-a-mile long. The Gorge itself is from 5 to 20 chains wide (Plate 3). Buffalo Creek valley is a still greater achievement by denuding agencies, for in this case a mass of rock 3 miles long, from half-a-mile to 1 mile wide, and from a few feet to 2,000 feet deep, has been bodily removed to form the valley. The direction of this valley corresponds with that of the N.E. and S.W. system of joints. Whether the whole of this was granite or not is uncertain, but the direction appears to have been decided by one set of joints for over 3 miles down the course of the creek, and at this point the creek takes a sharp turn to the N.W. and follows the other set of joints.

The scarps on the S. side of Buffalo Creek, at the S. end of the mountain group, along the most eastern edge of the plateau, and on the eastern edge further south all exhibit the influence that has been exerted by the two sets of jointing in determining the shape of this mountain range. The creeks that flow N.W. from North Buffalo and the scarps that bound these creeks also show the influence of the prevailing directions of the jointing.

* Determined for the Geodetic Survey. † Determination by aneroid.

Just as the great mass of granite towers above the surrounding less-resistant rocks, so the harder portions of the granite mass project above the general level, as, for instance, the Cathedral (Plate 11), the Horn (Plate 12), and numerous peaks of granite that diversify the surface.

The principal water-course on the range is Crystal Brook, which has a total length of 5 miles before it runs through The Gorge.

Eurobin Creek is S. of Crystal Brook, and is nearly 3 miles long from its source to where it leaves the plateau. Dickson's Falls Creek is 2¾ miles long from the falls to its source. The creeks are remarkable for their tortuous courses and the sharp bends they make in following along the one or the other set of joints.

In some cases the dykes deflect the streams, in others the streams have flowed in one direction, but encroachments of streams flowing in another direction have diverted them.

The Dickson's Falls Creek bifurcates just below the falls; one portion flows to the N. of a granite spur and the other portion flows S. of it. This is not a common occurrence. Both branches ultimately reach the Buckland River. On the plateau the creeks flow with a moderate inclination, meandering through extremely tortuous channels in the peaty flats, but on reaching the edge of the plateau they are precipitated down rapids and over falls until they reach the foot of the mountains. Eurobin Falls are far down on the N.E. slope of the mountain. The watershed of the plateau is along its western edge, and the creeks flow eastward across it. So that the plateau has two inclinations, one from S. to N., and the other from S.W. to N.E.

Formerly the plateau must have been of much greater area, but the same processes which are now in progress right round the edge of the plateau wearing down the escarpment have been at work for a vast period of time, and although the effects may be but slight for a year or a century, they become very pronounced when whole cycles are involved.

The distance between the junction of the granite with the sedimentary beds and the steep slope of the granite, together with the height of the top of the mountain above the sediments, give some relative idea of the time that has elapsed since the sedimentary rocks and the granite were cut down to one horizon, for since that time the sedimentary rocks have been denuded to their present level below the top of the mountain, and the granite has been eaten into laterally for 3,000 or 4,000 feet from their junction. Some idea of the stupendous changes that have taken place in the area occupied by the Buffalo Mountains and the surrounding country can be gained by standing on the Horn, which is the topmost peak, and surveying the endless ridges and valleys that stretch away in all directions, and at such a depth below (Plate 2), especially when it is realized that at one time the whole surrounding region was at a higher altitude than even the Horn.

The sequence of events appears to have been that the ancient sedimentary rocks were laid down, and were subsequently bent into a series of folds; then the granite was intruded into them from below; and while the granite was cooling the sedimentary rocks over and around it were subjected to enormous heat for a great lapse of time, and by this means considerable changes have been caused in them.

As the granite cooled it shrank in bulk, perhaps to the extent of 10 per cent., and this probably caused the overlying sediments to collapse, and in this manner to become much broken up. Denuding agencies removed first the sedimentary beds resting upon the granite, and from that time weathered down both the granite and the sedimentary rocks to their present altitude. Whether there has been an uprising of the mass concurrent with the removal of the upper portion by denudation or not, is uncertain.

The Buffalo Mountains are incomparably grander than any others within the boundaries of Victoria. From their isolated position the views around are exceedingly fine and impressive. Kosciusko towers up on the N.E., Macedon on the S.W., while to the N. one's view reaches far into the fertile plains of Riverina. These are points on the extreme verge of vision. Nearer and in the middle distance are ranges that define the watersheds of a whole river system. Still closer are the forest-clad spurs and ridges that so clearly display the beautiful manner in which they have been carved out by the elements. In the process of scoring out the valleys, the gullies, and the dells the material has not been wasted, for the same waters that particle by particle removed cubic miles of material from the hills transported that material to fill up the hollows and to form the plains through which the Ovens and Murray Rivers now flow. When the Buffalo Mountains were perhaps thousands of feet higher than they are at present the bed rock along the Murray River and along the Ovens River was bare. The bed rock is now over 300 feet below the surface, and the whole of the material filling the old valleys to that depth has been washed down from the Buffalo and other mountains. This process is still actively at work, and a particle of granite from the highest point of the Buffalo may be transported within a day or two to a point far down the course of the Ovens River, and thousands of feet below its original position.

At one period the sedimentary rocks covered the highest portions of the granite to a considerable depth (see diagram page 9). Bearing this in mind, and then surveying the serried ranges, spurs, and ridges that surround the Buffalo, the first impression is of the vastness of the vacant spaces once filled with solid rock. How many cubic miles of material have been scooped out to form the valleys of the Ovens River, the Buckland River, and of their affluents, as Morse's Creek, Growler's Creek, &c., and, again, the gullies and branch gullies that run into these? Taking the level of the Ovens River at Porepunkah as a base line, it is evident that mountain ranges, spurs, and ridges as great as now stand above that bench-mark have been removed, and the material has been strewn over the valleys and on to the plains of the great rivers further down.

Properly to understand the former physical aspect of this region it is necessary to conceive what the country would be like if the whole of the alluvial deposits in the valleys were removed to bed rock and the whole of this material were filled into the upper valleys and piled on to the present mountains.

THE "PLAINS."

Along the principal water-courses on the Buffalo plateau there are narrow treeless strips of peaty soil, locally termed plains (Plates 5 and 6). Generally there is an absence of rocky material in these flats, so that they contrast sharply with the rock-strewn slopes that stretch right down to these bare, smooth strips of country. Grass grows on the surface of them, but the soil below appears to be a mixture of peat with sand and grit. These plains range from 1 chain to 5 chains across, and the largest is on Eurobin Creek; they run along the creeks up to their sources in some cases. The creeks follow in many instances a remarkably tortuous course through the peaty flats. Occasionally large blocks of granite are met with standing in the plains.

This general absence of prominent rocks from the plains is so marked a feature that there must be some general reason for it. The absence of trees is probably due to the presence of so much peaty material, in which the trees would not thrive, for while trees grow thickly right to the edge of the plains, none grow on them. The peat may also explain the absence of rocks on these plains, for it may have a tendency to decompose the felspathic constituents of the granite, and, in fact, does appear to have some such action, for in the areas bounding the creeks the granite seems to be more friable than on the hills. If the peat and water exert a decomposing influence, then it is easily understood that in process of time such rocks as came within the influence of the peat and water were slowly eaten away until the present smooth appearance was attained by the removal of every bit of granite. In some cases where granite does protrude in the plains the sides are worn around like a bollard on a wharf. That water charged with acids derived from decomposing vegetation does possess the property of causing the decay and disintegration of this granite appears to be proved by the frequent occurrence of hollows in the rock surfaces which have usually more or less vegetable matter in them, such as sticks, pieces of decaying wood, leaves, &c. (Plate 52). At first there are but shallow hollows in which a little water rests, and vegetable *débris* accumulates, but these are gradually deepened into regular pot holes. The iron, lime, potash, and soda in the felspar of this granite are the constituents that water charged with vegetable acids would attack.

THE BUFFALO ROCKS.

The marvellous groups of rocks, the monoliths and the perched blocks, are among the most attractive features of this region. No two groups or individuals are alike—there is diversity in the individuals and in the character of the groups. The features exhibited at Boulder Valley (Plate 26), where immense rounded tors 40 and 60 feet in diameter are scattered abundantly through the forest, are quite unlike those at the Horn, where huge angular blocks, dissevered by weathering along the joints, are still in their original position (Plate 12), and these again differ from such a massive group as the Eagle Point (Plate 10) or the grand group of blocks at Lyre Bird Hill, where the Grandfather, an angular block of granite 110 feet long, 40 feet high, and 20 feet thick, stands ready to be placed in some Cyclopean temple; others nearly as large adjoin it, with long narrow galleries between them. Then there are such granite blocks as the Kissing Stones (Plate 43), which have fallen together, forming a natural arch, or such a magnificent example as the mighty Leviathan (Plate 40), an enormous mass of granite rounded by the exposure to thousands of winters and summers, and still weighing many thousands of tons, or there are such conspicuous blocks as the Monolith (Fig. 1, Plate 49), or the Sentinel (Plate 46), and yet another class includes perched blocks like the Egg Rock (Plate 50), &c., in which the more or less spherical mass of granite is poised on a base so slender as to cause doubt as to its stability. Besides all these there are the rocks and groups that have some quaint resemblance to animals, men, &c., and groups innumerable embowered with trees that are a joy to the artist. Long before the Egyptian monarchs hewed granite monoliths the natural ones on the Buffalo Mountains stood like sentinels on their lofty pinnacles. The illustrations only show a few typical examples.

These rocks are not only grand, wonderful, and beautiful, but they inspire a feeling of awe when it is realized what gigantic forces have been employed in fashioning them, and how cycle has followed cycle while their evolution was in progress. That these marvellous rocks have been formed by the weathering away of all the surrounding and overlying mass of granite seems almost incredible, but that is what has really happened. It is as though a sculptor quarried away a whole mountain of granite to create one solitary statue.

WATERFALLS.

As might be expected in such country, there are some grand waterfalls on the Buffalo range. The principal one is at the mouth of The Gorge, where, during heavy rains, a considerable volume of water is hurled over rapids and falls for a depth of 800 feet. These are called the Buffalo Falls. Low down on the flanks of the range on the N.E. side, Eurobin Creek

leaps over falls and rapids, and runs down a flat face of granite. When the creek is in flood these are fine falls, but they are also dangerous. Dickson's Falls are 1½ miles E. of the Horn, and after heavy rains they are very impressive.

Many other waterfalls occur where the creeks leave the edge of the plateau, but the basin being so small there is little or no water except during rainy weather in any of them.

FISSURING.

The principal element in determining the present features on the Buffalo Mountains is the jointing of the granite. There are two sets of more or less vertical joints. The main set runs in a direction about N. 44 deg. E. (Plates 3, 4, 10, 12, 13, 18, 24, and 33), and the cross joints strike about N. 43 deg. W. (Plates 9, 19 (Figs. 1 and 2), 25, 32), so that they intersect at an angle of 87 deg. Where a smooth, clean surface of hard granite is exposed these joints may be noticed. In their first stage the fissures are so fine that they look like the scratches of a needle point, but though so fine they cut right through the granite mass. In some cases the joint merely intersects the crystals of felspar and quartz, without displacing them, but in other cases there is a distinct movement shown. Although these joints are so minute as to almost escape notice, yet the whole structure of this mountain range, with its wondrous scenery, its huge tors, monoliths, and poised blocks, directly results from their presence. To begin with, there is the scarcely visible fissure which has severed the granite rock down to its very roots. Buffalo Creek valley exhibits the fuller developments of these fissures, while The Gorge exhibits an intermediate stage and the Blow Hole a still more primitive stage. Every step in the progression from the fine joint to the great valley can be observed in progress on this tract of country.

The fine joints are not straight lines, but they branch in a curious manner, and on a small scale, and while the portions of the same crystal of quartz or felspar are to be seen on opposite sides of the joints in some cases, in others there has been much movement, and the opposite sides of the joints are well slickensided. Whatever the cause that produced the jointing, enormous forces must have been exercised to rend the granite mass right through (Plates 13 and 14). The distances between the parallel joints vary widely, in some cases they recur at intervals of a few inches, in others they are many feet apart. The whole mountain mass is, however, jointed from end to end and from top to bottom. Possibly the great stresses that were set up as this granite mass cooled may have been the cause. The directions of the two sets of vertical joints are of interest. At the Baw Baw Mountain they bear a general resemblance to the two sets at the Buffalo, and the bearings appear to correspond if the principal direction of the water-courses is taken as an indication. In each case the angle at which the two sets of joints intersect approaches a right angle.

These joints generally are more or less vertical, as is well shown on the N. side of The Gorge (Plates 3, 18, and 19, Fig. 2). On the S. side of The Gorge and at the Horn they are inclined (Plates 12 and 19, Fig. 1).

Where the joints are close together (Plate 18), the granite decomposes without leaving conspicuous blocks, but where the joints are wide apart (Plate 12), the grandest examples of tors, &c., exist. Some of the belts can be traced in which there are few joints, and along their course are groups of gigantic tors and massive isolated blocks. The jointing in many cases is so minute that weathering does not affect the blocks for long periods (Plate 35). Frequently the joints have not been developed in great granite blocks until they have become isolated from the general mass and weathered into well-rounded tors. After all this exposure the latent jointing is developed, and such tors are to be seen split right through as in the case of the Split Rocks (Plate 23), where the granite blocks exhibit the jointing only after an immense amount of weathering, although they must have existed from the time when the isolated blocks were a portion of the solid mass of granite.

The first condition of these joints or fissures is as a scarcely perceptible scratch in the hard granite. As the weather affects this, minute fragments are detached along the course of the joint, and in time a groove is formed because frost and the other disintegrating elements act more effectively and rapidly along such a fissure than on an unfissured surface. The groove would hold water, and this would still further help to hasten the disintegration of the rock along the joint and the groove would become a trench, and this trench would eventually cut through many feet in depth, and together with other parallel and cross joints they would cut up the original massive granite into a number of detached blocks (Plate 34, Fig. 2).

After the joints became weathered to the width of a few inches, then all the disintegrating forces would be acting on both sides of the separated rock faces and later on the parallel joints would be acted upon and slabs would become detached (Plate 18) and would crumble away or fall down into what would develop into a chasm, such as the Blow Hole. The enlargement of such a chasm, especially by the falling away of slabs from the sides, would eventuate in an abyss like The Gorge, and the ultimate result would be a valley such as that down which Buffalo Creek flows.

Besides the two sets of more or less vertical joints there is a third set, the tabular or horizontal joints (Plates 20 (Figs. 1 and 2) 21, 32, 33, 34, Fig. 2). It seems rather doubtful whether these are inherent in the rock mass, as the vertical joints undoubtedly are, or whether the tabular joints are dependent on the surface weathering. There is much to be noticed that favours the latter view. For instance, Plate 19, Fig. 2, shows tabular jointing only near the [illegible] The tabular joints appear to follow the general surface, and not to be actually

horizontal (Plate 20, Fig. 1). They are infrequent compared to the other systems of joints. In fact, the tabular joints appear to result from surface influences rather than from causes such as produced the systems of vertical joints. In many cases there is no proper tabular jointing, but irregular joints that connect the vertical jointing and sever the granite into irregular blocks. A good example is seen near the Horn in the Wall of China (Plate 22).

In following out the development of a joint or set of joints there are many conditions that help the work on. As soon as a slight depression occurs along a joint water lodges there, and this acts on the minerals both mechanically and chemically, helping to break them down. The water, especially when living and dead vegetation lies in it (Plate 52), is active in disuniting the constituents of the minerals. Living vegetation also shares in the work of destruction, for after a while a little soil accumulates along the lines of hollow which mark the joints and seeds germinate, so that lichens and minute forms of vegetation grow, their rootlets always endeavouring to insinuate themselves into the cracks and fissures, and then they grow and exert great force, and by this means detach small portions of the rock. Later on shrubs take root where there is more soil, and even trees take possession and try to live (Plate 53). Generation after generation of young trees strive to exist, but perish, each making it easier for the next to live. At last, perhaps after centuries of vain endeavour, a seedling grows which succeeds in getting its rootlets down the joint, and perhaps after a long and severe struggle the joint is wedged slightly open (Plate 51). Once this is accomplished the rest is easy, for the force exerted by roots of trees under these conditions becomes irresistible, and the rock is split right through (Plates 51 and 52). Then the roots quickly travel down to the earth, and with the more generous supply of food the tree flourishes and splits the rock apart and sometimes pushes it away down a slope altogether. In grooves along the course of joints the wind also assists by moving the grains of disintegrated granite along the grooves, and thus wearing away a little of the mass. When the grooves have been cut deep enough to become a trench water flows along the joint course in some cases, and then the work of deepening is hastened. Once a chasm is formed all the above forces would assist in detaching the rocks forming the sides and in widening it.

The influence of the jointing in producing tors, monoliths, and perched blocks is very evident, for every stage of the process can here be studied, from the needle-like scratch in the face of solid rock to the final stage where such a perched block as the Egg Rock has been carved out of the solid mass, all the surrounding granite bodily removed, and this heart core left standing on a perilously small base on another boss of rock, which itself projects many feet above the surrounding rock level.

Not only is the present surface contour of the Buffalo Mountains largely due to jointing, but there can be little doubt that the stupendous operations, by which probably as much as 5,000 feet of granite rock has been removed from above the present surface, leaving the truncated wreck of a mountain as it now stands, were greatly facilitated by the systems of joints.

As to the period when the jointing took place, it was certainly after the rock had crystallized, for the crystals are broken through and the rock must have been solidified to permit of the fracturing. It appears probable that it took place after solidification and during the cooling stage. In such a mass of granite the contraction due to loss of heat between the stage at which crystallization was completed and the stage at which its present temperature was attained may have amounted to one-tenth. As the cooling took place from the outside inwards, unequal strains were developed, and these may have penetrated from the surface downward as the process of cooling extended.

Why the jointing should run in the directions that prevail is not apparent, but there appears to be some law involved, for at the Baw Baw Mountains, where the rock is granodiorite, the directions are very similar, and the angle between the joints much the same as at the Buffalo.

Just as the development of the joints can be traced on the Buffalo from the finest needle-like scratch to the huge Buffalo Creek valley, so every stage is traceable over the same area by which the tors, monoliths, and perched rocks are evolved from the solid rock mass—(Plates 20 (Fig. 1), 13, 12, 35, 33, 49 (Fig. 1), and 50). In places the granite mass is exposed with barely perceptible lines of jointing crossing it; elsewhere the joints are well defined, and have deepened into little trenches (Plate 20, Fig. 1). The trenches increase in depth until a block of granite is isolated; then a lateral joint completely severs the block from the parent mass (Plate 35). As time elapses adjacent blocks of softer nature are removed, and the angles of even the hardest mass are truncated partly by expansion and contraction, by which thick shells of the rock are removed (Plate 46), partly by the ceaseless removal of small particles. These processes continue until eventually a rounded tor remains above the wasted rock (Plate 39), or a monolith projects high above its surroundings (Plate 45), or perhaps a poised rock which has been weathered in such a manner as to stand on a narrow base (Plates 37 and 38) conspicuously above the surrounding rock attests to the prodigal manner in which nature has laboured to remove, particle by particle, vast bulks of hard granite, leaving only these remnants just as a contractor for removing earth leaves pillars at intervals to indicate how much has been scooped out.

DEGRADING AND DENUDING INFLUENCES.

Quite a variety of forces are at work by different methods, but all tending towards undoing the bonds that chemically bind together the elements that form the mineral constituents of the granite, to unloose the particles of matter that make up the rock, or to tear these particles away from the mass and to transport them to more or less distant localities.

Engaged in this destructive work are heat, cold, frost, rain, streams, wind, lichens and mosses, shrubs, trees, decaying vegetation, &c.

During the summer season the rock surfaces become highly heated while the sun shines on them, and the expansion that follows must cause ruptures, fissures, &c., especially near the surface of the rocks. Just as violent as the strains produced by changes from a cold to a heated state are the strains that occur while the rock becomes cold again. No matter how hard or intractable the rock, alternations from a highly heated condition to a cold one and *vice versâ* would eventually disintegrate it; the Buffalo granite appears to be not difficult to disintegrate. There is an absence of those smooth, hard, apparently unweathered faces that obtain over some other granite areas. On the contrary, it is a general feature that from the surfaces of the exposed granite blocks loose and partly-loosened grains can be easily rubbed off by the hand.

Frost is perhaps the most powerful of the influences actively engaged in demolishing these mountains. The terrible strains set up by alternating expansion and contraction of the granite cause rending and fissuring, and water finds its way into the minute fissures, into cracks, joints, &c. (Plate 22). Later on the temperature falls to freezing point, with the result that the water confined in these narrow channels expands and thrusts the walls apart, and so all over exposed surfaces. In this manner the quantity of material being wedged away from the main mass must be enormous. Where shallow hollows occur on flat rock surfaces (Plate 52), the water becomes expanded into ice and detaches particles freely. For months in the year the conditions are such that the temperature daily falls below freezing point, and therefore the changes from freezing to thawing and the converse are frequent. The sum of the effects for a year must be very great, and when years are multiplied to cycles these mountains are planed down to hills and hills to mounds.

Rain contributes its share to the work of demolition. As it falls heavily on the loosened particles they become detached, and are borne down the sides of the blocks, and on down the slopes into the runnels and so into the creeks, and then they are hurled over the brink of the mountain and so are carried to the plains, where they have filled in square miles of valley to the depth of hundreds of feet. The rain also fills the fine fissures and cracks with water which becomes frozen, thus loosening the grains ready for the downpours to sweep away.

Streams also help. During heavy rain small rills run down the larger surfaces of granite, and they sweep away loose material. Lower down these little streams mingle and are more effective in removing the *débris* from the granite area. Still lower creeks are formed, and these carry off great quantities of grains from the granite right away from the mountain and well into the valleys.

The air in motion shares in the toil of tearing these old granite mountains away piece by piece, for as it whistles around the weathered blocks the loose grains are blown away from the face, and often helped well on their way to the water-courses. In the case where hollows exist on the rocks the grains are worn one against the other, and against the solid rock, and always with some loss to the fragments and to the rock they come in contact with.

Lichens and mosses help the disintegration (Plate 32), and although the work of each individual is small there are so many of them that their united efforts are colossal. Everywhere the humble lichen is to be seen covering the rocks, and wherever lichens exist the rocks are being destroyed.

Larger forms of vegetation, such as shrubs, &c., obtain roothold on some of the rock surfaces, and their roots tend to widen cracks and to open fissures. The decaying portions (Plate 52), form acids that also tend to decompose the constituents of the granite.

Seeds of the Snow Gum lodge on ledges and in cracks in the granite blocks, and germinate only to die. Others struggle on for a short time and then perish; still others grow in an extremely stunted manner for years (Plate 53), and then they succumb to adverse influences and to want of nourishment. When these decay another seedling begins life in the same spot (Plate 52) and eventually after a long and hard struggle for existence the roots open out a crack, joint, or fissure, so as to allow them to extend sufficiently, and perhaps eventually to split the rock mass (Plates 51 and 52). Once this is accomplished, and the roots extend into the soil beneath, the future of the tree is assured. Frequently small trees are to be seen on isolated blocks of granite where the roots cannot possibly reach the soil. A great deal of destructive work is being accomplished in the splitting apart of rocks, some of large size, by the tree roots. On the surfaces of the granite dead trunks and limbs of trees, branches, and sticks, as well as collections of twigs and leaves (Plate 52) are found, and these decay and the rock becomes hollowed out where they rest on it. As soon as a hollow is formed then leaves and decaying matter accumulate, and water lodges there, and in this manner the beginning of pot holes is made. Where dead timber and dry vegetation lies on the rocks, and a bush fire passes along, the granite is burnt and disintegrated where the fire passes over it, and the loose grains are blown away by the wind. Vegetation in one form or another contributes largely towards the breaking down of the granite on this mountain range.

METAMORPHISM.

Around the granite mass of the Buffalo Mountains the sedimentary beds (Ordovician ?) are altered in consequence of the proximity of such a great mass of formerly heated rock. This action is traceable easterly for a quarter of a mile or more, but on the W. side of the range it extends to the Buffalo River, so that probably the granite mass extends westerly for a greater distance near the surface than on the eastern side. The production of secondary mica and of a schistose character are the most salient features of this alteration. Just around the Buffalo range the sedimentary rocks do not appear to have been very rich in gold, judging from the scarcity of it in the alluvial deposits in the nearest creeks that drain from it. Even close to the granite the sedimentary rocks do not appear to have been much indurated, nor do granite dykes appear to be common in the surrounding sedimentary beds.

DYKES.

The most common dykes are of a fine-grained euritic rock, evidently segregated from the mass of coarser granite. Such dykes (Plate 20, Fig. 1), are very irregular in outline; they run only for short distances in one direction, and they range from horizontal to vertical in dip. A flat dyke of this character occurs on Crystal Brook, about 2½ miles from the Hospice. The colour is generally light red, and the rock breaks up into small, nearly rectangular blocks. There is no sharp line of demarcation between these dykes and the enclosing granite. Over the whole area dykes of this character are to be found. Probably they were formed just before the mass solidified. In some cases they split up into veins and ramify through the ground mass.

This class of dykes is the oldest and the most common, but there are other dykes of more recent origin, and more basic in character. The best example of such a dyke occurs at the creek marked The Wash Out on the plan. It is about 4 feet wide, and follows the course of a N.E. joint. Calcspar is associated with it. Quartz veins also crop out in several localities, and the principal sites are marked on the plan. Dykes occur in both sets of joints and also cross them at many angles. Where a dyke of material that decomposes more readily than granite cuts through that rock the weathering away and removal of the dyke helps on the work of breaking down the granite mass. From such a line of weakness the hardest granite would be attacked in such a manner by the denuding forces that destruction would be greatly accelerated.

THE BUFFALO GRANITE.

Petrological Determinations by D. J. Mahony, M.Sc., F.G.S.

The specimens submitted to me for examination are light-coloured granites of rather coarse grain, consisting of plentiful dark-looking quartz and white and pinkish felspar, with scattered flakes of black mica considerably smaller than the felspars, and rarer flakes of white mica. The felspar in the hand specimen appears for the most part to be orthoclase, but some of the cleavage flakes show the typical repeated twinning of the plagioclases.

The specific gravities of two specimens are 2·64 and 2·63.

Under the microscope the thin slices (Nos. 1118 and 1120) are seen to have the typical granitic structure (holocrystalline granular) and to consist of quartz, orthoclase, plagioclase, biotite, and muscovite, with iron ores and zircon and rare apatite as accessories.

The quartz is of the usual granitic type, with numerous liquid inclusions, and very plentiful. There are some interesting examples of the intergrowth of quartz crystals having a different orientation, and producing between crossed nicols an effect like a graphitic intergrowth of quartz and felspar. The orthoclase (perthite) belongs to two generations. The earlier crystals are marked by well-defined crystal outlines, and are often surrounded by the larger irregular orthoclase crystals that have been the last mineral to crystallize out except the quartz. Both generations are twinned on the Carlsbad Law or untwinned. All the orthoclase is more or less turbid and decomposed.

Few sections of the plagioclase are suitable for giving determinative extinction angles, and the highest angle measured in the zone 100–001 was 10°. The refractive index, when compared with that of quartz, was found to be almost identical with it, and this, together with the extinction angle, would point to a moderately basic oligoclase. It is quite subordinate to the quartz in abundance. Zonal structure is common, and the twinning is almost always on the albite law. Both felspars occasionally form microscopic intergrowths with the quartz along their margins.

The coloured mica is fairly plentiful, and appears light brown with a greenish tint in ordinary light. It is strongly pleochroic, changing from light brown to almost black. Zircon inclusions surrounded by the usual pleochroic halos are plentiful, and there are a few small included needles of apatite. It is decomposed in places to green chlorite. The white mica is less plentiful. It has crystallized after the plagioclase and before the orthoclase, in which it is sometimes included either as single crystals or as veins or strings. In some cases it appears to have been formed by the bleaching of the biotite.

The following analysis was made by Mr. P. G. W. Bayly, A.S.A.S.M., at the Departmental Laboratory:—

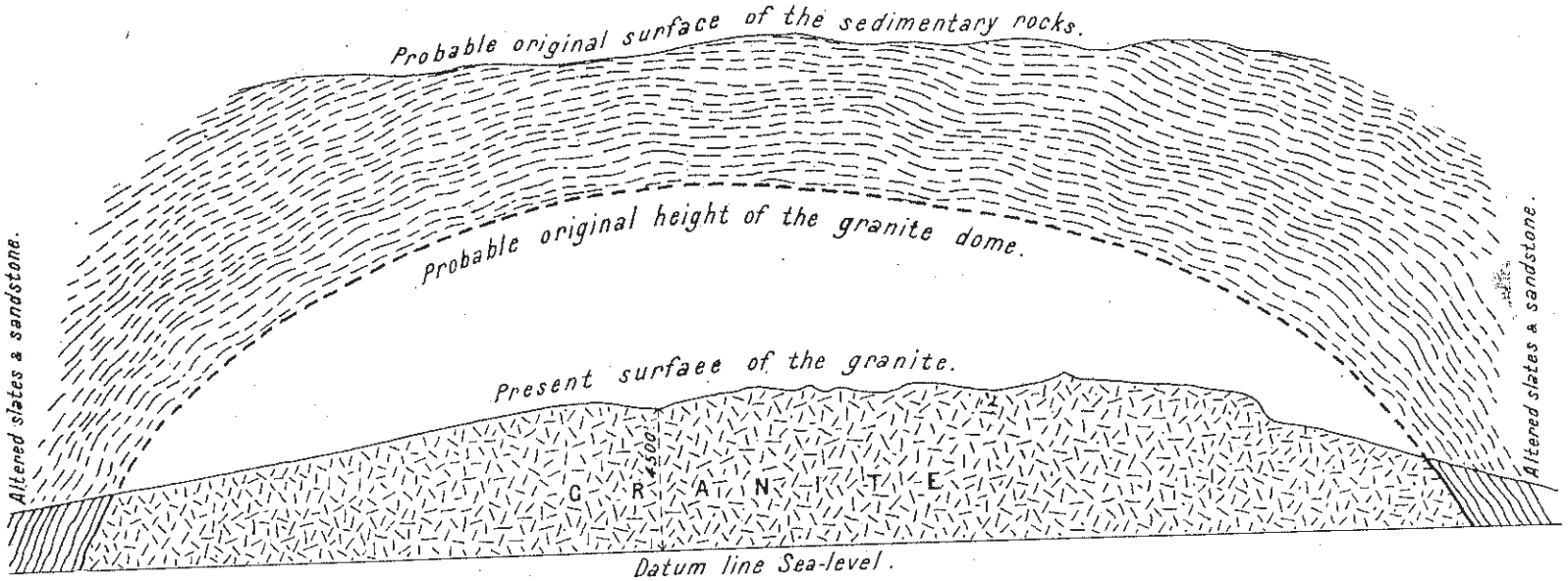
	per cent.
SiO_2	73·30
Al_2O_3	13·84
Fe_2O_3	0·82
FeO	1·22
MgO	0·82
CaO	0·84
Na_2O	3·12
K_2O	4·89
H_2O + (above 110° C.) ...	0·50
H_2O — (110° C)	0·19
TiO_2	0·20
P_2O_5	0·08
SO_3	nil
Cl	nil
MnO	0·15
NiO	nil
CoO	nil
Li_2O	nil
CO_2	p.n.d. (included in H_2O + above.)
	99·97

A specimen from one of the typical dykes is a fine-grained pinkish rock with granitic structure, consisting principally of quartz and felspar with a little white mica.

Under the microscope this is seen to consist of quartz, orthoclase, plagioclase, and mica (Slice 1148). The texture is considerably finer than that of the main granite mass, and the structure is holocrystalline granular. The quartz is the usual granitic type, and the orthoclase is rather less plentiful than in the specimens described above. Several measurements were made of the symmetrical extinctions in the plagioclase felspars with albite twinning, and the maximum angle was found to be about 15°. The refractive index appears to be practically the same as that of quartz, so that the plagioclase felspar is oligoclase-andesine. The mica is moderately abundant and almost all colourless. It is remarkable on account of its having crystallized out after the felspars and quartz on which it is moulded. Biotite is represented by one or two flakes which have been almost completely bleached, and are decomposed in part.

BUFFALO MOUNTAINS

Diagram, shewing relations of the present surface of the granite with the probable original surface and with the sedimentary rocks that originally covered the granite dome.



CATALOGUE OF VIEWS.

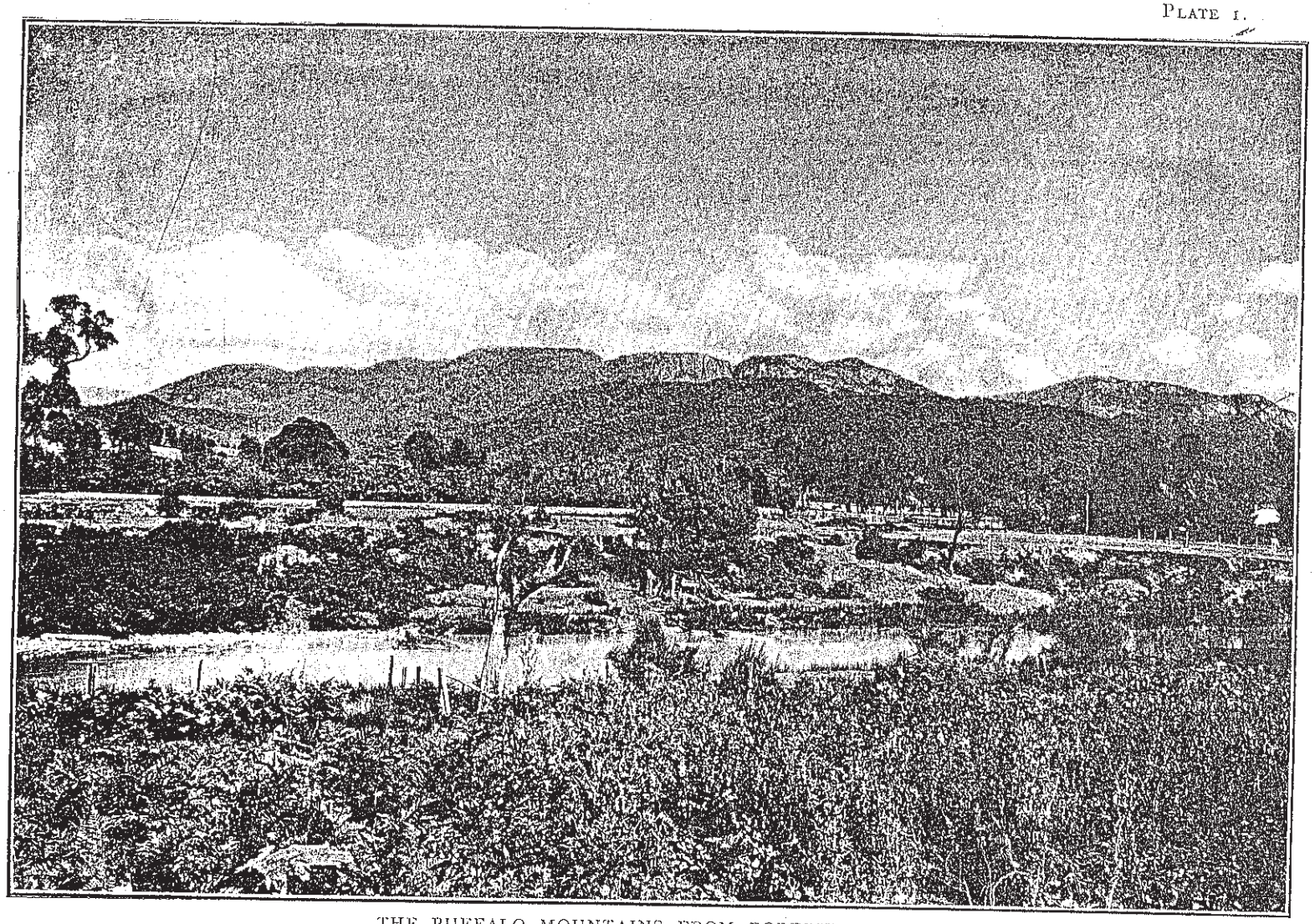
BUFFALO MOUNTAINS.

Plate Number.	Locality. No. on Plan.	Description.
1 ..	..	View of Buffalo Mountains from Porepunkah. The Ovens River in the foreground. The range in the middle distance is of altered sedimentary rocks (Ordovician or Silurian).
2 ..	..	View from the top of Dickson's Falls looking south-eastward up the Buckland Valley, showing the extensive denudation of the sedimentary rocks that has taken place since the granite mass was intruded.
3 ..	22	View from the S. side of The Gorge looking south-eastward up the Ovens Valley, showing the northern wall of The Gorge. The Bogong Mountain on the horizon to the right of the picture.
4 ..	23	The top of The Gorge looking E., showing the manner in which it has been developed in consequence of the N.E. jointing of the granite.
5 ..	28	Camp Plain, N.W. of the Monolith, which stands out prominently on the left in the picture, showing a smooth grass-covered plain, treeless, and for the most part free from rocks. Such plains form a great contrast to the rugged rock-strewn tree-covered slopes of the hills. The soil of these plains consists of peaty matter and granite detritus. The small streams that wind through them have very tortuous courses.
6 ..	20	The Long Plain. Around the margin the Snow Gums attain a height of from 40 to 60 feet. It is proposed to build a dam across the outlet, and in this manner form a lake of 30 to 40 acres in extent.
7 ..	1	The Horn, looking W. This is the highest peak of the Buffalo, 5,650 feet above sea-level, as determined by the geodetic survey. The view is taken looking across a portion of the Giant's Playground.
8 ..	31	Mt. Dunn, looking S.W., a typical rocky peak exhibiting the several stages by which the massive granite is cut up into blocks, and how by further weathering massive tors and perched blocks are produced.
9 ..	31	North side of Mt. Dunn, showing jointing in the massive granite and weathered blocks.
10 ..	40	Eagle Point, a characteristic group of tors.
11 ..	9	The Cathedral from the north. A massive granite core.
12 ..	1	Top of the Horn, showing cairn and the N.W. dip of the N.E. set of joints.
13 ..	11	Le Souef's Peak, looking W., and showing N.E. joints.
14 ..	5	Big Gun Hill, looking E. Well weathered tors, isolated and perched blocks interspersed with dwarfed Snow Gums.
15 ..	5	Big Gun Hill, looking N.
16 ..	6	The Tombstones, exhibiting well-rounded outline due to weathering.
17 ..	34	The Devil's Couch. A very prominent landmark on the S. side of Crystal Brook.
18 ..	22	N. side of the Gorge, looking N.E. A precipice 800 feet high forms the N. wall. The N.E. set of joints is particularly well shown. The poised block on a prominent peak is known as Queen Victoria.
19, Fig. 1	23	South side of The Gorge, showing curved jointing.
19, Fig. 2	23	North side of The Gorge. The N.E. set of joints form the face of the cliff. The N.W. set of joints show as vertical lines on the face of the cliffs. The tabular jointing shows near the present surface, but is absent lower down.
20, Fig. 1	42	Smooth face of granite, showing both sets of vertical joints and tabular jointing. Dykes also show near the lower right-hand corner of the picture, and in the principal block in the upper part of the photograph.
20, Fig. 2	24	Tabular jointing near The Gorge on S. side.
21 ..	29	Tabular jointing resembling rude masonry, near the head of Eurobin Creek.
22 ..	1	The Wall of China, near the Horn. A good example of irregular jointing. This precipice and the more distant cliff give some idea of the abrupt boundary of portions of the tableland.
23 ..	35	The Split Rocks. A group of tors that have become isolated from the parent rock mass by weathering. The latent joint structure has been tardily developed. The largest tor still shows no sign of joints through its mass, the next tor to the right shows one vertical joint. The tor on the extreme right is split in two. The right-hand tor in the background is split in two, and the portions have fallen apart. The left-hand tor in the background is split in three pieces, which have fallen apart. The remarkable feature about this group of rocks is that the jointing has only been developed subsequent to the complete carving out of these blocks from the original granite mass and their later weathering into rounded tors.
24 ..	25	Group of tors, showing N.E. jointing, looking E.
25 ..	25	Same group, showing N.W. set of joints, looking N.
26 ..	30	Boulder Valley, showing numerous well-rounded tors.
27 ..	33	Group of large tors that have become displaced. Such sites were formerly frequented by the blackfellows, who visited the plateau at certain seasons for the purpose of feasting on the "bogong" moth, which frequents the dark passages and crevices among the jumbled granite blocks, especially of the Horn, in marvellous numbers.
28 ..	26	The Three Knights. Three well-rounded tors. The one in the background is split in two, and one portion has fallen away.
29 ..	3	Stonehenge. The upright block is about 60 feet high.
30 ..	4	The Table and Loaves. The table is a rectangular parallelogram in form. It is about 60 feet long. The Horn shows in the background.
31 ..	39	The Biscuit and Cheese, showing rectangular and spherical weathering at the same site.
32 ..	32	The Woolpack, looking N., about 40 feet high.
33 ..	32	Same looking E. This group shows the three sets of jointing remarkably well.
34, Fig. 1	9	The Cathedral, looking E.
34, Fig. 2	41	Group of tors, North Buffalo.
35 ..	36	Og, Gog, and Magog. Three gigantic tors on the crest of a hill. The face of the largest is about 100 feet high, 104 feet long, and 43 feet wide. The dark lines near the figure are stains made by water.
36 ..	21	The Pigeon Hole Rock. A fine poised rock standing on a bare granite floor. There are holes underneath the mass large enough for a man to creep into (vide the photo) 61 feet long, 17 feet broad, and 16 feet high; greatest circumference 80 feet.

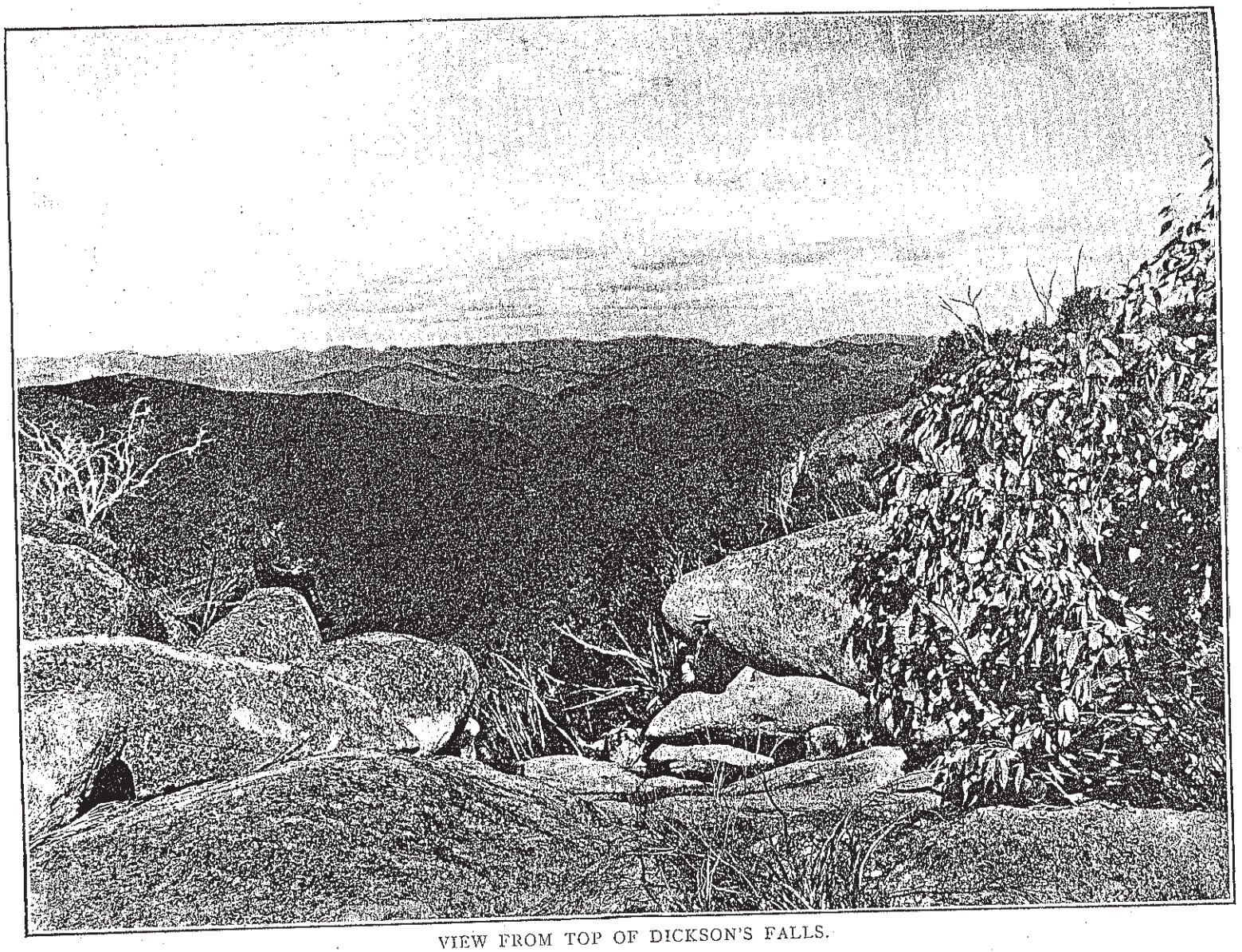
CATALOGUE OF VIEWS—BUFFALO MOUNTAINS—*continued.*

Plate Number.	Locality. No. on Plan.	Description.
37 ..	21	The Pigeon Hole Rock, W. end.
38 ..	19	The Torpedo, looking S. Length, 45 feet, breadth 10 feet, height 13 feet, girth 46 feet.
39 ..	18	The Pebble. Length 54 feet, breadth 42 feet, height 40 feet.
40 ..	12	The Leviathan. Length 108 feet, breadth 70 feet, height 40 feet, girth 170 feet. Stands on base 21 feet long, 12 feet wide.
41 ..	2	The Bridge of Sighs.
42 ..	16	Mahomet's Coffin. About 30 feet long, suspended by the two ends only.
43 ..	14	The Kissing Stones. The larger stone is 18 feet in length, and it rests on a pillar 20 feet high.
44 ..	13	The Mussel Rock.
45 ..	15	The Riven Rock. Height about 80 feet.
46 ..	10	The Sentinel. About 60 feet high. The shell which has fallen from the end of this rock is shown in black shadow.
47 ..	8	The Whale Rock.
48 ..	37	The Sarcophagus. The portion that overhangs its support is about 25 feet long.
49, Fig. 1	27	The Monolith. Length 22 feet, breadth 14 feet, height 30 feet. This is the most conspicuous rock on the mountains.
49, Fig. 2	5	The Logan Stone. Approximate weight 60 tons. The small block on top weighs about 2 tons, and it poises the larger rock. This stone can be rocked with the hand.
50 ..	7	The Egg Rock. The best example of a poised rock. The base of this well weathered tor, which weighs from 70 to 80 tons, length 16 feet, width 12 feet, is so small (7 feet by 1 foot) that a slight earth tremor would certainly displace it. Its perilous balance testifies that for some thousands of years no severe earthquake has affected this locality.
51 ..	38	Snow Gums growing on granite tor. The height of the top of the rock is about 20 feet from the ground surface. The joint is where the roots of the trees have passed down to the ground.
52 ..	38	Top of the same tor, showing prostrate dead trees and their living successors, and illustrating the manner in which trees force the rocks apart along joints by means of their roots.
53 ..	17	A dwarfed Snow Gum growing on an exposed granite tor. It is crooked and wizened, starved as regards nourishment, exposed to bitter cold and to fierce storms, but it still struggles for existence.

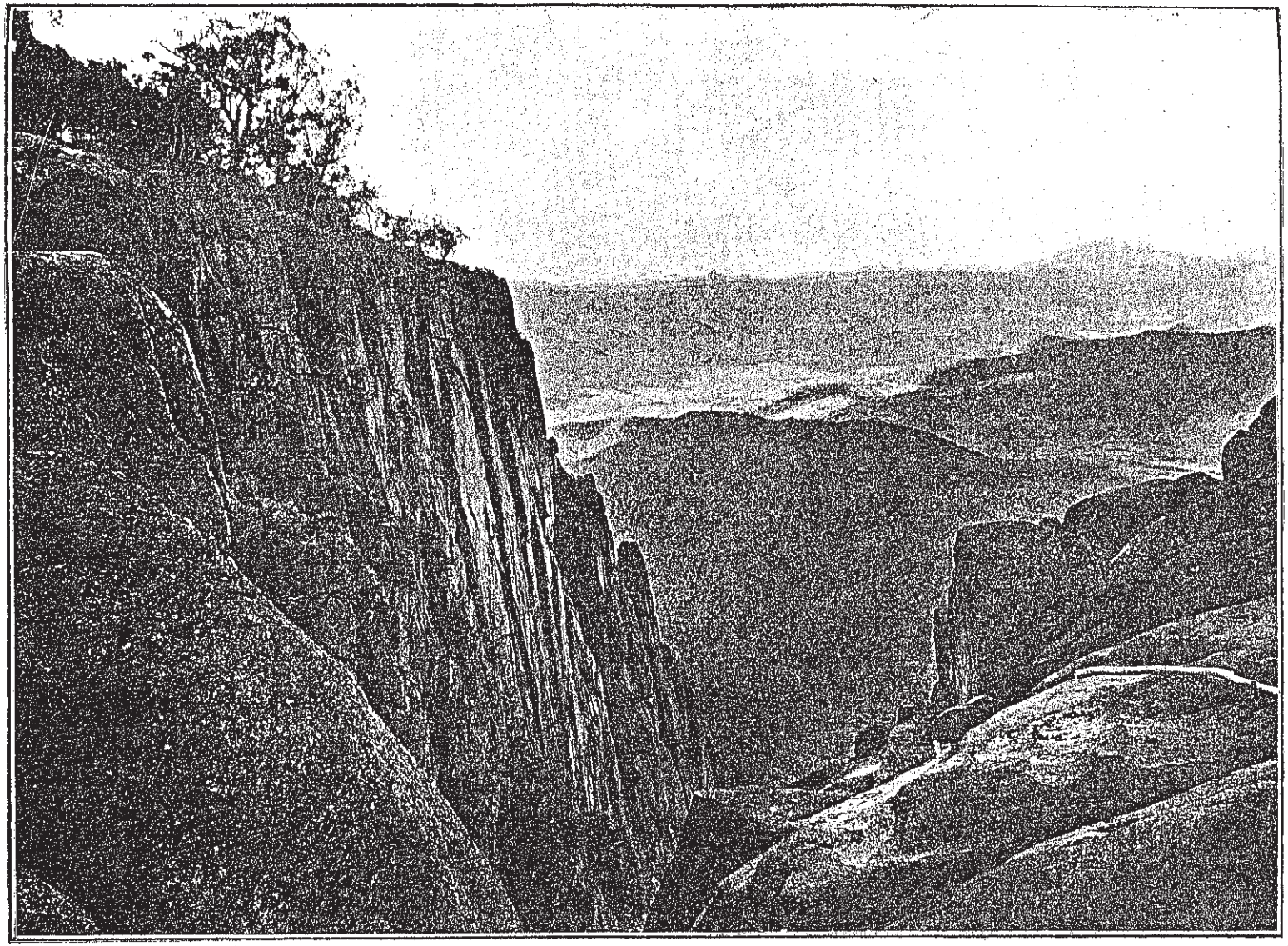
PLATE I.



THE BUFFALO MOUNTAINS FROM POREPUNKAH.

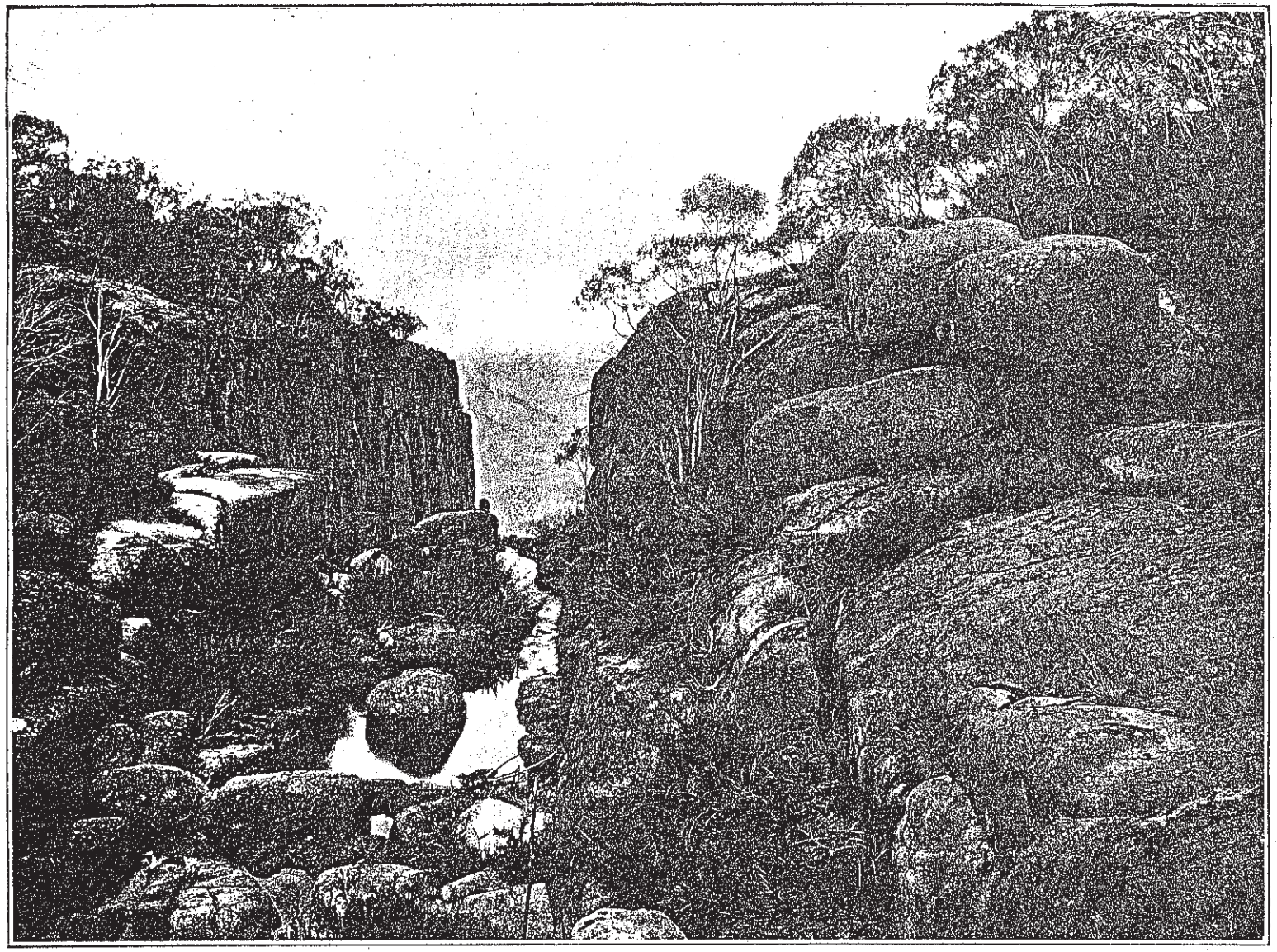


VIEW FROM TOP OF DICKSON'S FALLS.



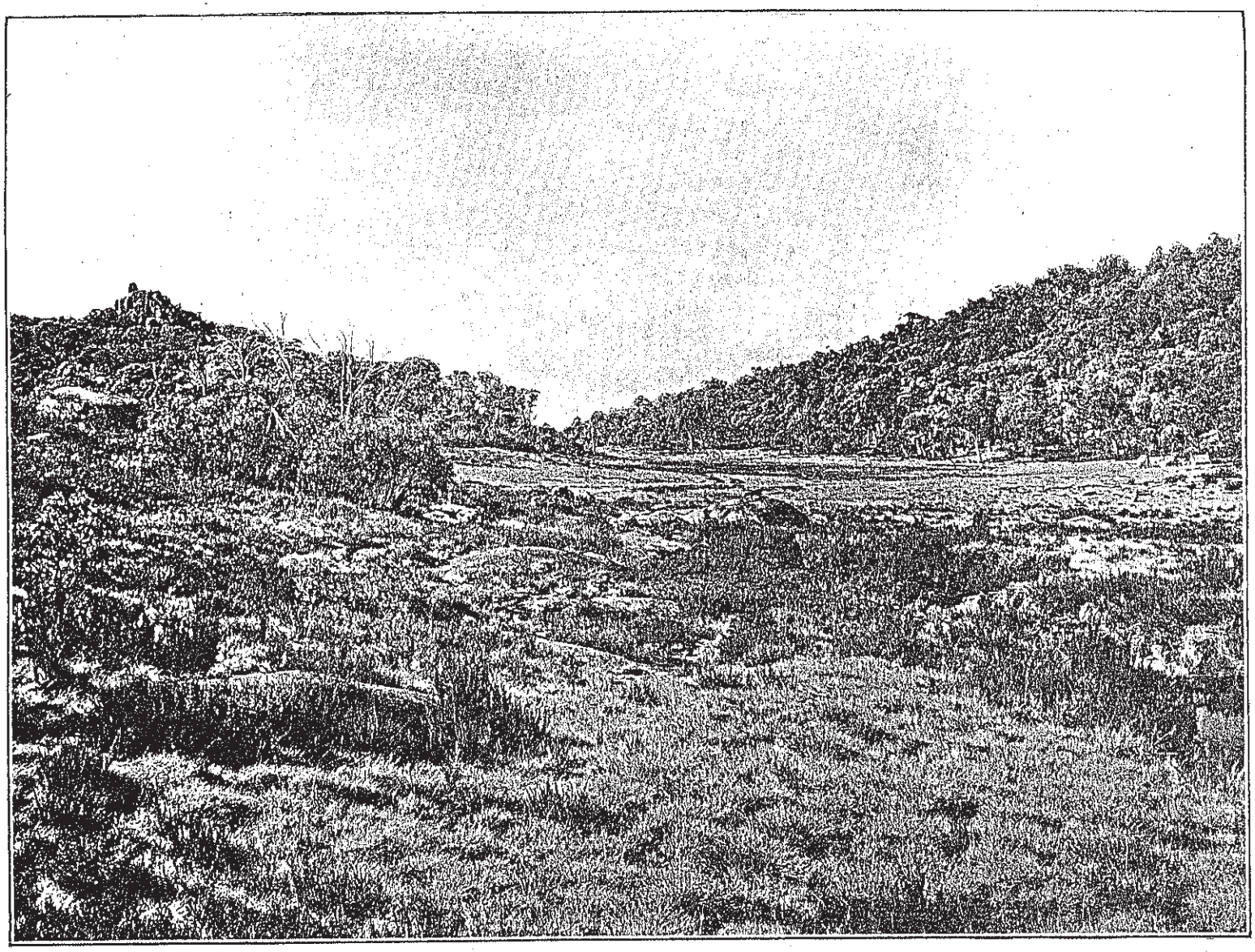
Loc. 22 on Map.

VIEW FROM SOUTH SIDE OF THE GORGE.



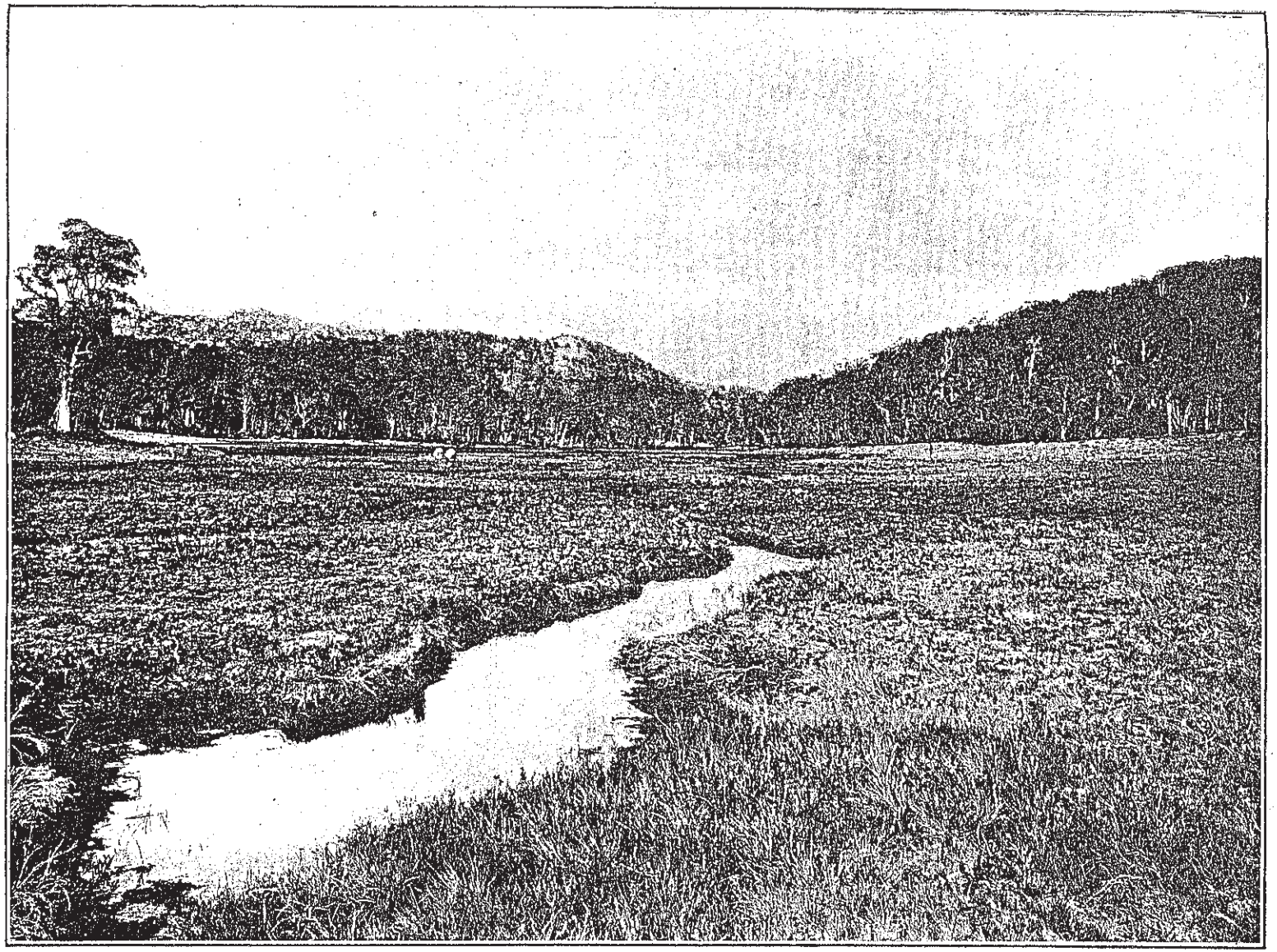
Loc. 23 on Map.

THE GORGE: LOOKING EAST.



Loc. 28 on Map.

CAMP PLAIN: LOOKING SOUTH.

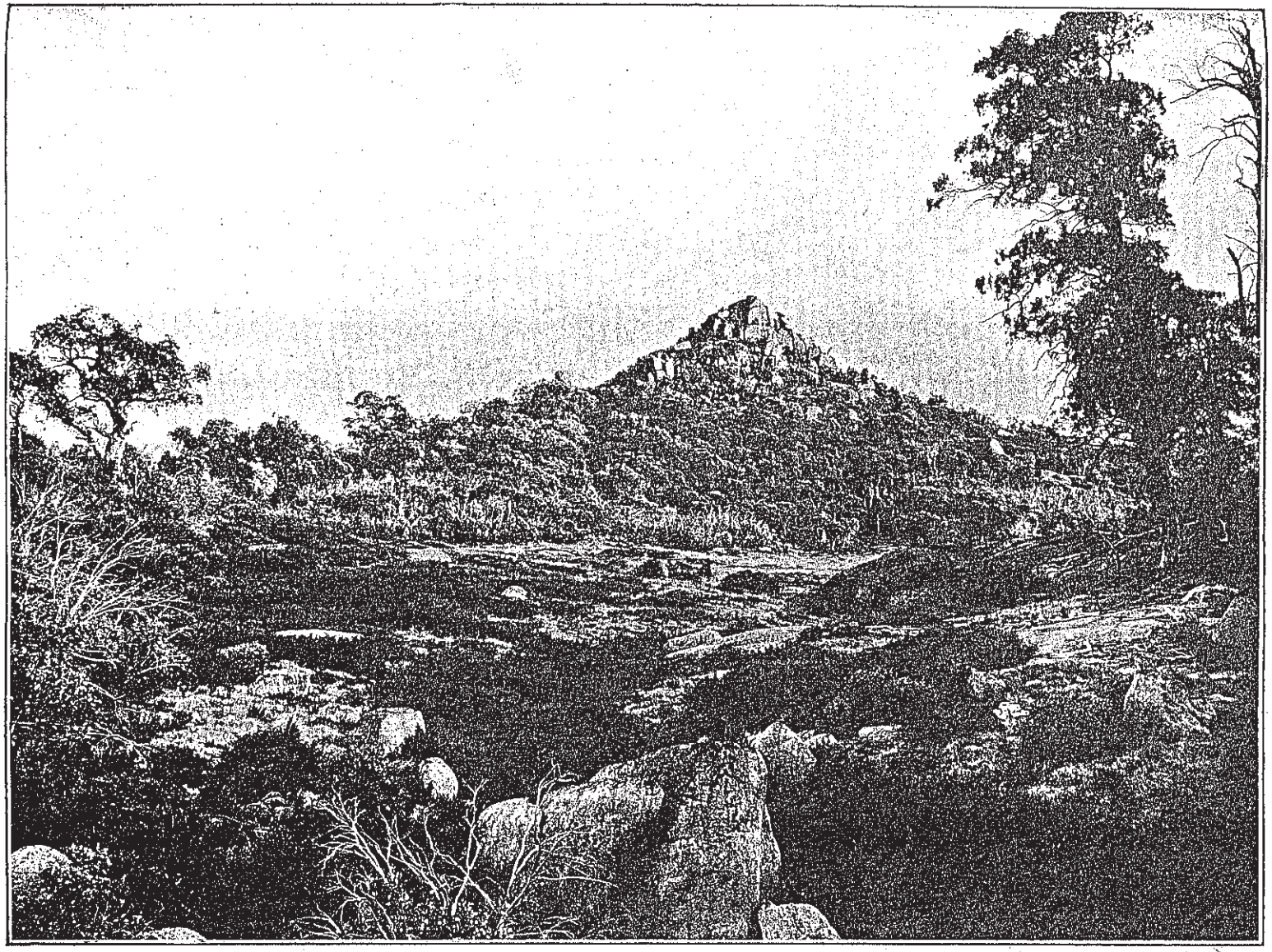


Loc. 20 on Map.

THE LONG PLAIN: LOOKING WEST.

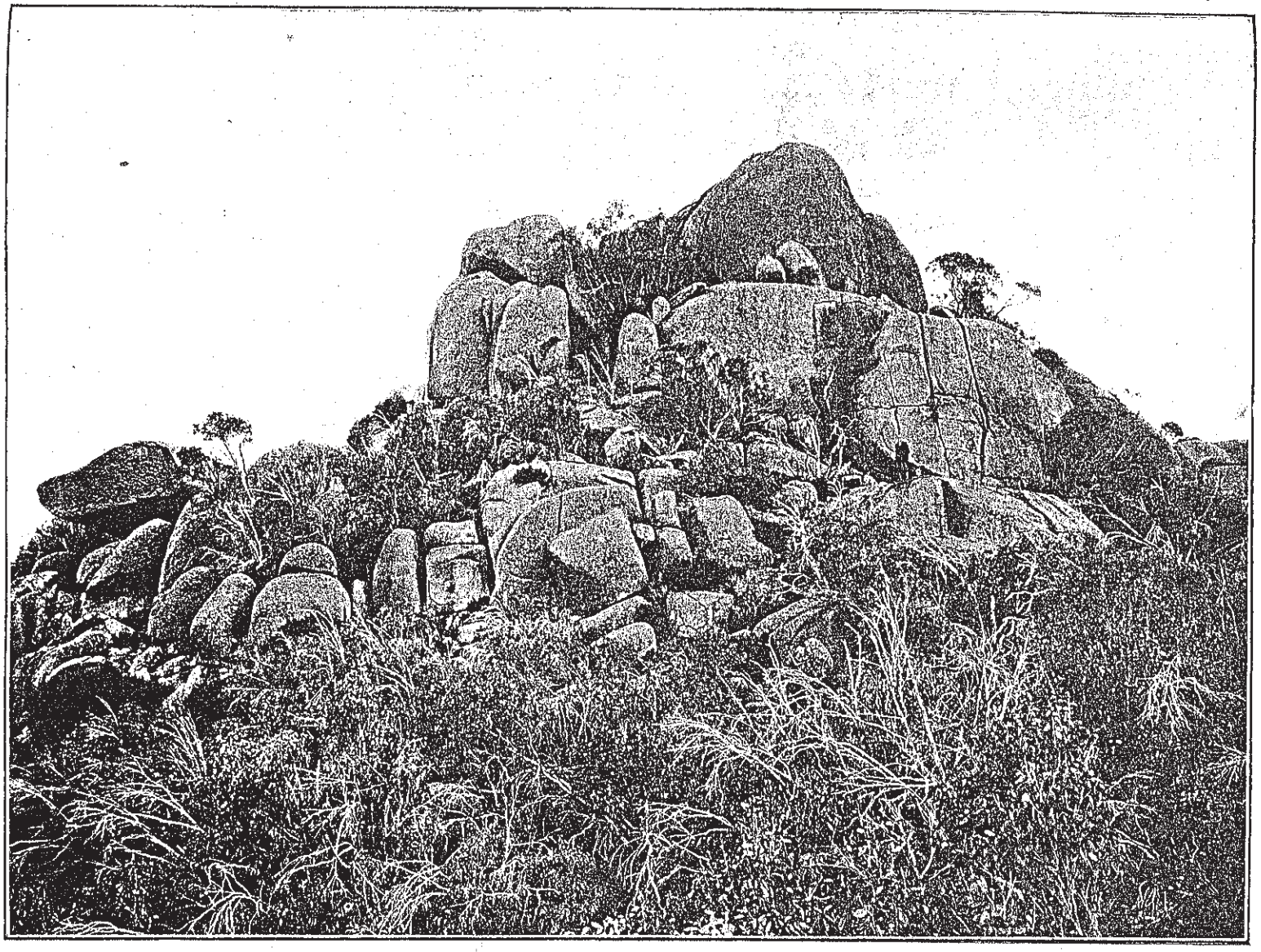
Loc. 1 on Map.

THE HORN: LOOKING WEST.



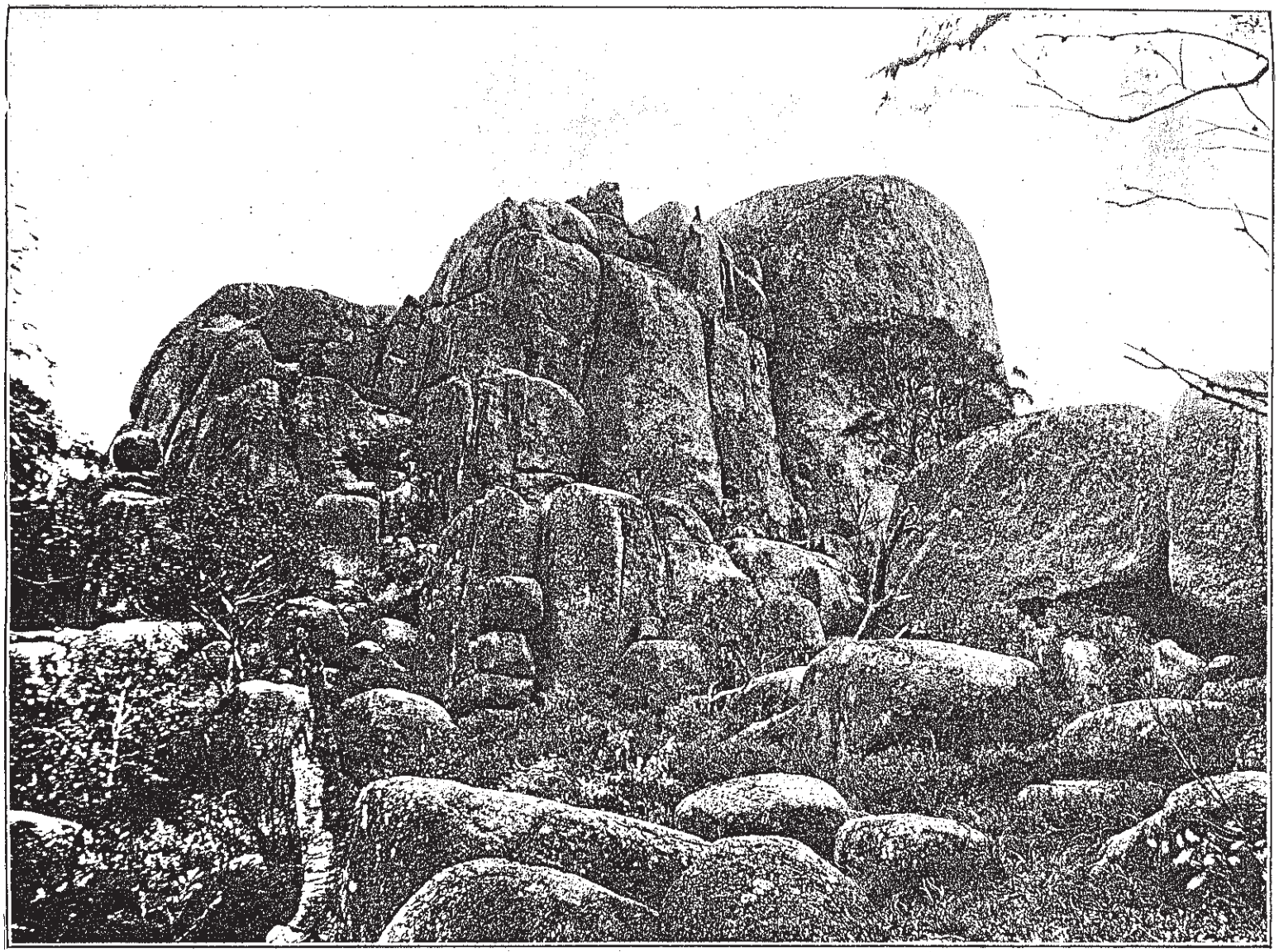
Loc. 31 on Map.

MOUNT DUNN: LOOKING SOUTH-WEST.



Loc. 31 on Map.

NORTH SIDE OF MOUNT DUNN.



Loc. 40 on Map.

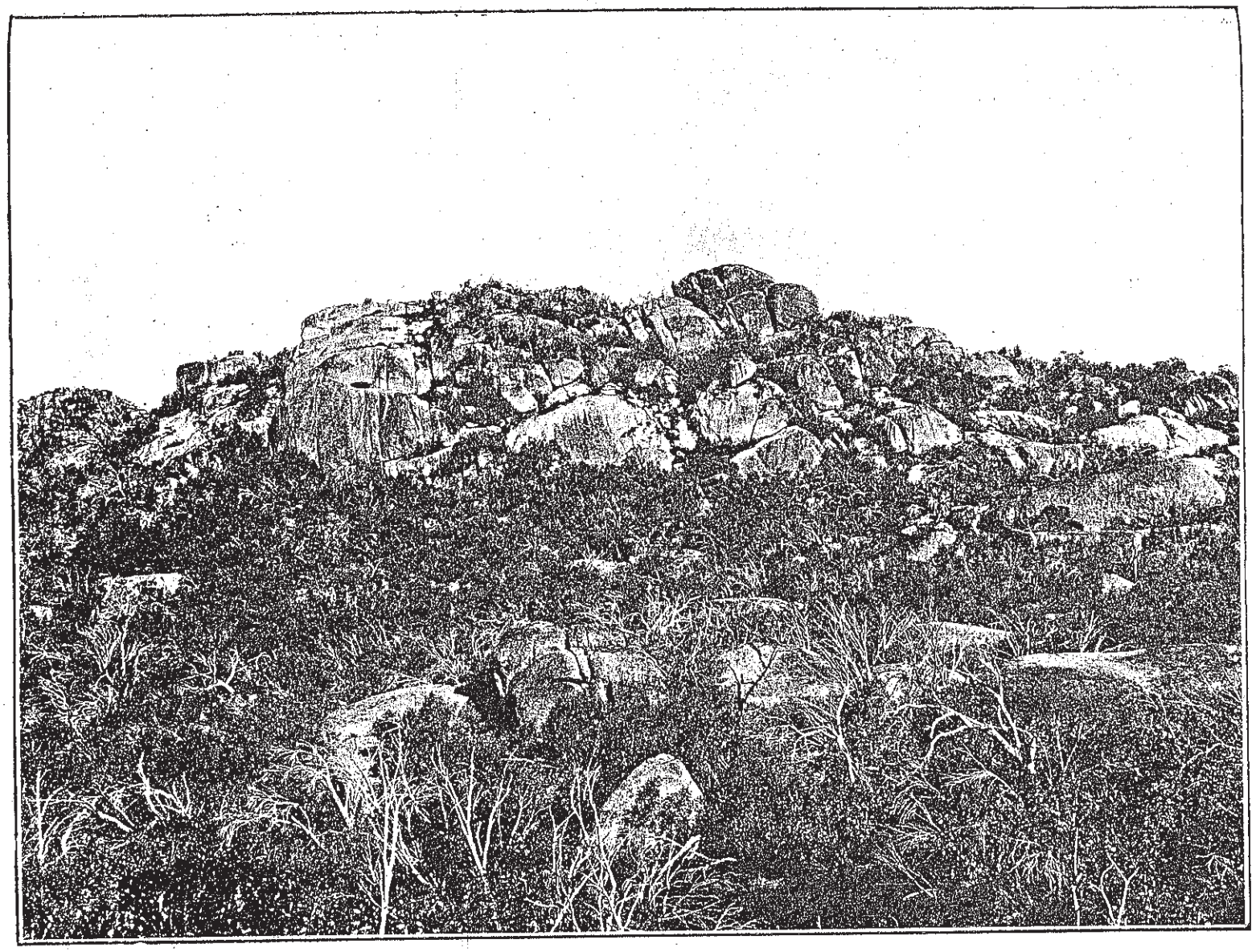
EAGLE POINT.

Loc. 9 on Map.

THE CATHEDRAL: LOOKING SOUTH.

Loc. 1 on Map.

TOP OF THE HORN

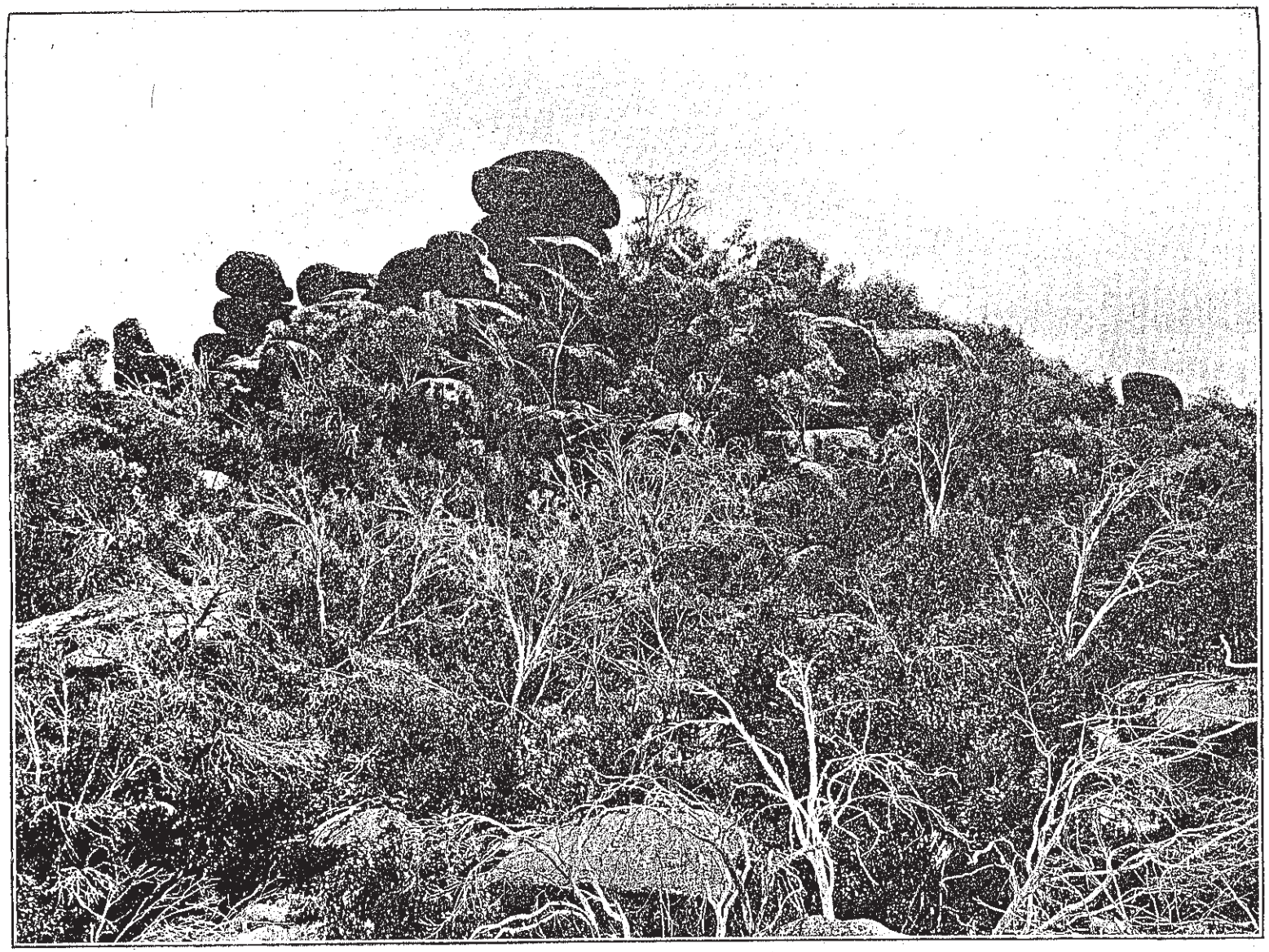


Loc. 11 on Map.

LE SOUEF'S PEAK: LOOKING WEST.

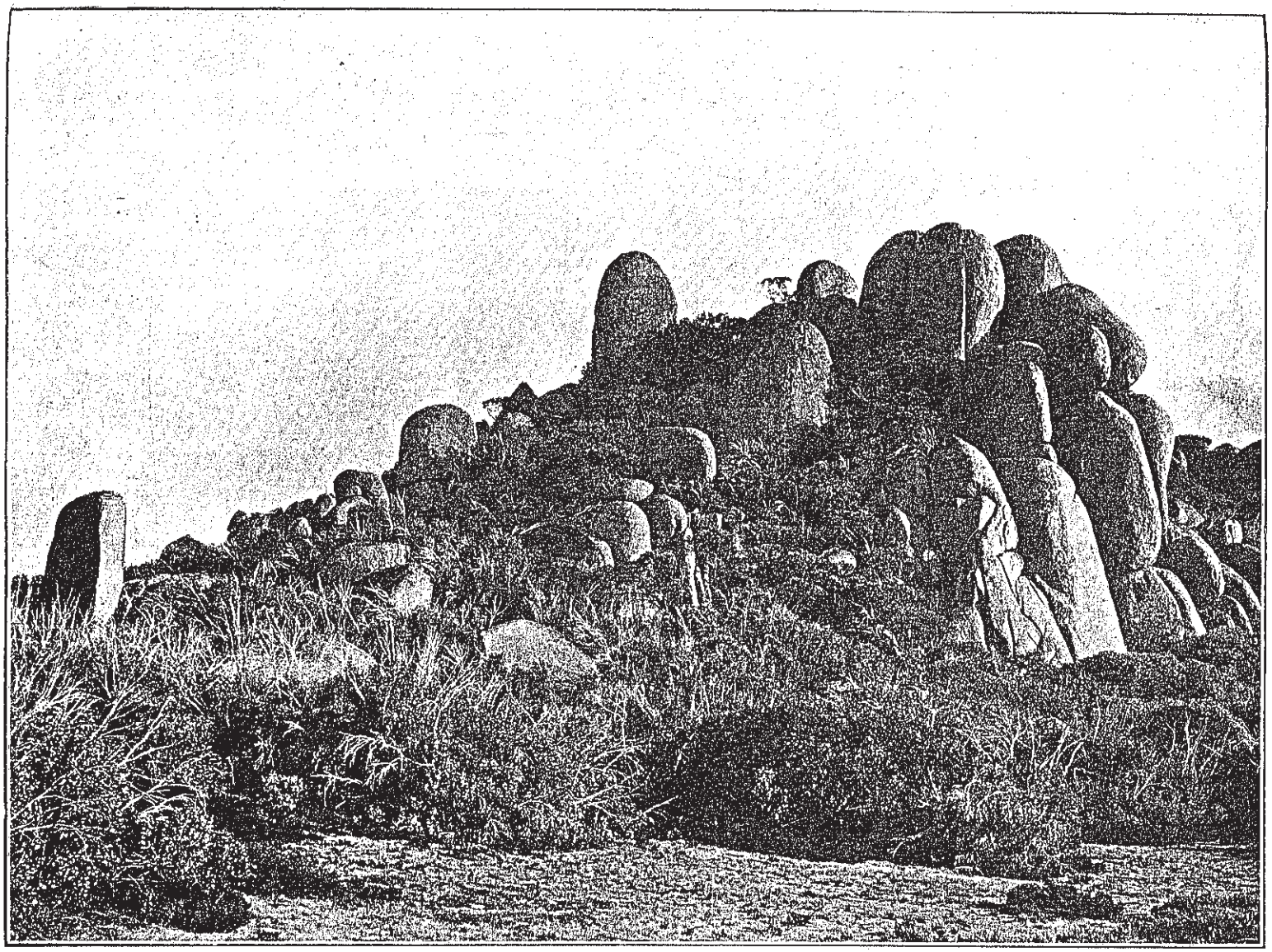
Loc. 5 on Map.

BIG GUN HILL: LOOKING EAST



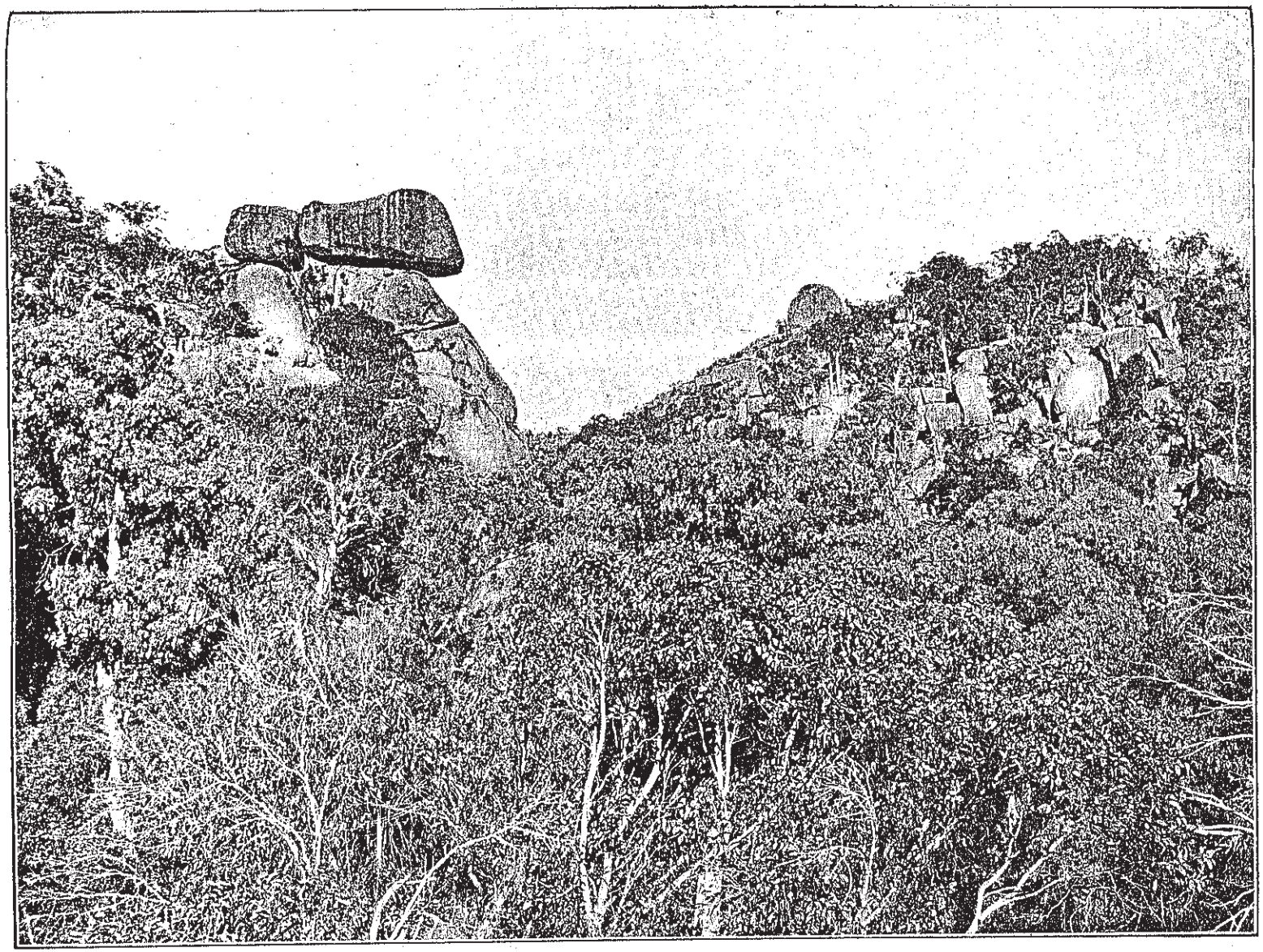
Loc. 5 on Map.

BIG GUN HILL: LOOKING NORTH.



Loc. 6 on Map.

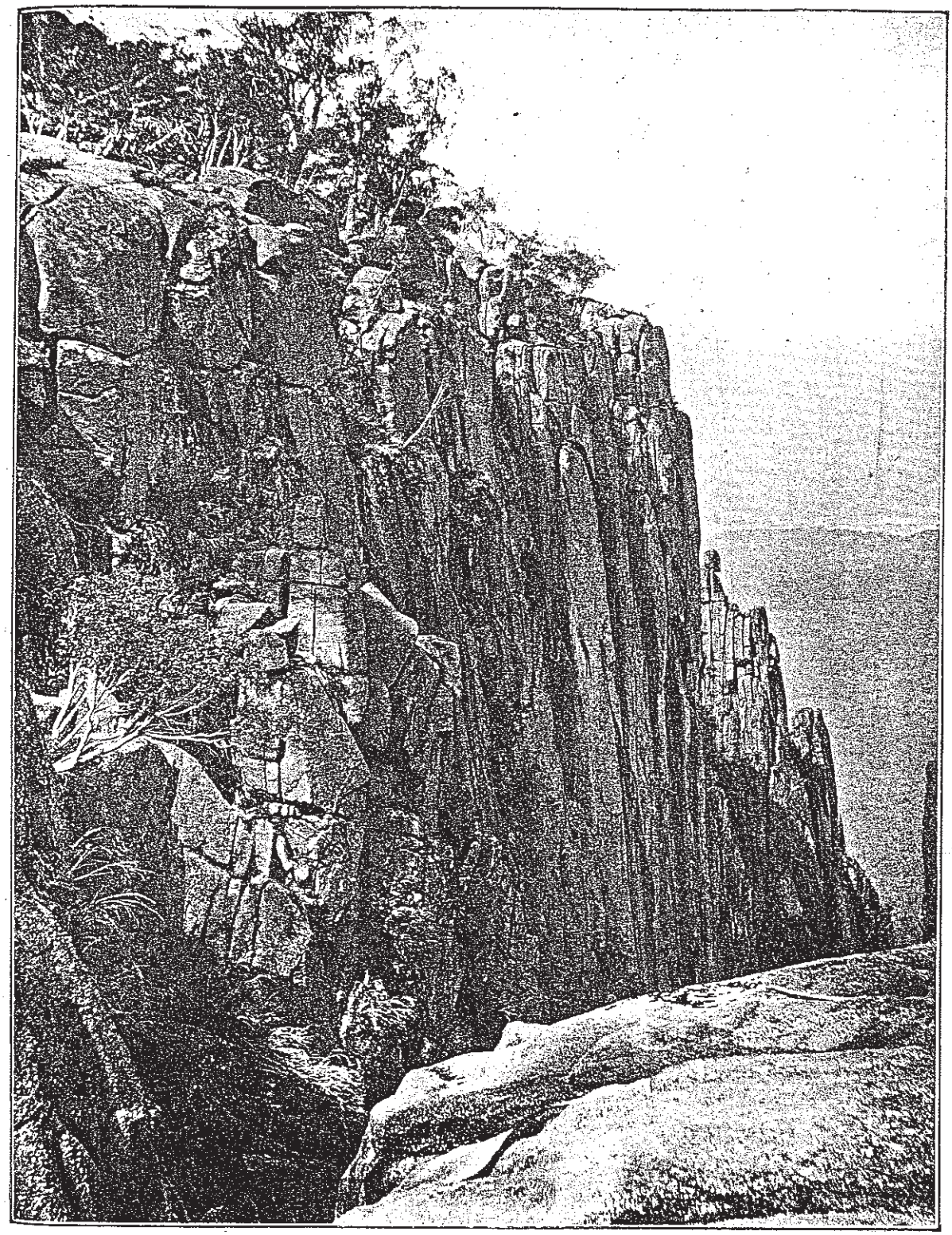
THE TOMBSTONES.



Loc. 34 on Map.

THE DEVIL'S COUCH.

PLATE 13.



Loc. 22 on Map.

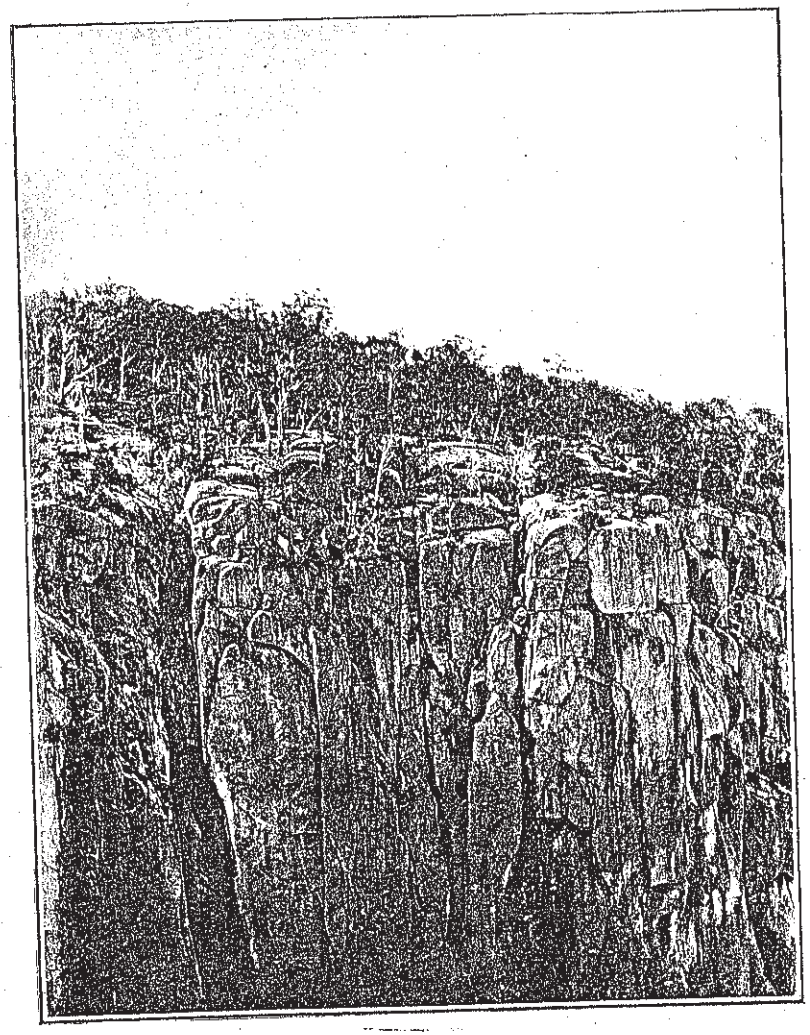
NORTH SIDE OF THE GORGE: LOOKING NORTH-EAST.

Fig. 1.

Loc. 23 on Map.

SOUTH SIDE OF THE GORGE: LOOKING SOUTH.

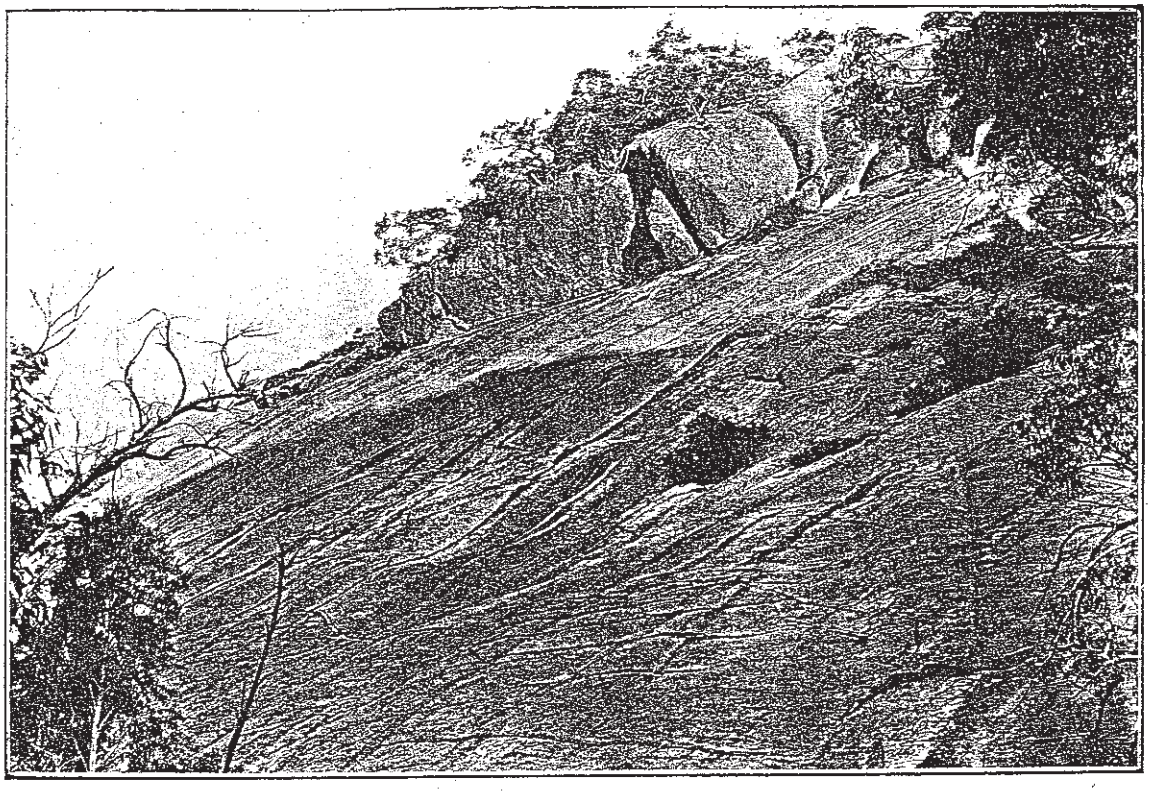
Fig. 2.



Loc. 22 on Map.

NORTH SIDE OF THE GORGE: LOOKING NORTH.

Fig. 1. PLATE 20.



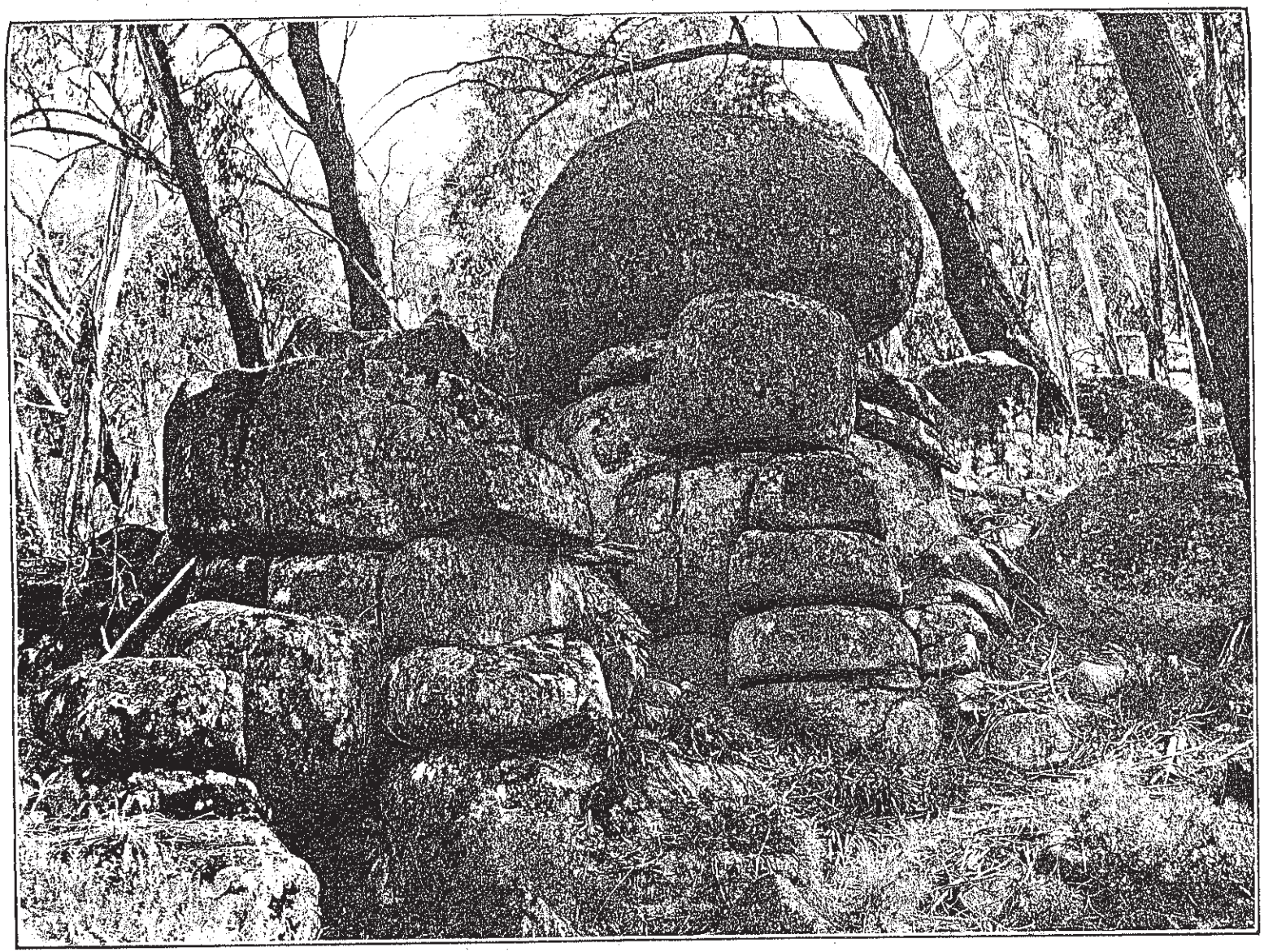
Loc. 42 on Map.

TABULAR JOINTING, ETC.: NORTH BUFFALO.

Fig. 2.

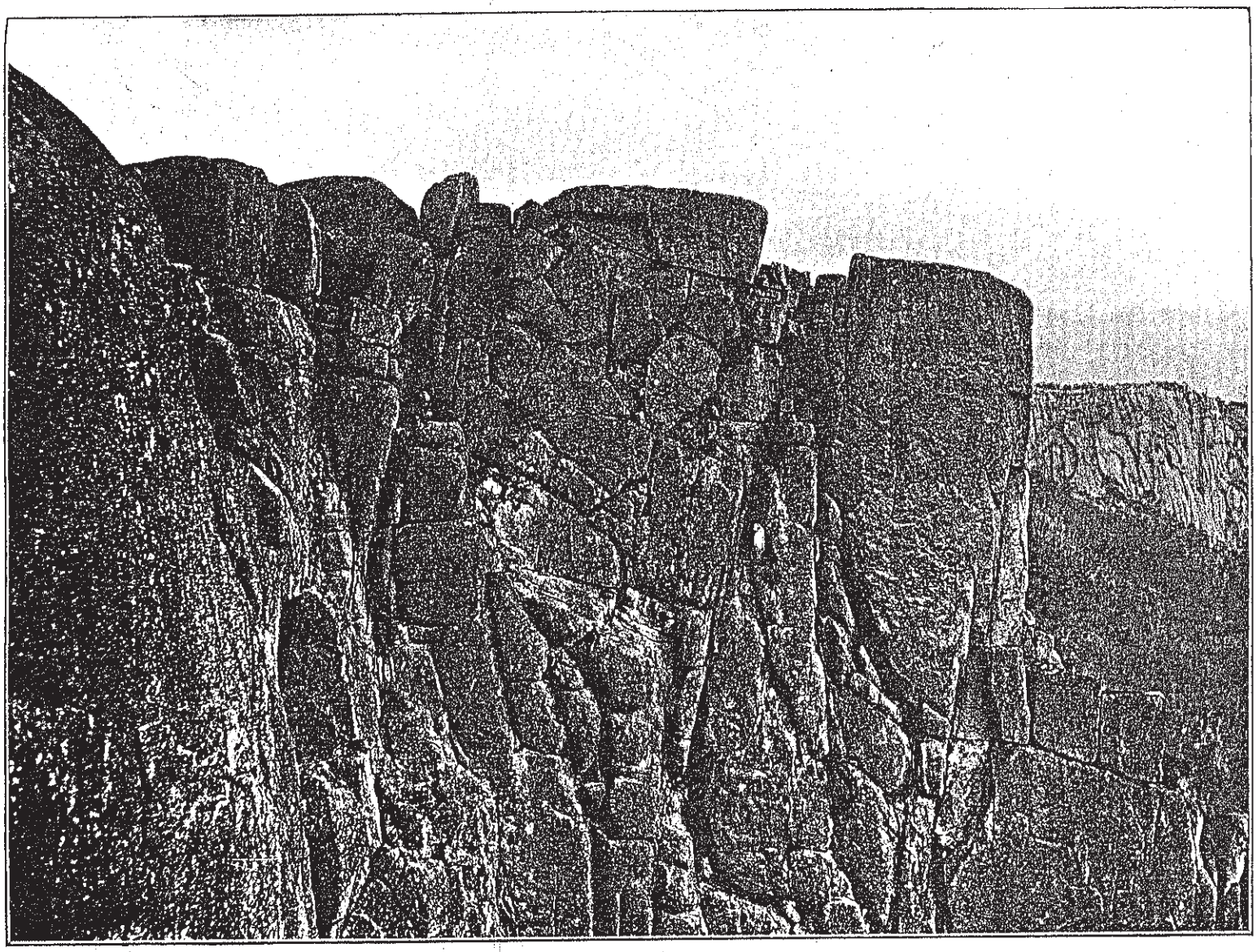
Loc. 24 on Map.

TABULAR JOINTING: NEAR HOSPICE.



Loc. 29 on Map.

TABULAR JOINTING: NEAR HEAD OF EUROBIN CREEK.



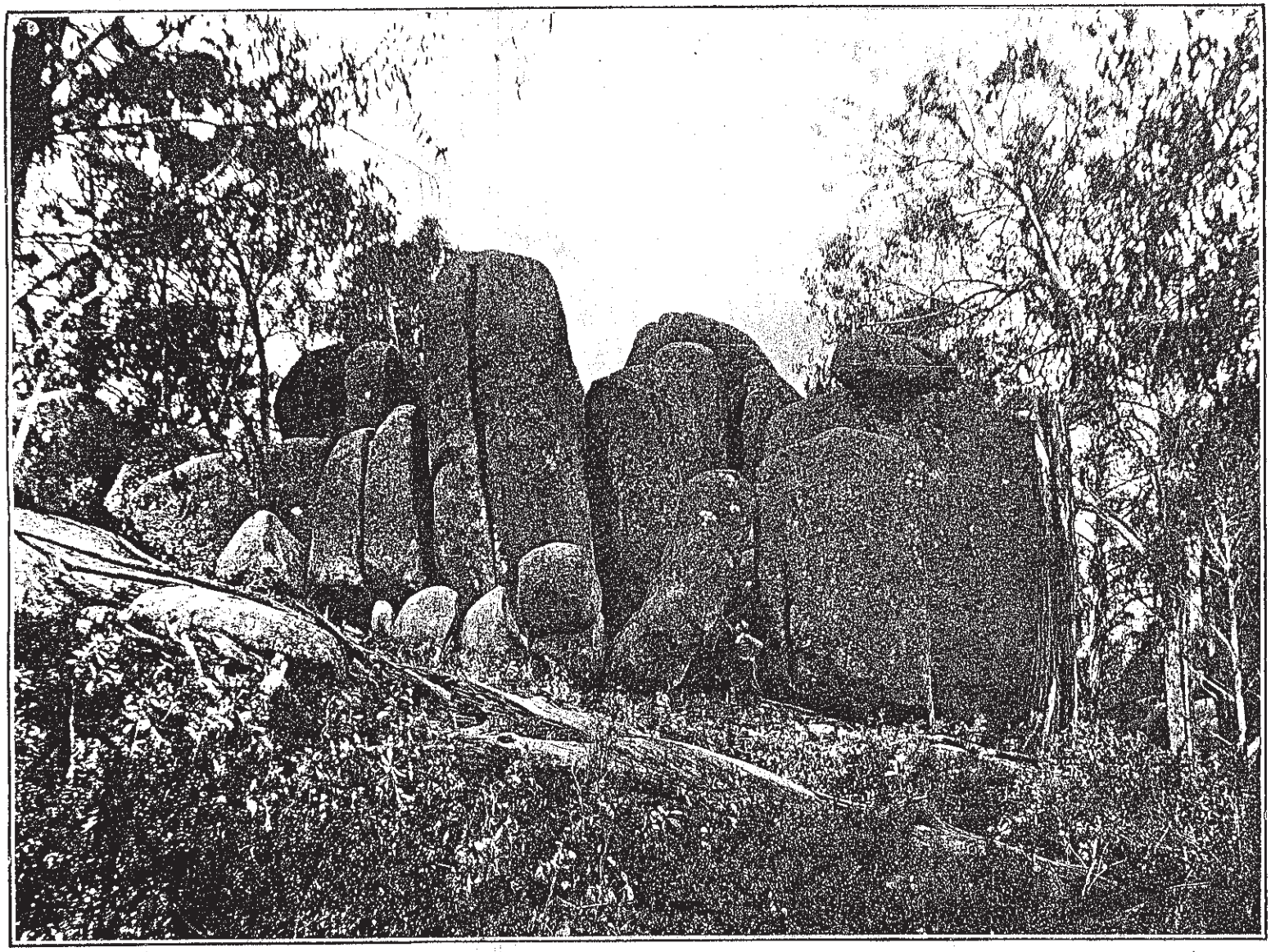
Loc. 1 on Map.

THE WALL OF CHINA NEAR THE HORN.

Loc. 35 on Map.

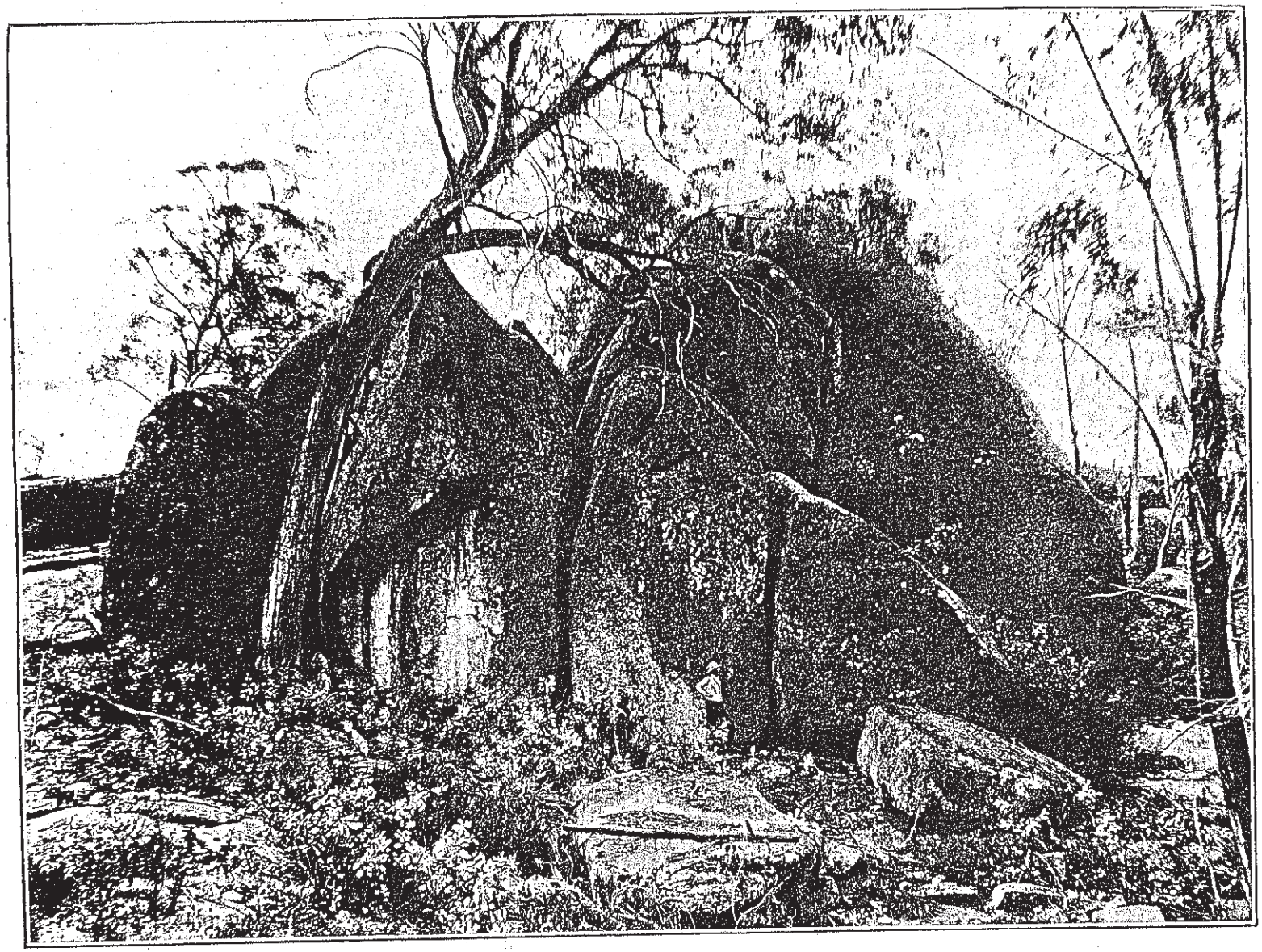
THE SPLIT ROCKS.

36



Loc. 25 on Map.

GROUP OF TORS SHOWING NORTH-EAST JOINTING: LOOKING EAST.



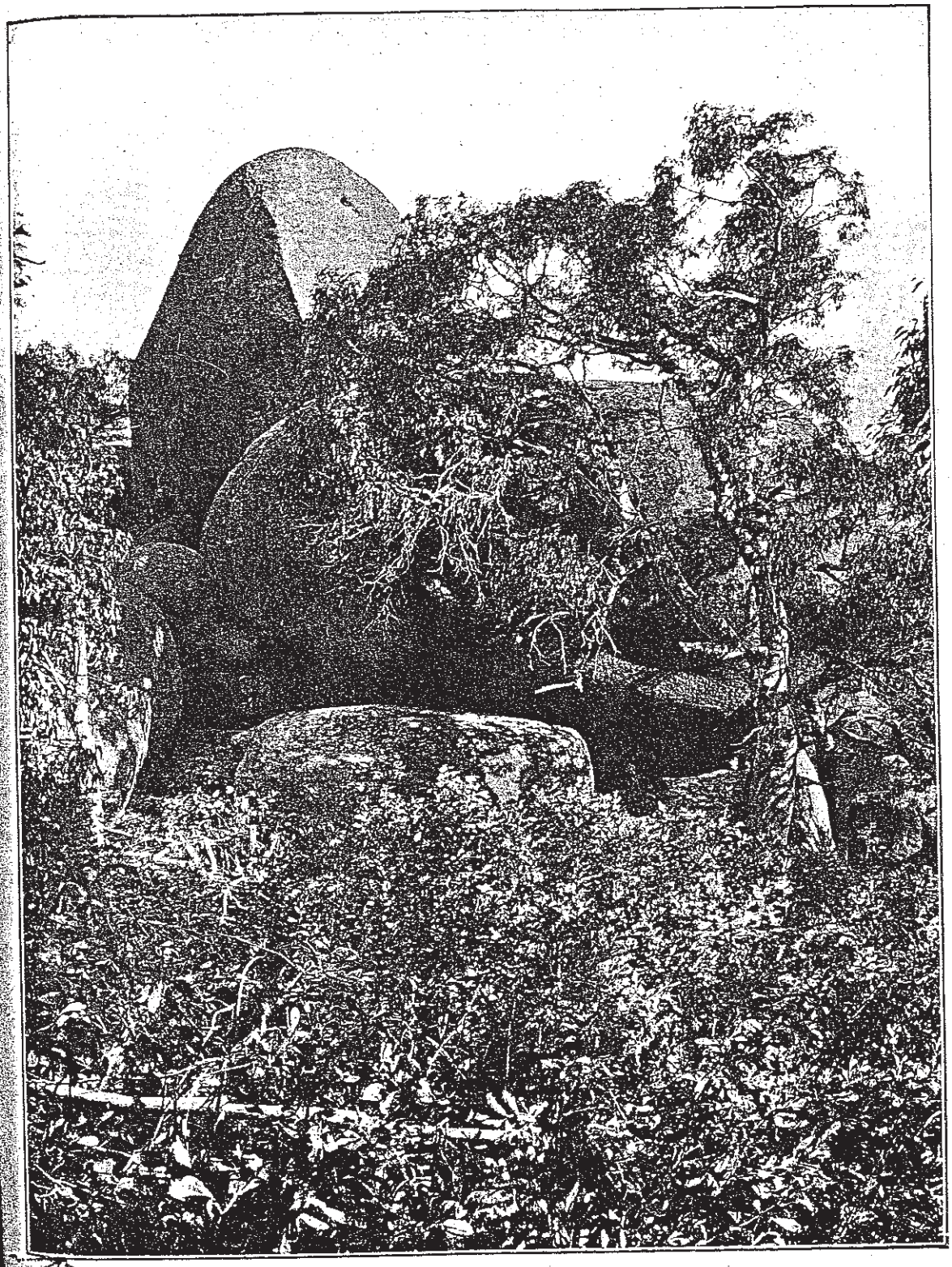
Loc. 25 on Map.

SAME GROUP AS ON PLATE 24, SHOWING N.W. JOINTING: LOOKING NORTH.

Loc. 30 on Map.

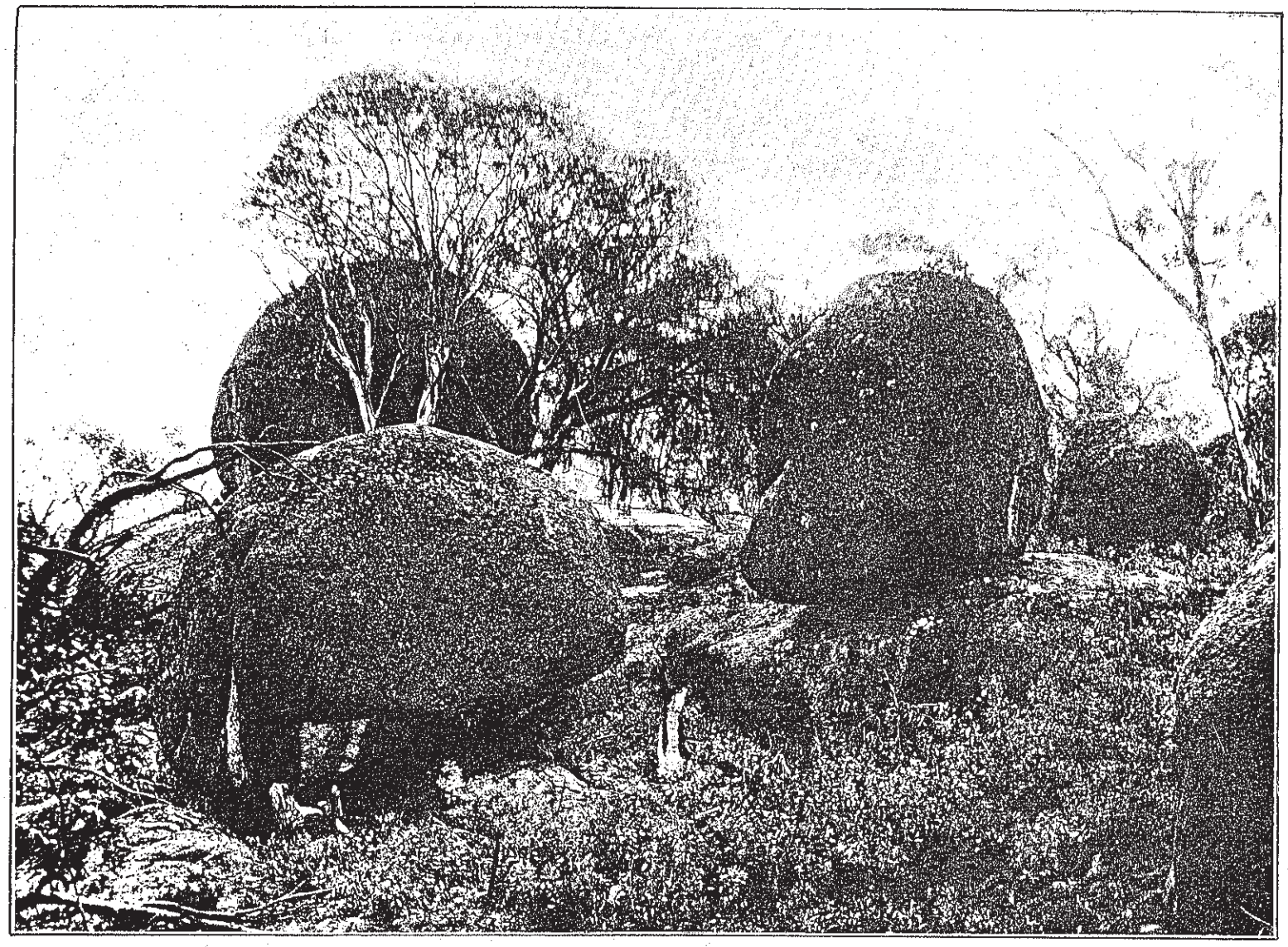
BOULDER VALLEY.

PLATE 27.



Loc. 33 on Map.

GROUP OF TORS.

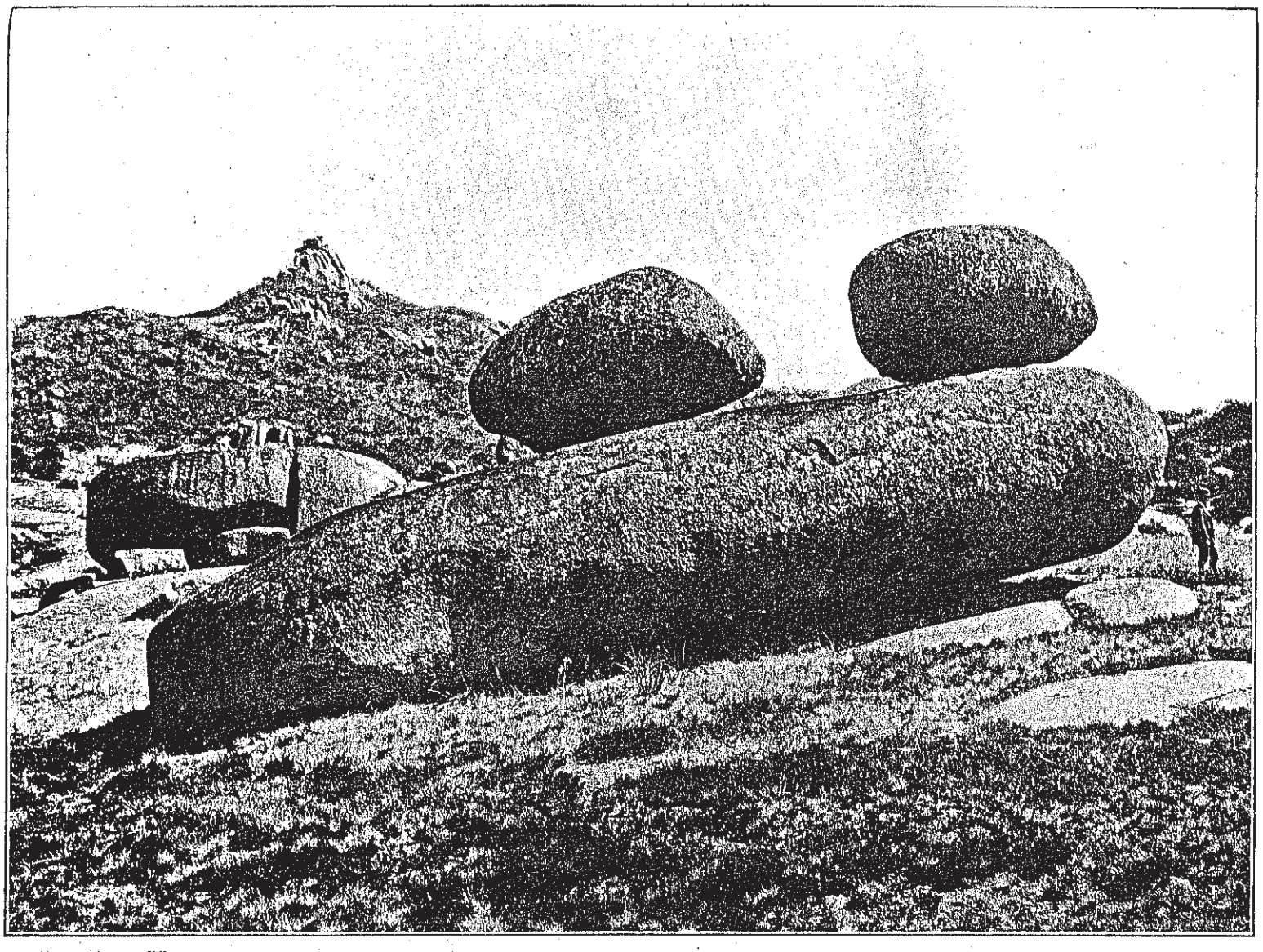


Loc. 26 on Map.

THE THREE KNIGHTS.

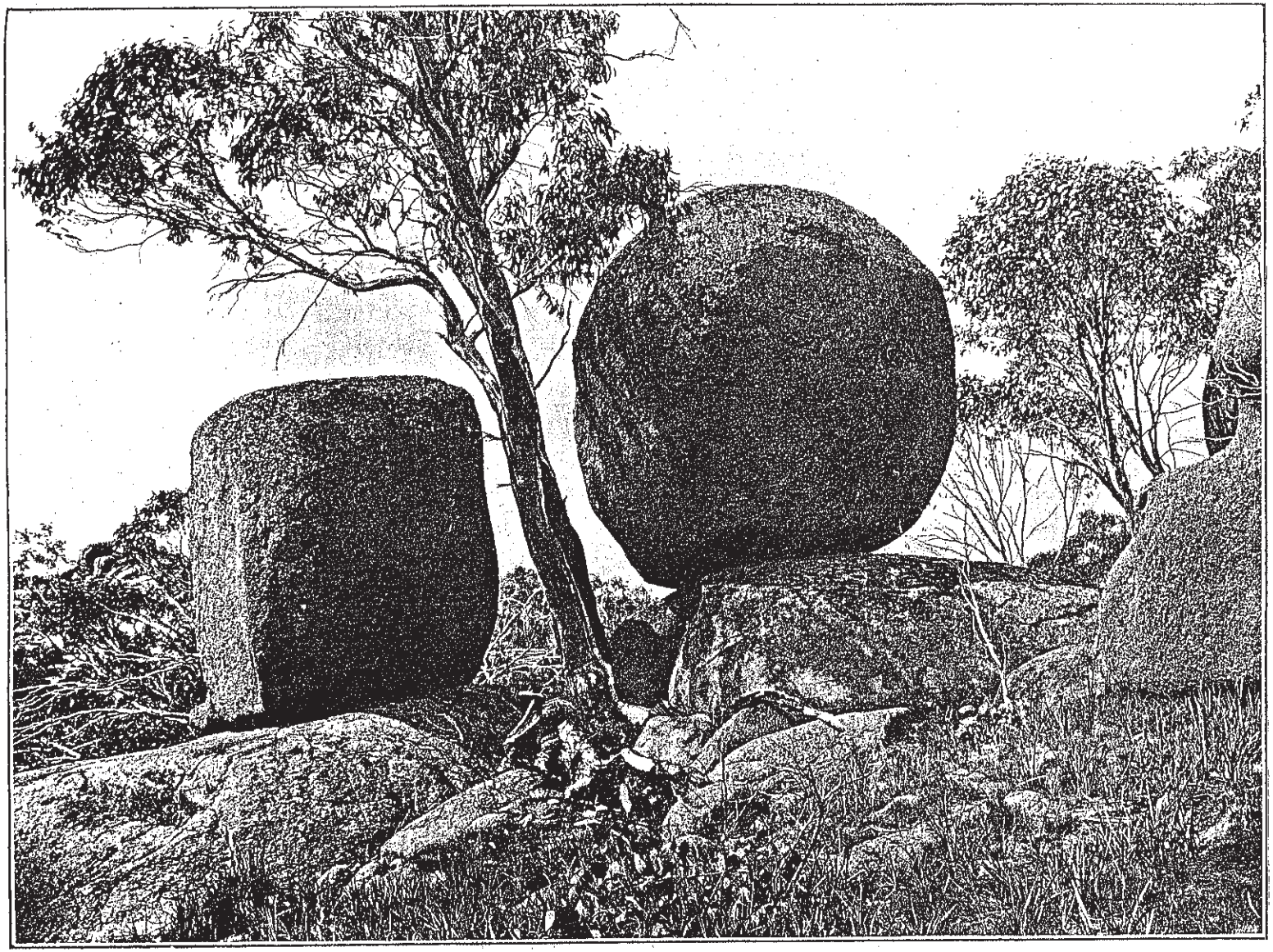
Loc. 3 on Map.

STONEHENGE.



Loc. 4 on Map.

THE TABLE AND LOAVES.



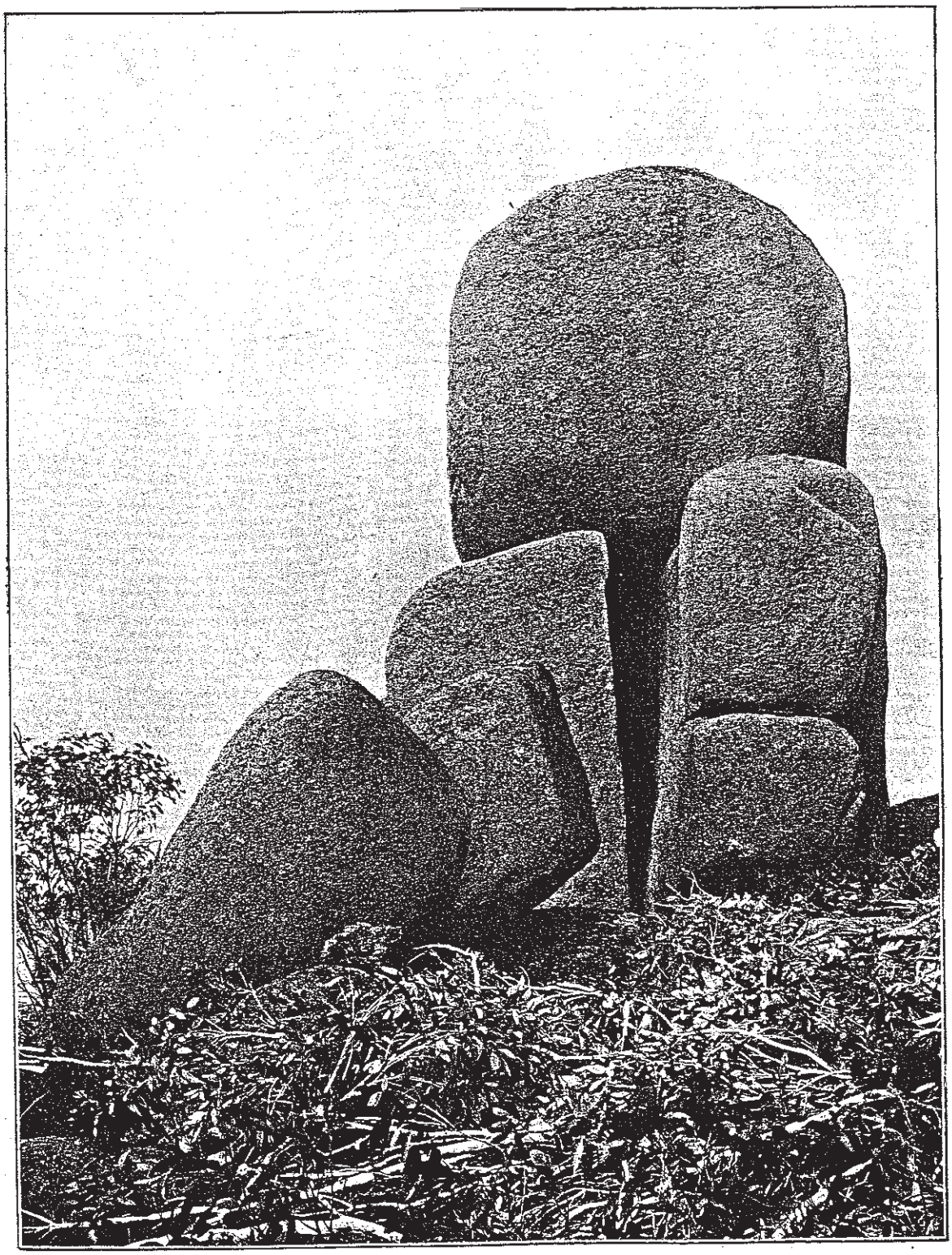
Loc. 39 on Map.

THE BISCUIT AND CHEESE.

Loc. 32 on Map.

THE WOOLPACK: LOOKING NORTH.

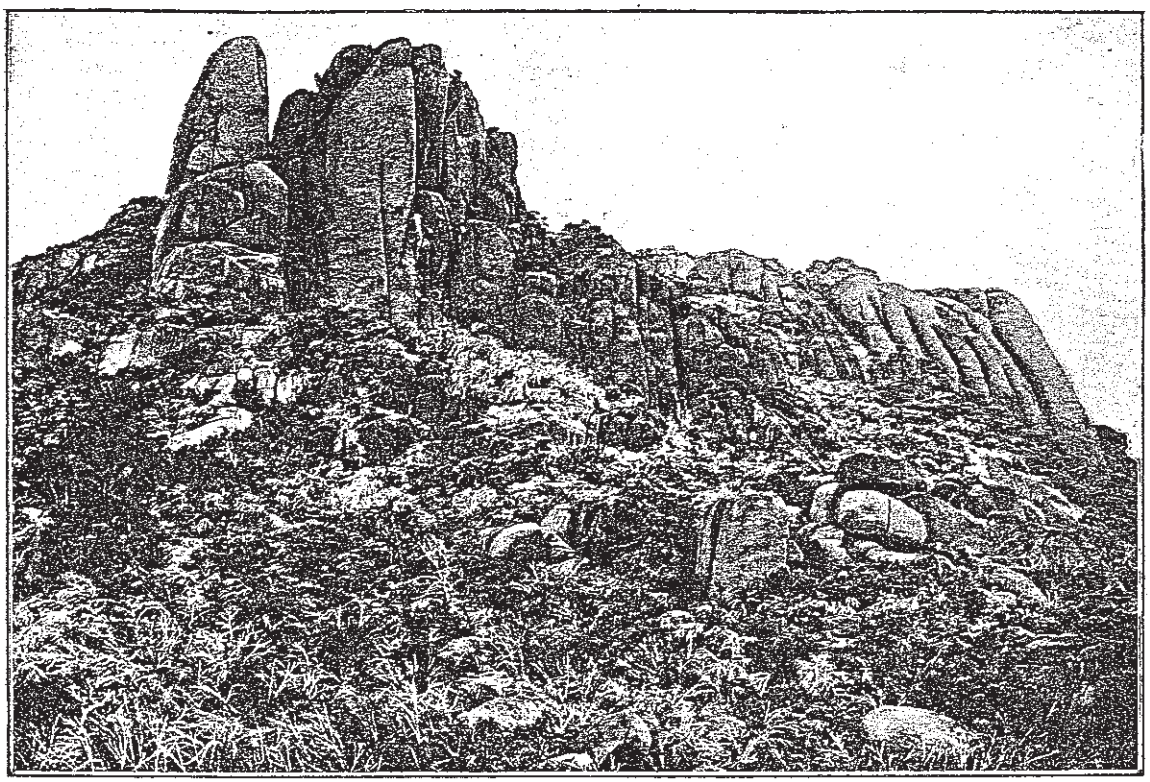
PLATE 33.



Loc. 32 on Map.

THE WOOLPACK: LOOKING EAST.

Fig. 1. PLATE 34.



Loc. 9 on Map.

THE CATHEDRAL: LOOKING EAST.

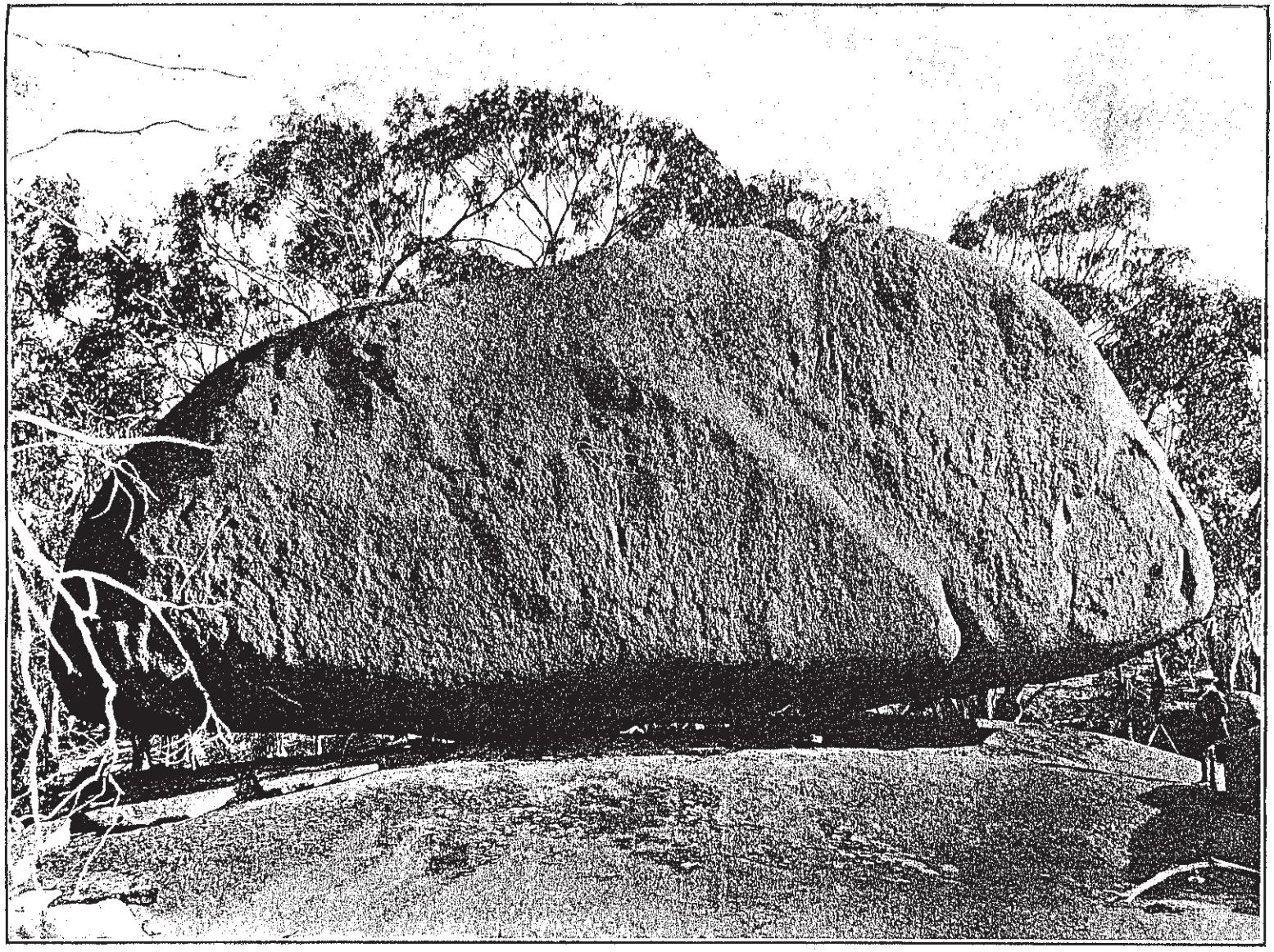
Fig. 2.

Loc. 41 on Map.

GROUP OF TORS, NORTH BUFFALO.

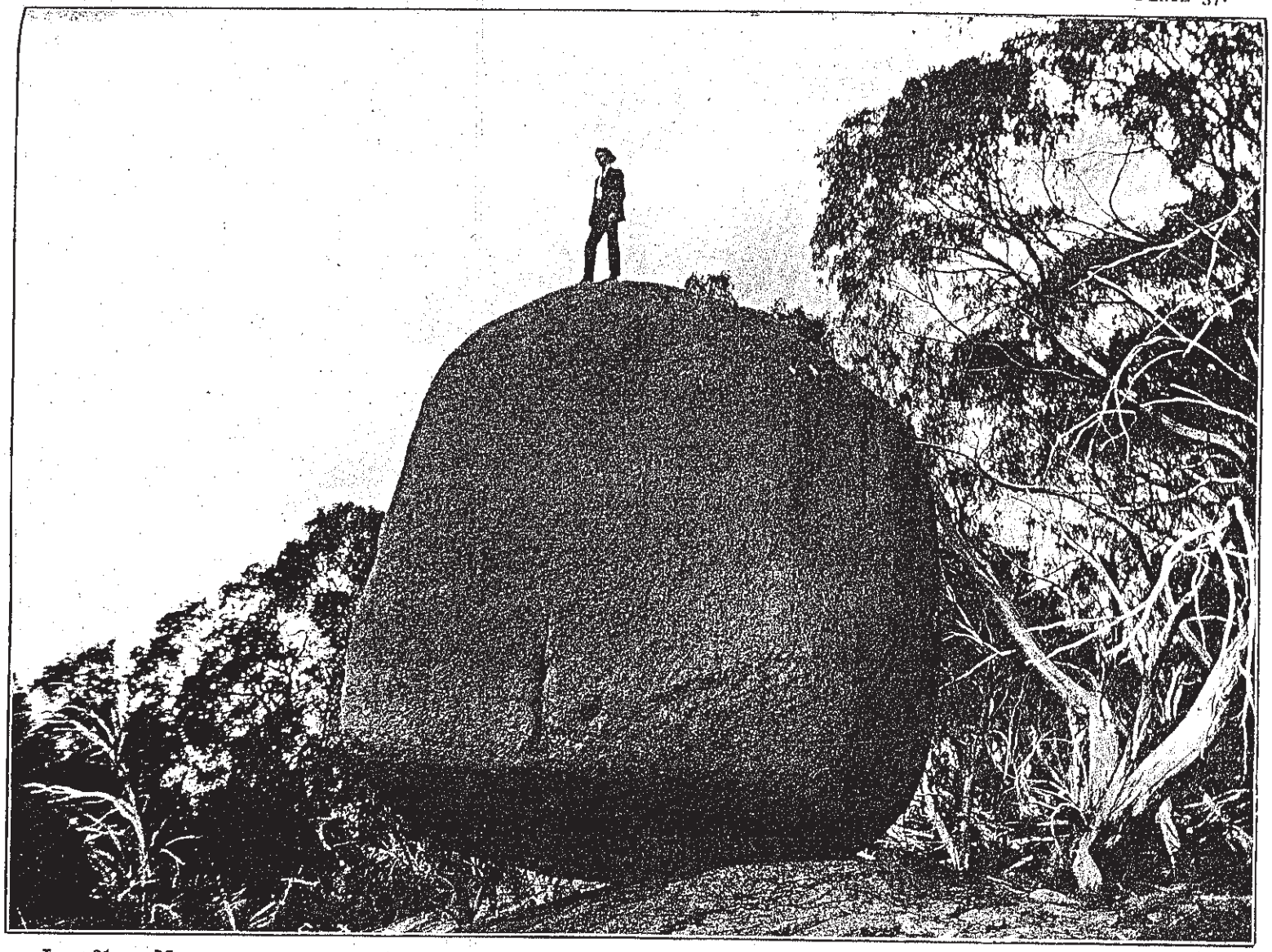
Loc. 36 on Map.

OG, GOG, AND MAGOG.



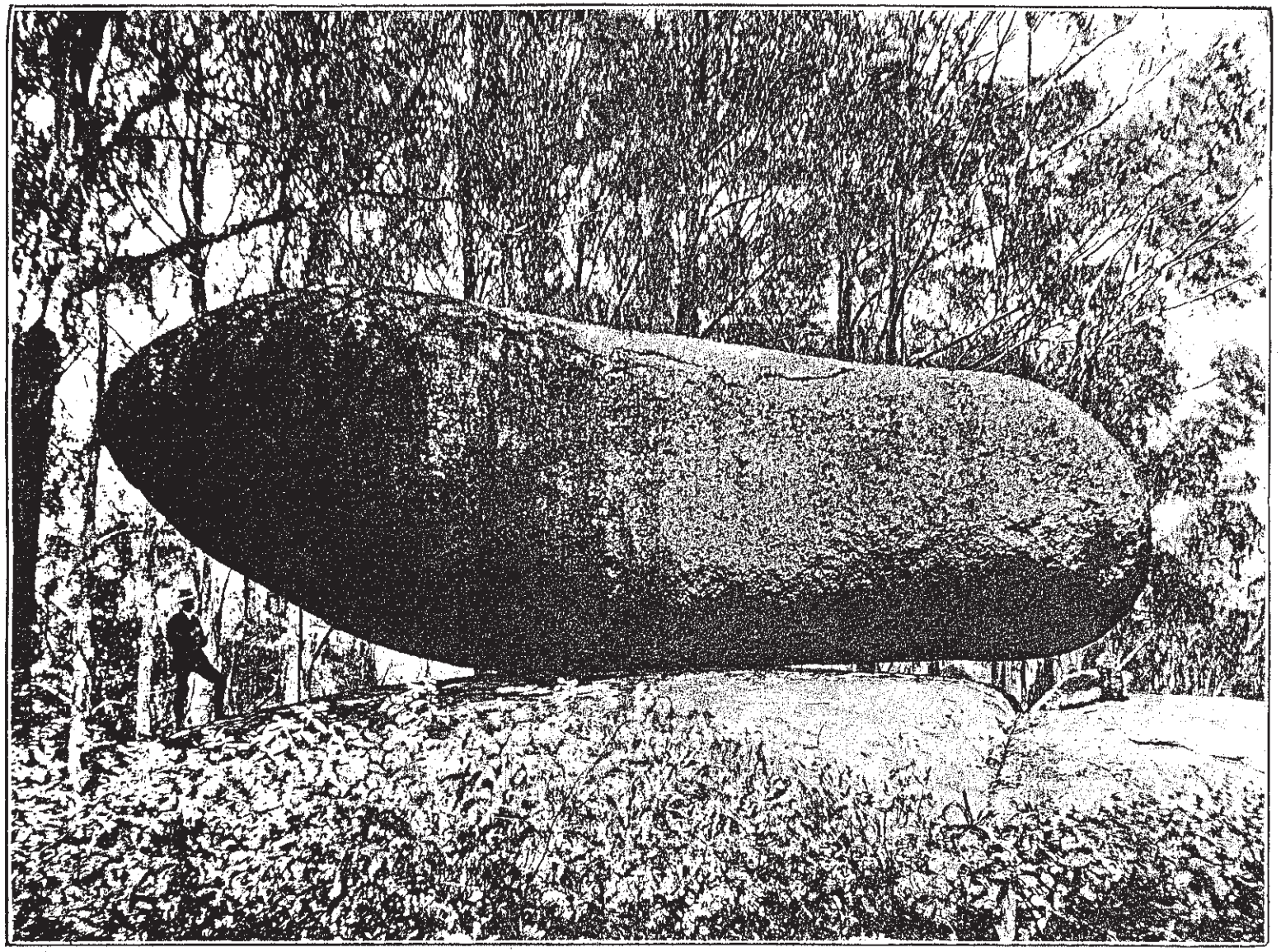
Loc. 21 on Map.

THE PIGEON-HOLE ROCK.



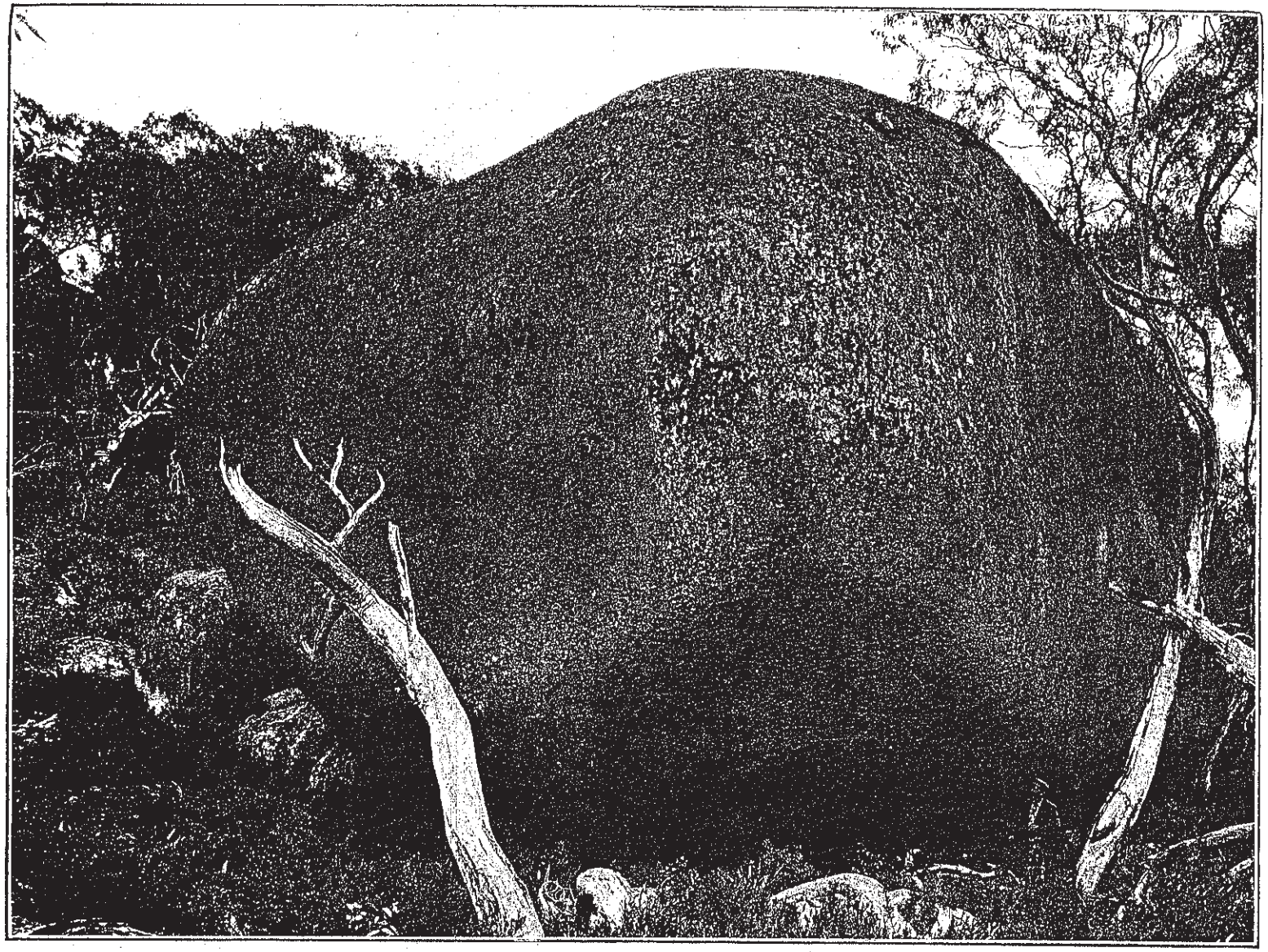
Loc. 21 on Map.

THE PIGEON-HOLE ROCK: WEST END.



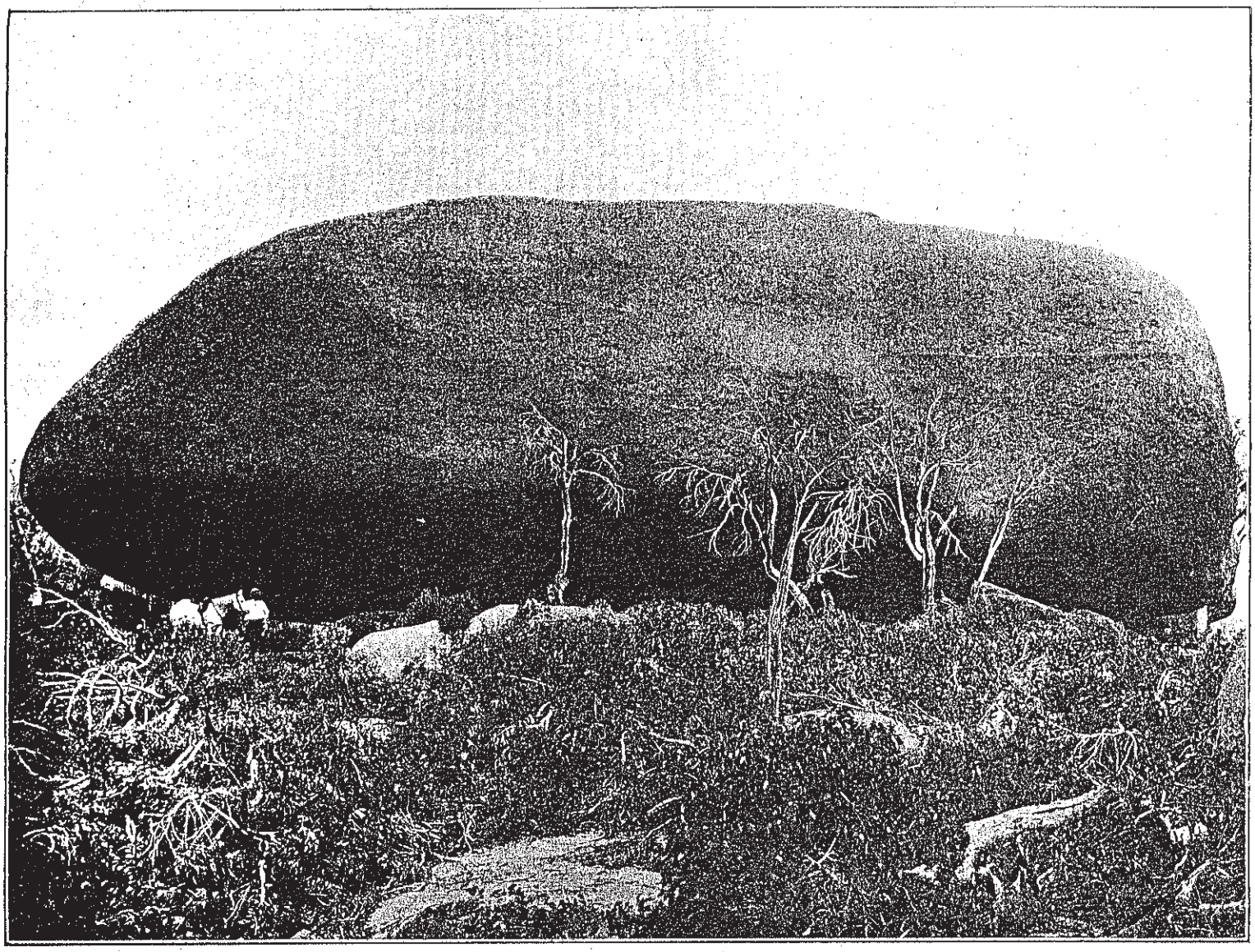
Loc. 19 on Map.

THE TORPEDO : LOOKING SOUTH.



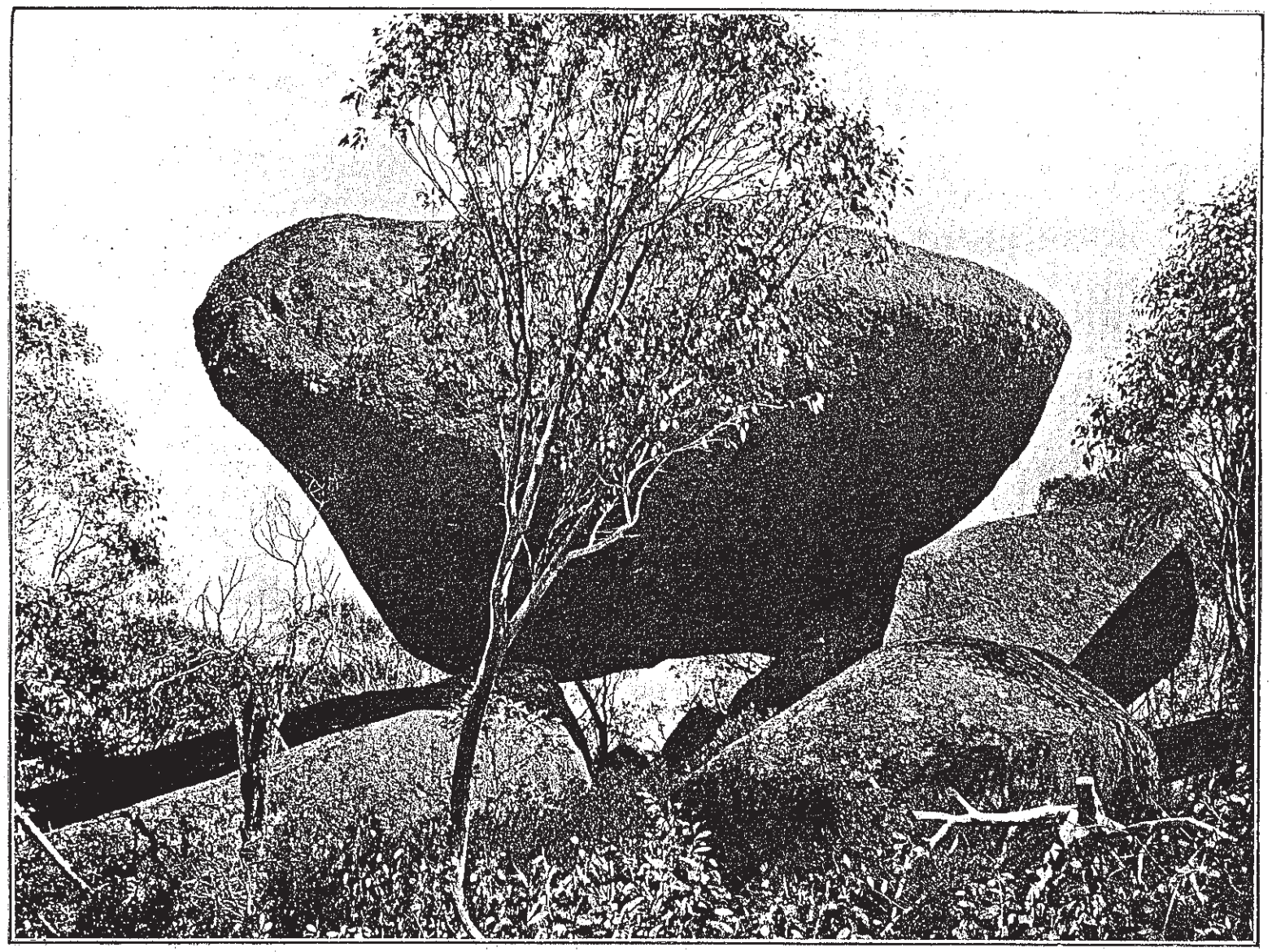
Loc. 18 on Map.

THE PEBBLE.



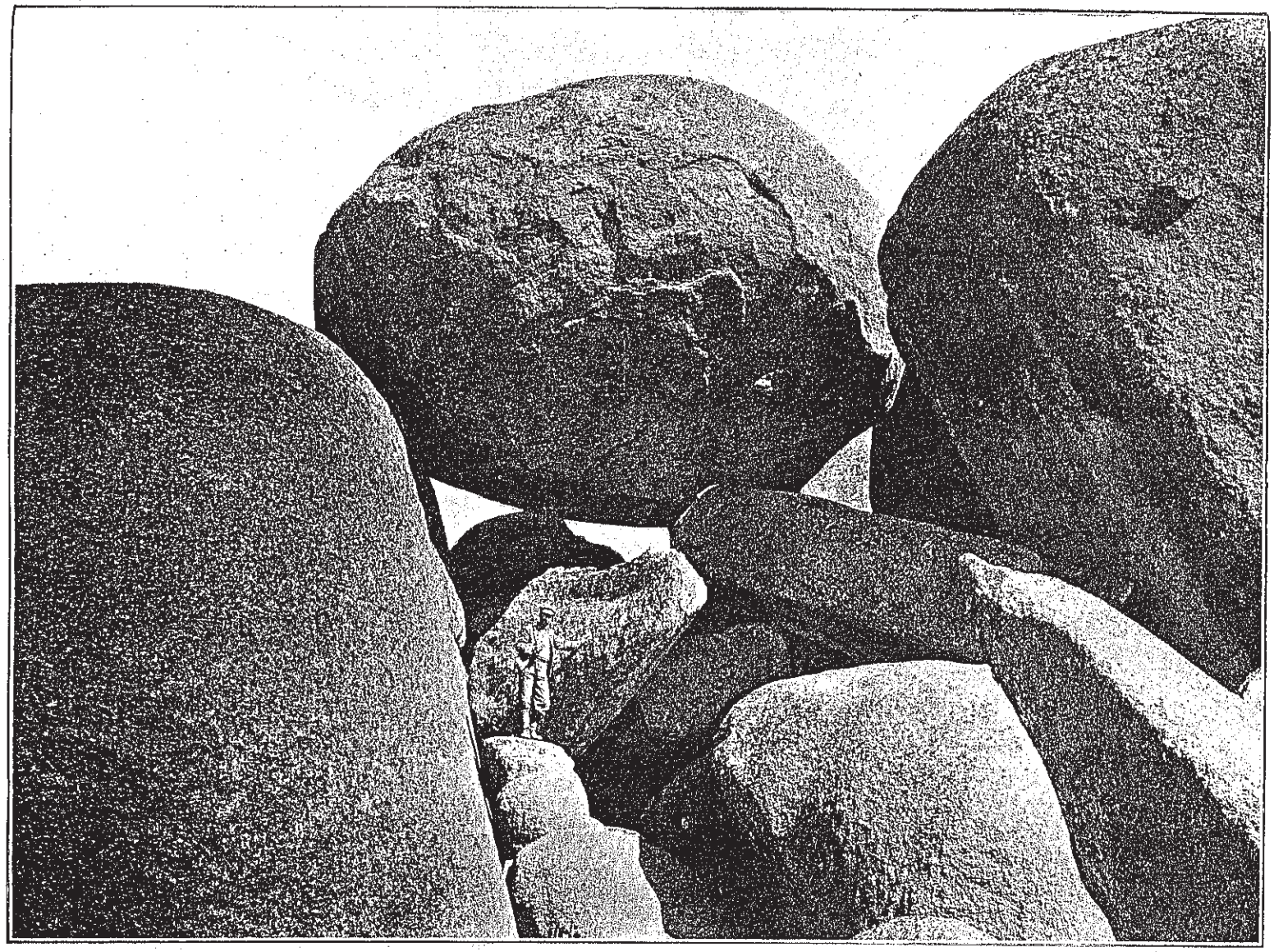
Loc. 12 on Map.

THE LEVIATHAN.



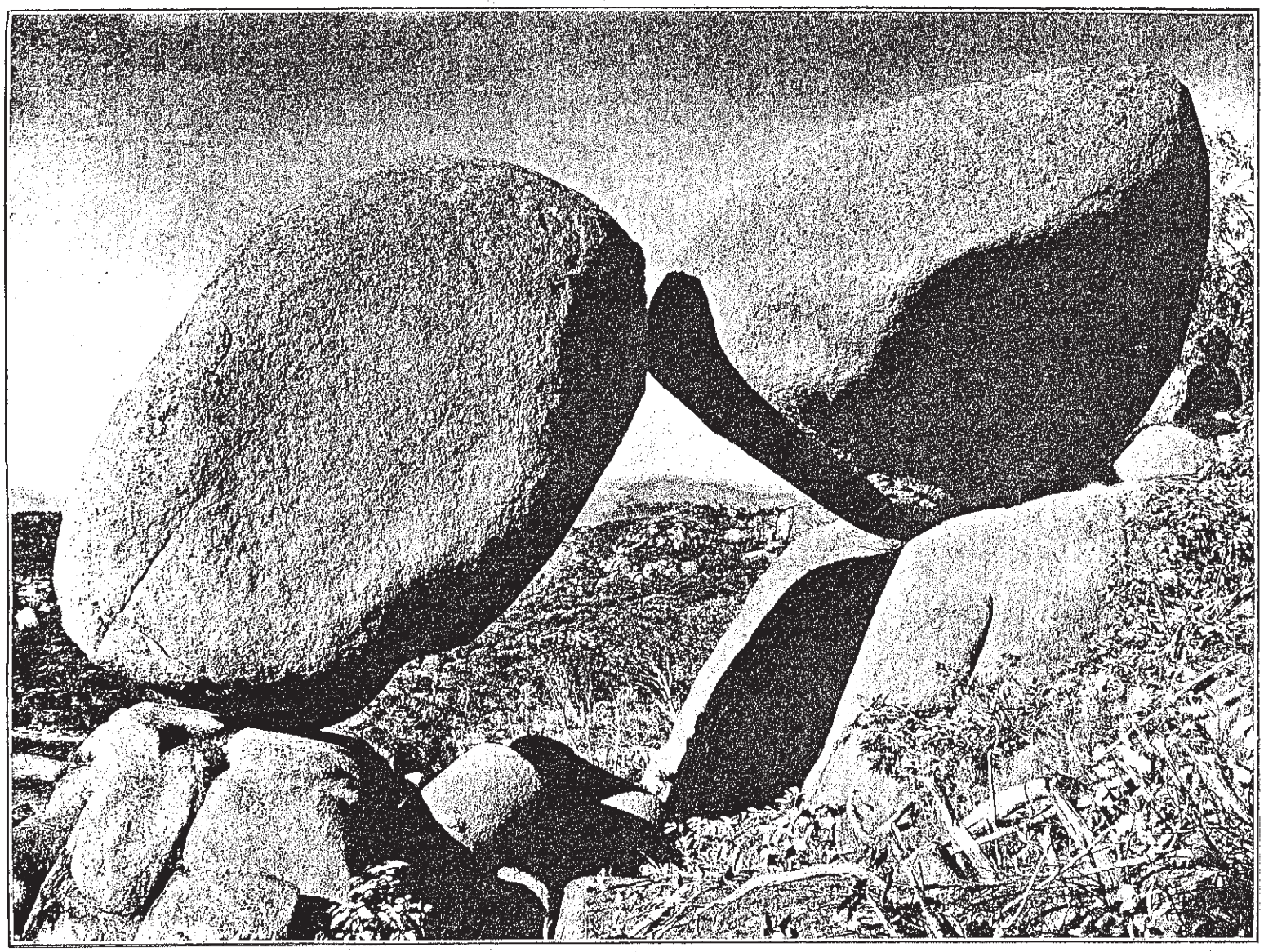
Loc. 2 on Map.

THE BRIDGE OF SIGHS.



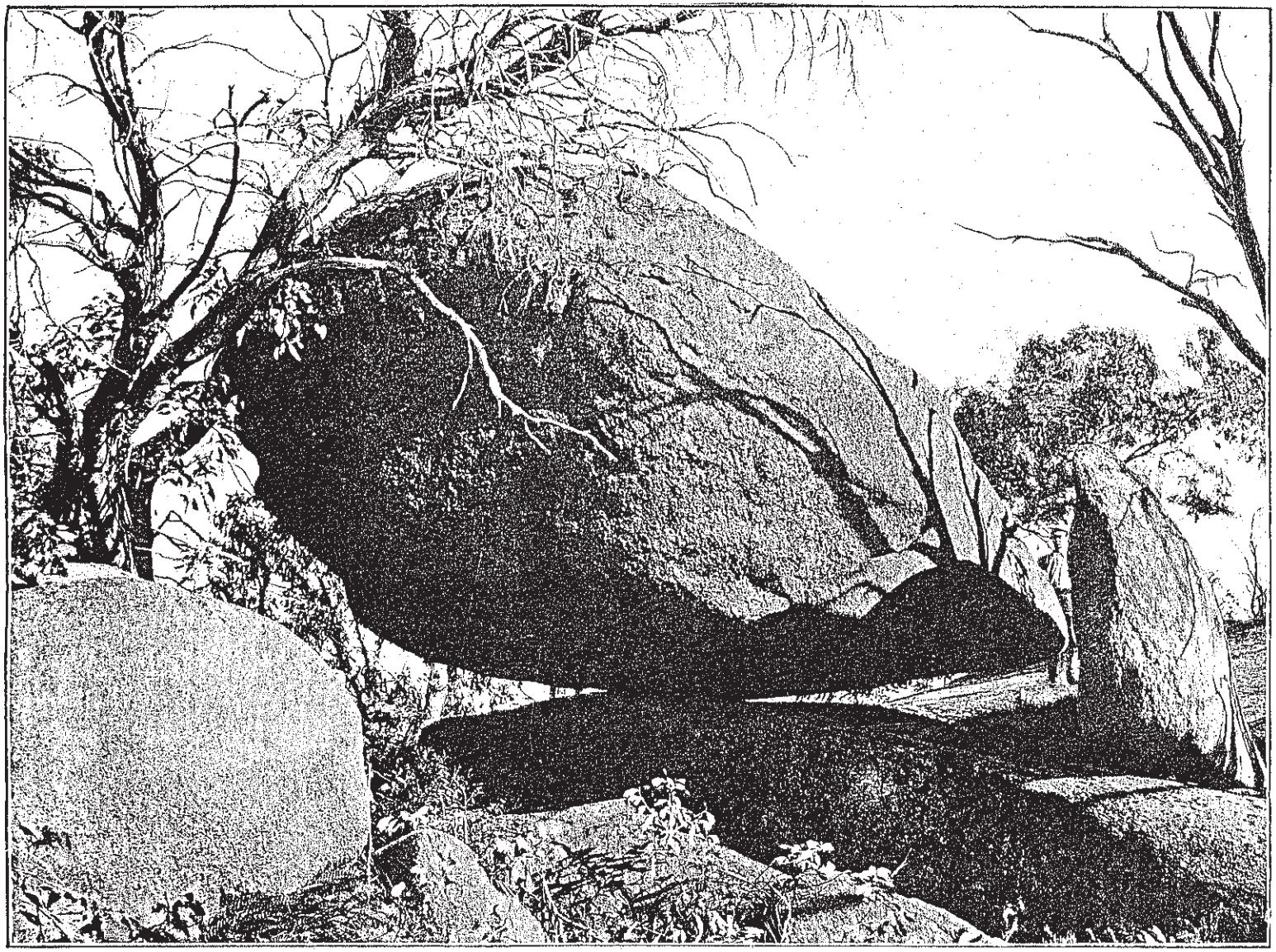
Loc. 16 on Map.

MAHOMET'S COFFIN.



Loc. 14 on Map.

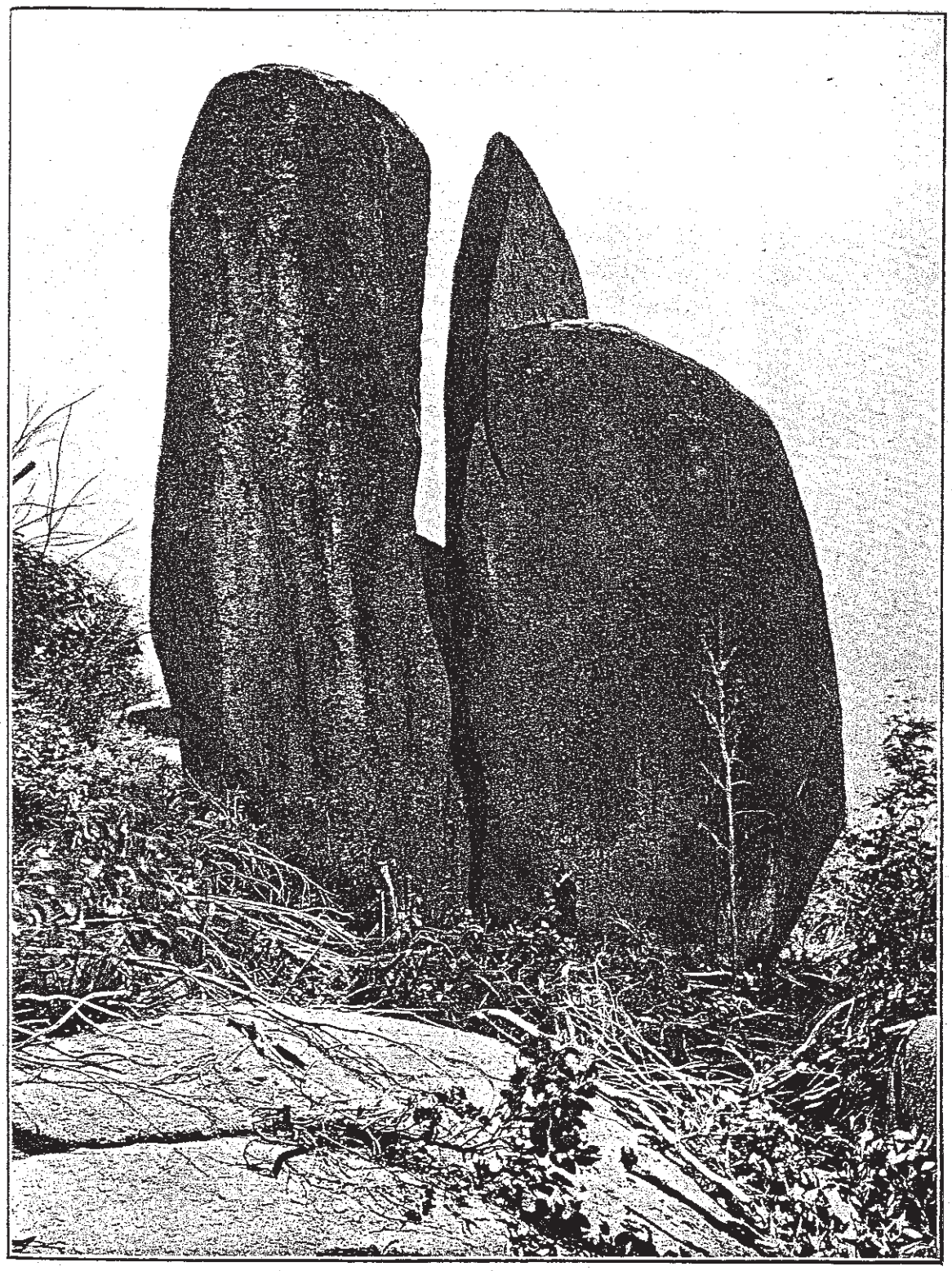
THE KISSING STONES.



Loc. 13 on Map.

THE MUSSEL ROCK.

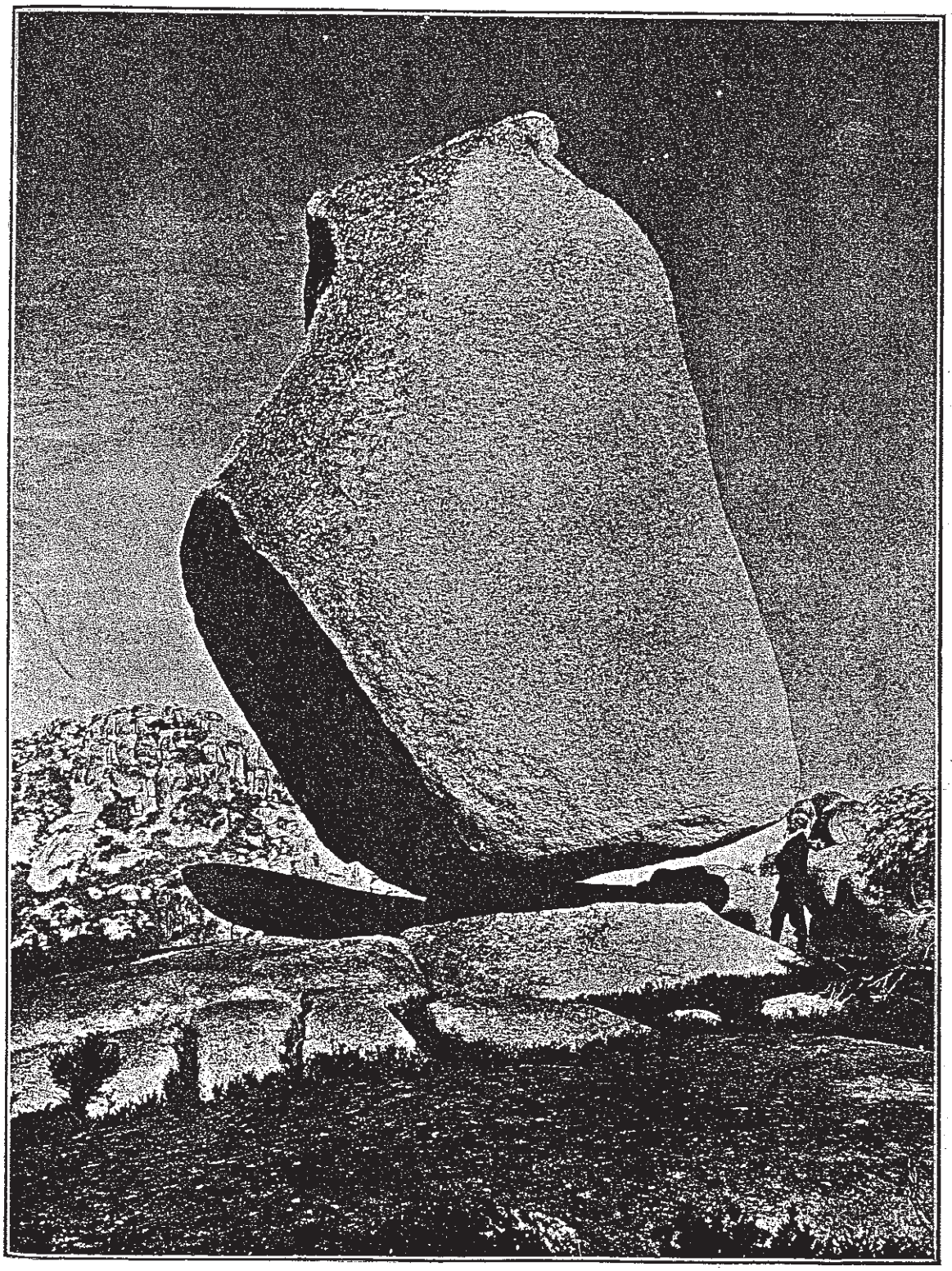
PLATE 45.



Loc. 15 on Map.

THE RIVEN ROCK.

PLATE 46.

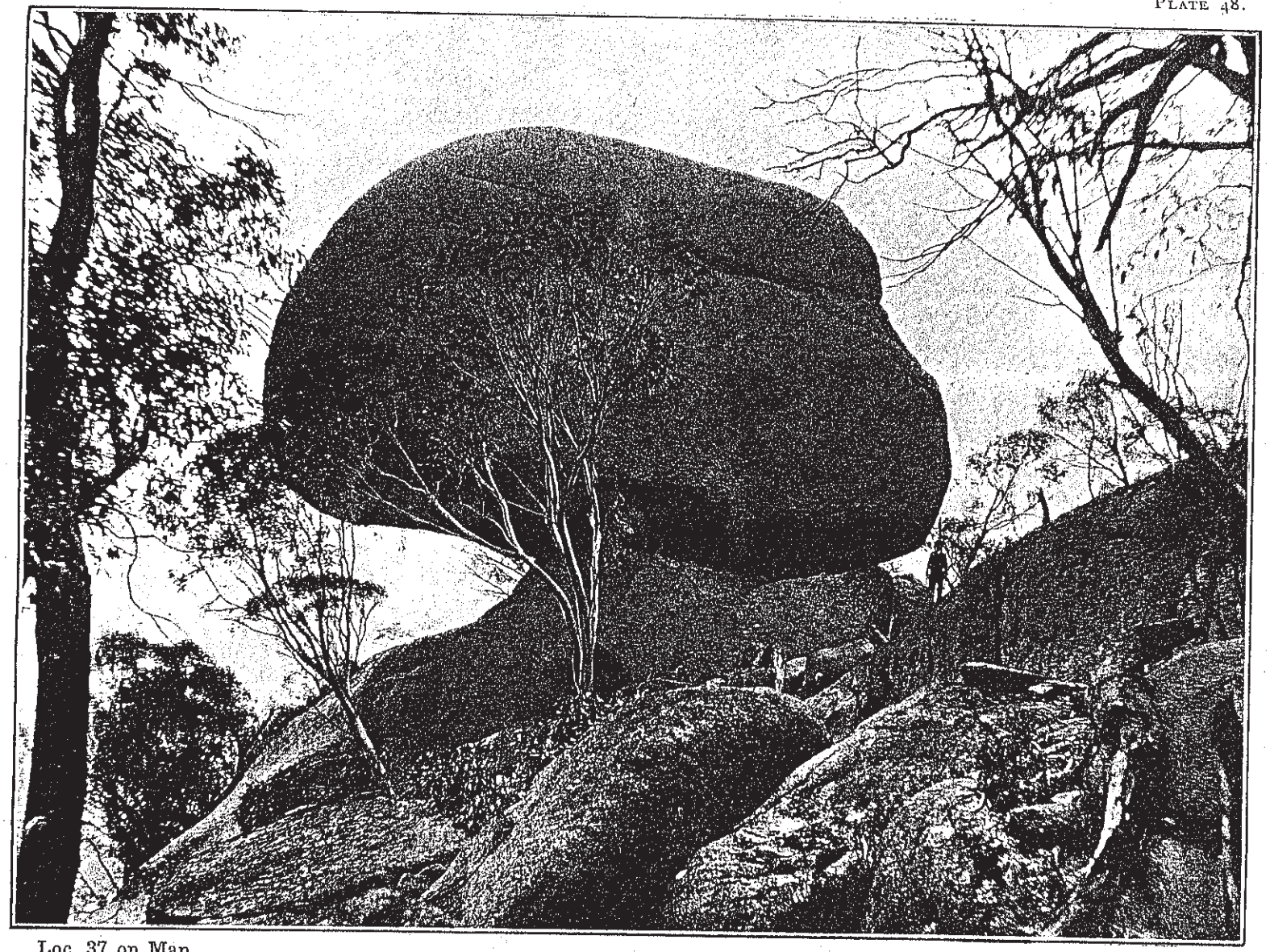


Loc. 10 on Map.

THE SENTINEL.

Loc. 8 on Map.

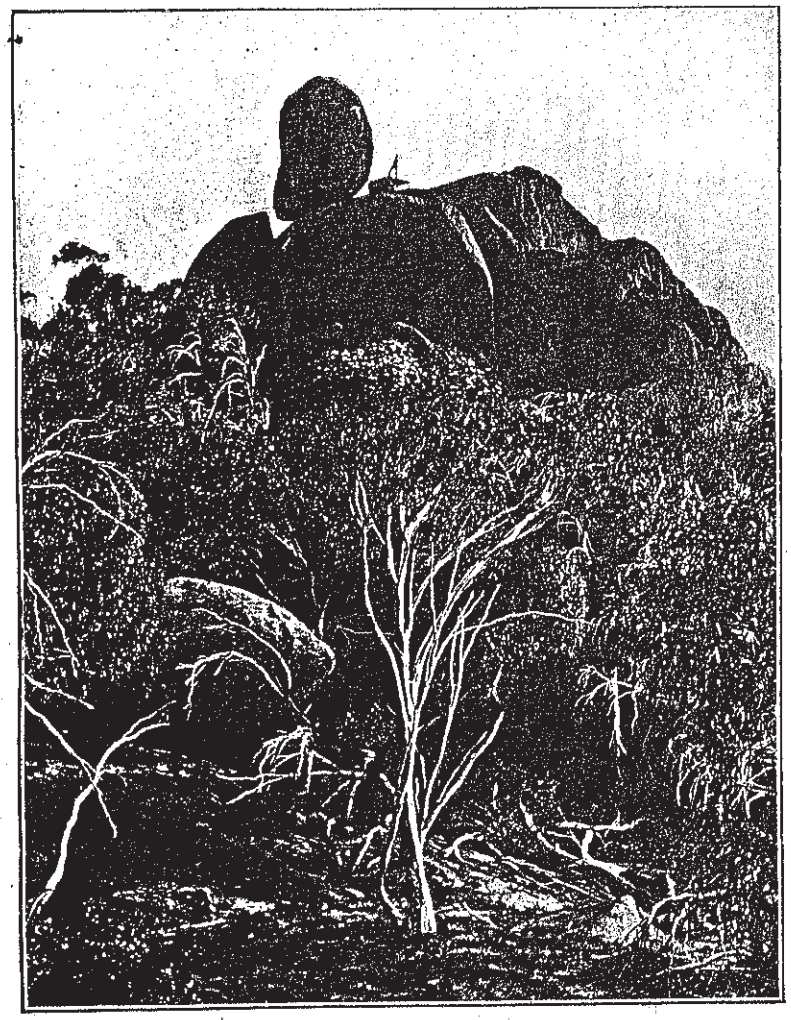
THE WHALE ROCK.



Loc. 37 on Map.

THE SARCOPHAGUS.

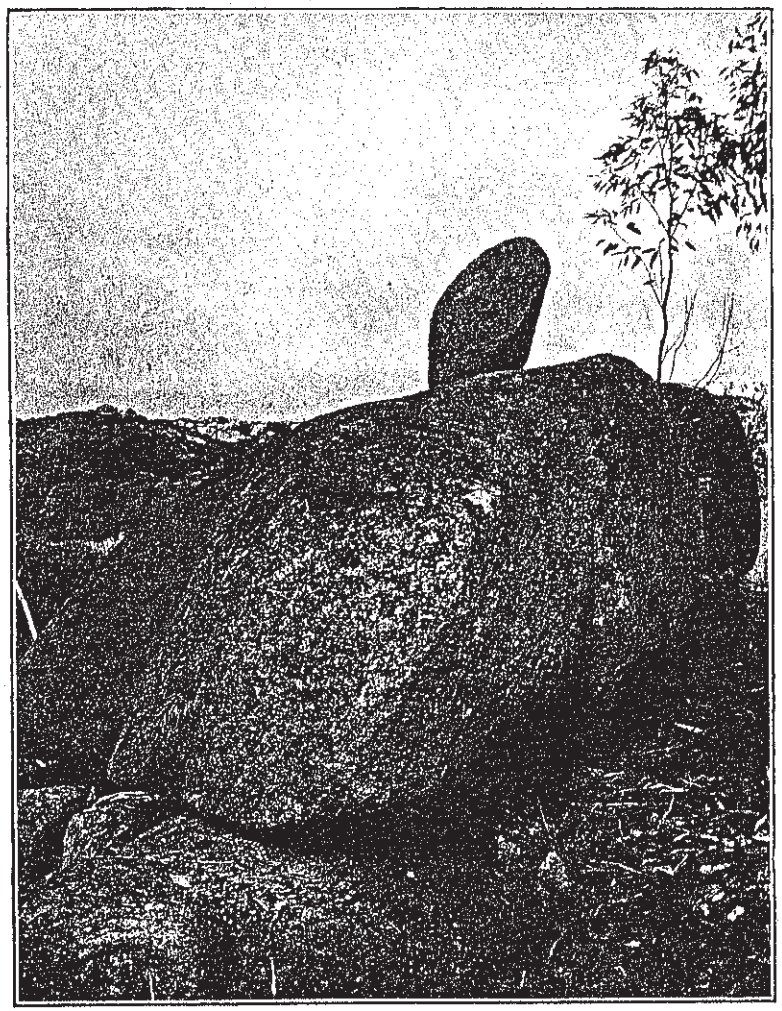
Fig. 1.



Loc. 27 on Map.

THE MONOLITH.

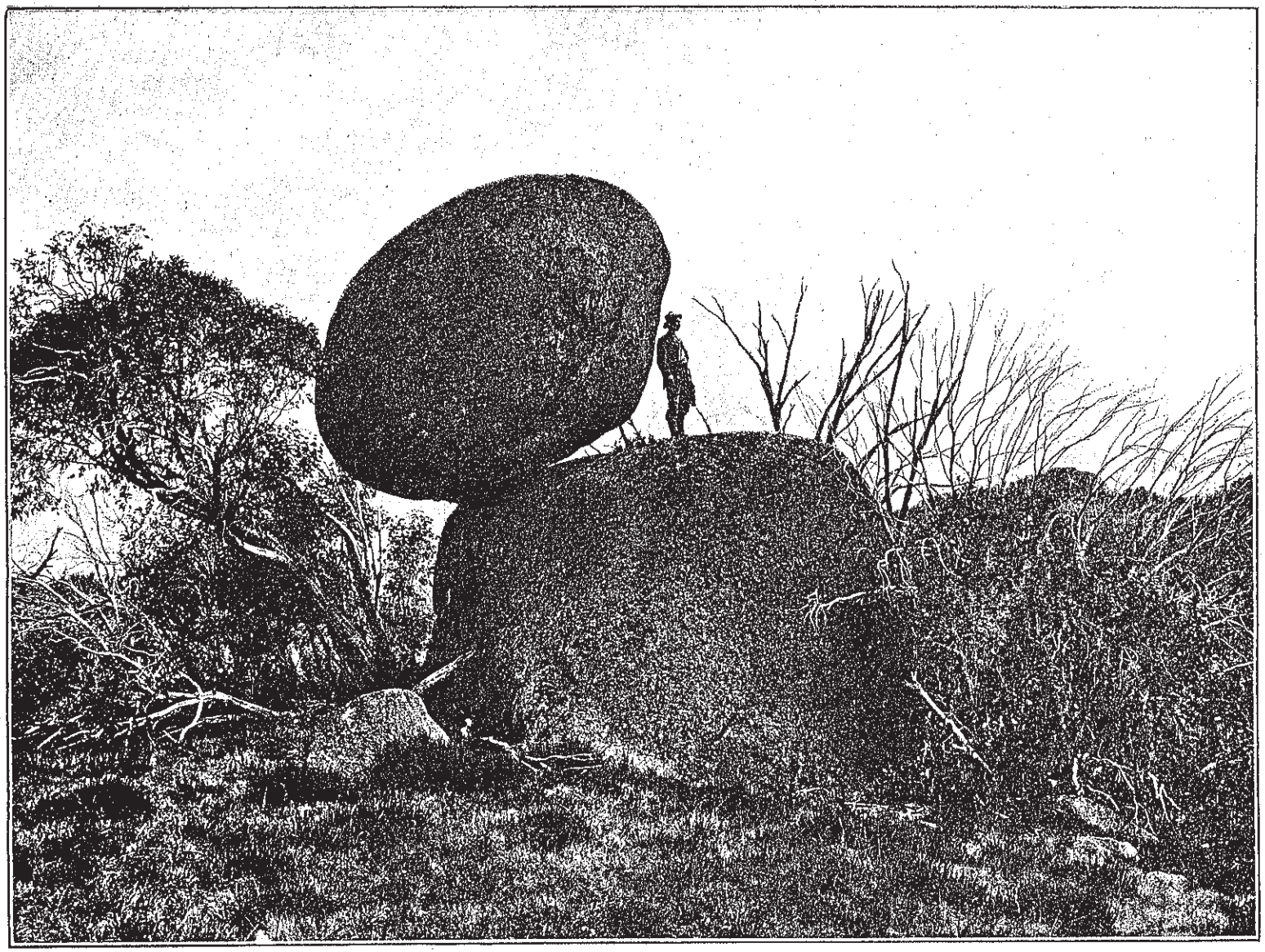
Fig. 2.



Loc. 5 on Map.

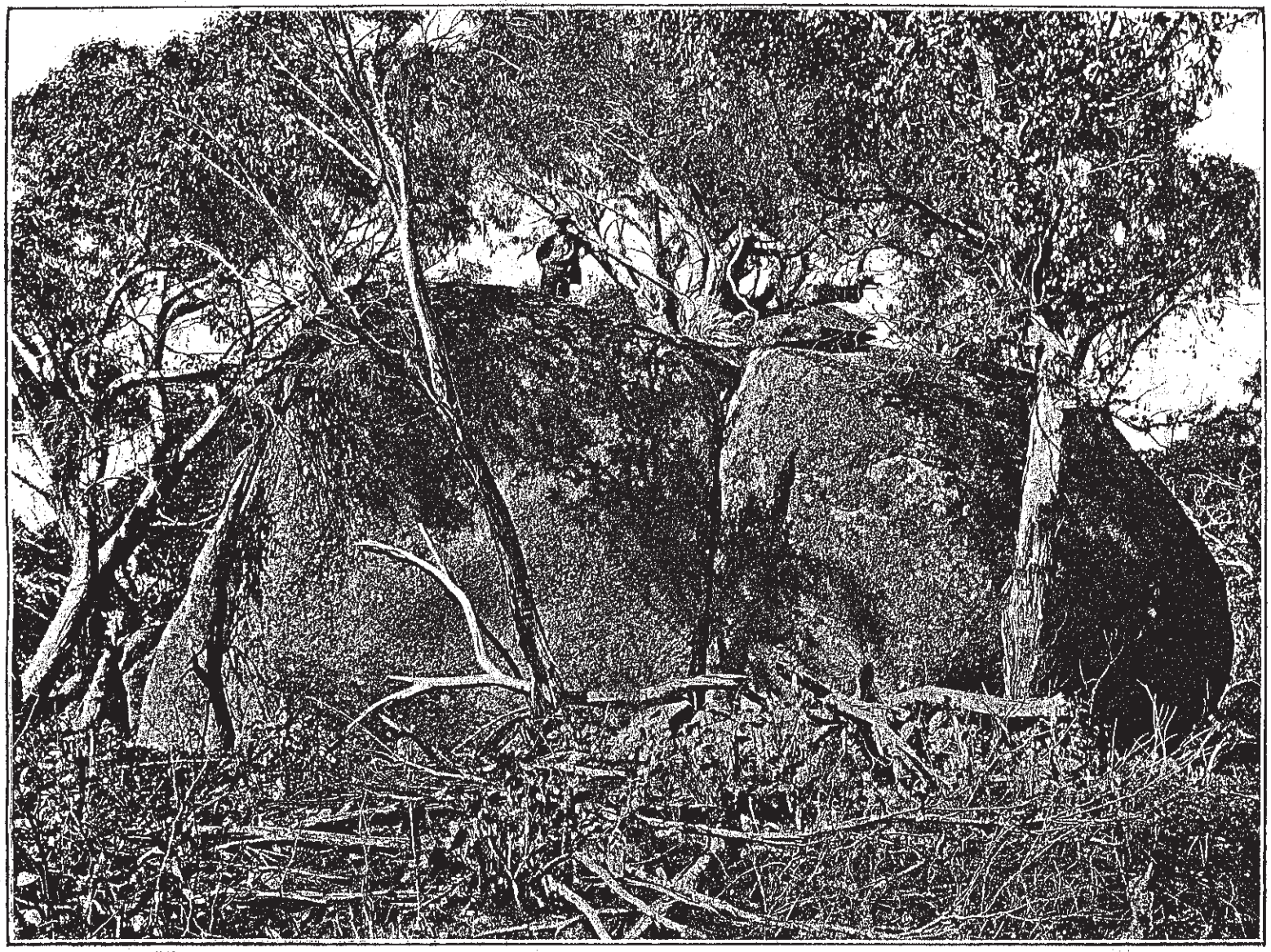
THE LOGAN STONE.

62



Loc. 7 on Map.

THE EGG ROCK.



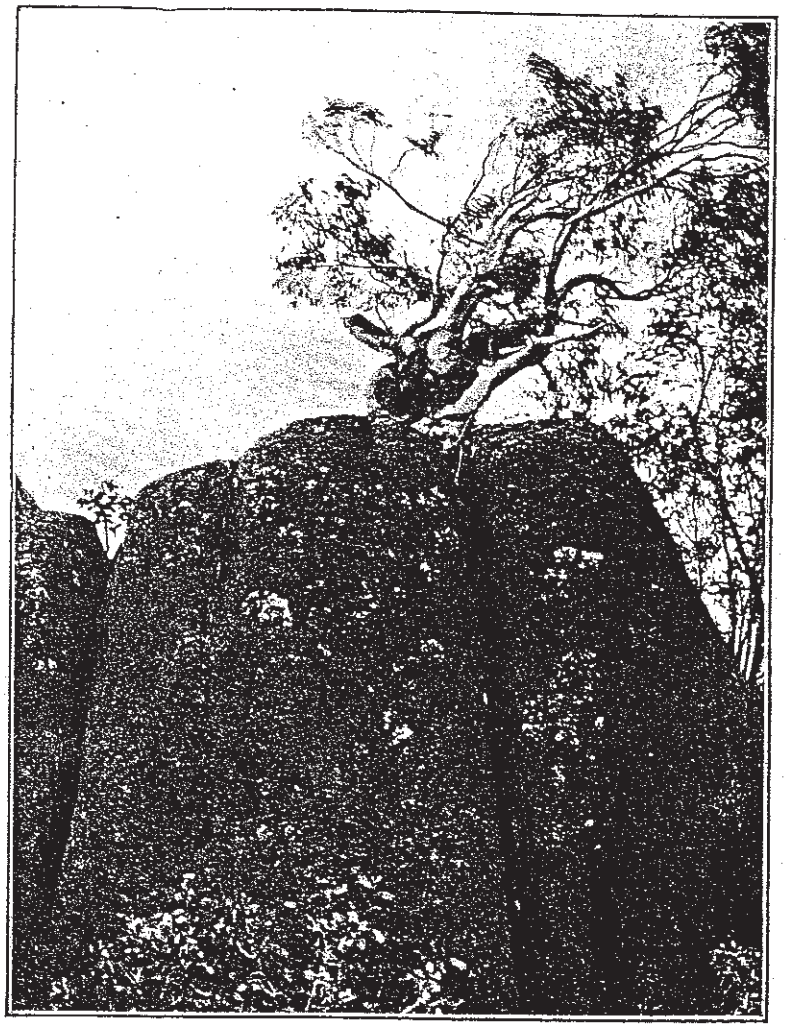
Loc. 38 on Map.

SNOW GUMS GROWING ON GRANITE TOR.

Loc. 38 on Map.

SNOW GUMS GROWING ON GRANITE TOR, SHOWING TOP OF THE TOR.

PLATE 53.

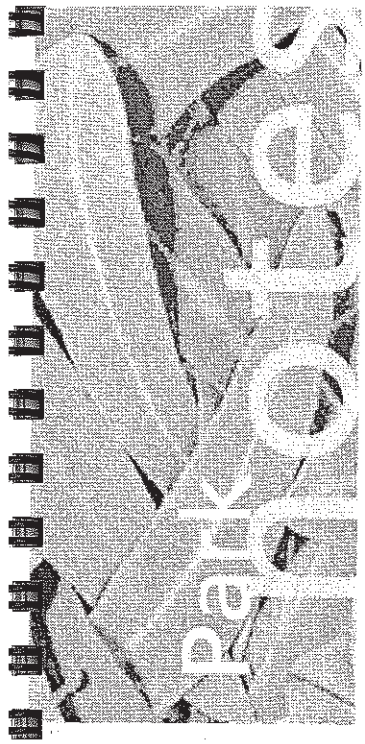


Loc. 17 on Map.

DWARFED SNOW GUM GROWING ON TOP OF A GRANITE TOR.

Note: The following paper, included in the original field guide, have been omitted from this on line file for copyright reasons:

O'Sullivan, P.B. Belton, D.X. and Orr, M. 2000. Post-orogenic thermotectonic history of the Mount Buffalo region, Lachlan Fold Belt, Australia: evidence for Mesozoic to Cenozoic wrench-fault reactivation? *Tectonophysics* 317, 1–26



Mount Buffalo National Park

The Great Granite Plateau

Approaching Mount Buffalo, few people could fail to be impressed by the spectacular granite cliffs rising before them. This sub-alpine plateau is one of Victoria's oldest national parks and has been giving visitors a unique park experience for over 100 years. Crisp fresh air, giant tors, deep gorges, tumbling waterfalls, snow gum woodlands and masses of wildflowers all combine with views of nearby Alps and valleys to enhance any visit, whether for summer camping, winter skiing for walking during spring and autumn.

A story starting with granite

The making of a mountain

Massive as the mountain now is, it was once three times its present height. Originally this area was covered with sedimentary rock laid down by the sea. More than 360 million years of natural forces then set about exposing and eroding a huge granite 'batholith' which had been forced up into the earth's crust as a molten mass.

The fantastically shaped boulders and tors were further shaped by heat, wind, plants, water and ice attacking joints in the granite, widening cracks, forming soil and giving this park its unique and spectacular landscape.

A natural island in the sky

The plateau's isolation, harsh alpine climate and range of altitudes have resulted in a rich array of plants and animals. Some plants, like Buffalo Sallee, Buffalo Sallow Wattle and Fern-leaf Baeckea are found nowhere else in the world. Dry, foothill forests, tall wet mountain forests, Snow Gum woodlands, alpine heathlands, sphagnum bogs, Snow-grass plains and wildflowers can all be found along the main road and on tracks throughout the park.

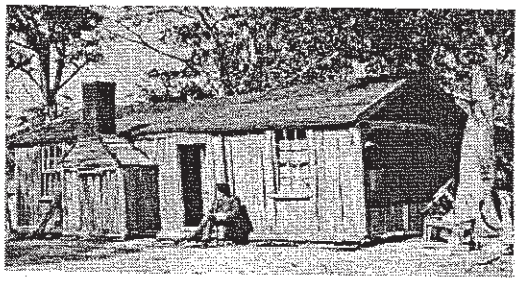
Look for Crimson Rosellas and Gang-gang Cockatoos feeding in the tree tops. Superb Lyrebirds are often seen scratching in the leaf litter. If you walk quietly, Wombats, Swamp Wallabies and Brown Antechinuses may be visible as well as a variety of snakes and lizards. At night Greater Gliders, Tawny Frogmouths and Eastern Pygmy Possums are active. Some animals are quite common, others like Spotted Tree Frog are rare or threatened.

Fern-leaf Baeckea
Illust: Sue Forrester

The first visitors

The Minjambuta are believed to be the Aboriginal people who journeyed up the mountain in summer to feed on Bogong Moths, gather for ceremonies and socialising. Explorers Hume and Hovell named Mount Buffalo, likening it to a sleeping buffalo as they passed present day Glenrowan in 1824 on their journey to Port Phillip.

Squatters first took up land in the area in the 1830's. The 1850's saw goldminers rushing to the surrounding valleys seeking their fortunes. Once the gold dwindled some people remained to settle the area. Seeking summer grazing land they became curious with what lay hidden on the top of the rugged 'buffalo mountains' and began guiding wealthy tourists up to the island in the sky.



Mansfields Chalet, Gorge area Circa 1909

A classic national park

The Bright Alpine Club actively lobbied the government to protect the area. Subsequently 1152 ha surrounding the Gorge was declared a national park in 1898, becoming (with Wilsons Promontory) one of our first national parks.

Following this the park became a focus for tourism and in 1908 a road was cut up the mountain. Mt Buffalo Chalet, built two years later, became very popular and in 1936 Australia's first ski tow was installed at Cresta Valley.

One hundred years later

In 1998 Mount Buffalo celebrated its centenary. The park now covers 31,000 ha, encompassing the entire plateau and most of the forested foothills down to nearby valleys.

The park is also now part of the collective Australian Alps National Parks. A co-operative agreement between NSW, ACT, Victoria and the Commonwealth assists with cohesive management of fragile alpine eco-systems.

Parks Victoria Ranger

"Victoria has all the outdoors you could wish for – mountains, forests, beaches and bushland, all preserved in our parks. Our natural landscapes have been here longer than anyone knows, and together we can make sure they're here forever."

For more information call the Parks Victoria Information Centre on 13 1963 or visit our website at www.parkweb.vic.gov.au

Healthy Parks Healthy People

Parks VICTORIA

Walking Track Guide

Walking is one of the best ways to see Mount Buffalo. There are over 90km of tracks traversing pristine sub-alpine plant communities and unique landscapes. Please keep to formed tracks. They are generally well defined and signposted, but maps are useful on the longer walks.

Self Guided Walks

These informative walks with on-site interpretive signs or a parknote, are a great way to learn about the natural and cultural heritage as well as identifying highlights of the park.

1 Gorge Heritage Walk - 2.5km, 1 hour, return.

This loop walk starts in the Gorge Day Visitor Area, opposite the Chalet. Interpretive signs describe the areas history and beauty through the eyes of local pioneer, Guide Alice.

2 View Point Nature Walk - 4km, 2 hours, return.

Access to this walk is easiest from Lakeside Day Visitor Area starting about 500m from the Lake Catani jetty. The natural features of montane forests are explained here.

3 Dicksons Falls Nature Walk - 4km, 1.5 hours, return

This walk starts on the east side of the road opposite Cresta Valley Ski Area. Sub-alpine plant communities and masses of wildflowers are a highlight of the walk in late summer.

Shorter Walks

If you don't have a lot of time, these walks are perfect. All are less than 4km and generally take less than an hour to complete. They are all easy walks and good for the family.

4. Eurobin Falls Track - 1.5km, 45 mins return.

Shortly after the Entrance Station this track climbs past the pretty Ladies Bath Falls and onto Lower Eurobin Falls. A steeper track continues up to the base of the Upper Falls.

5. Rollasons Falls Track - 4km, 1.5 hours return.

Start at Rollasons Falls Picnic Area for this walk down to Rollasons Falls. Turn left at the intersection for the Upper Falls lookout and right to the Lower Falls and rock pool.

6. Gorge - Lake Catani Track - 4km, 1.5 hours return.

Links the Gorge and Lakeside Day Visitor Areas through fine stands of Alpine Ash. View Point Nature Walk begins at Eurobin Creek bridge below the Lake Catani dam wall.

7. Underground River Track - 2.5km, 1 hour return.

From the lower Gorge carpark, this track leads to Billsons and Haunted Gorge Lookouts, then onto the Underground River. Continue on to link up with View Point Nature Walk.

8. Monolith Track - 1.8km, 1 hour circuit.

Access to this unusual tor is best from the Park Office, returning by a loop down to the Snow Clearing Depot, or continue 1.5km through to the Gorge Day Visitor Area.

9. Lake View Track. - 2km, 45 mins return.

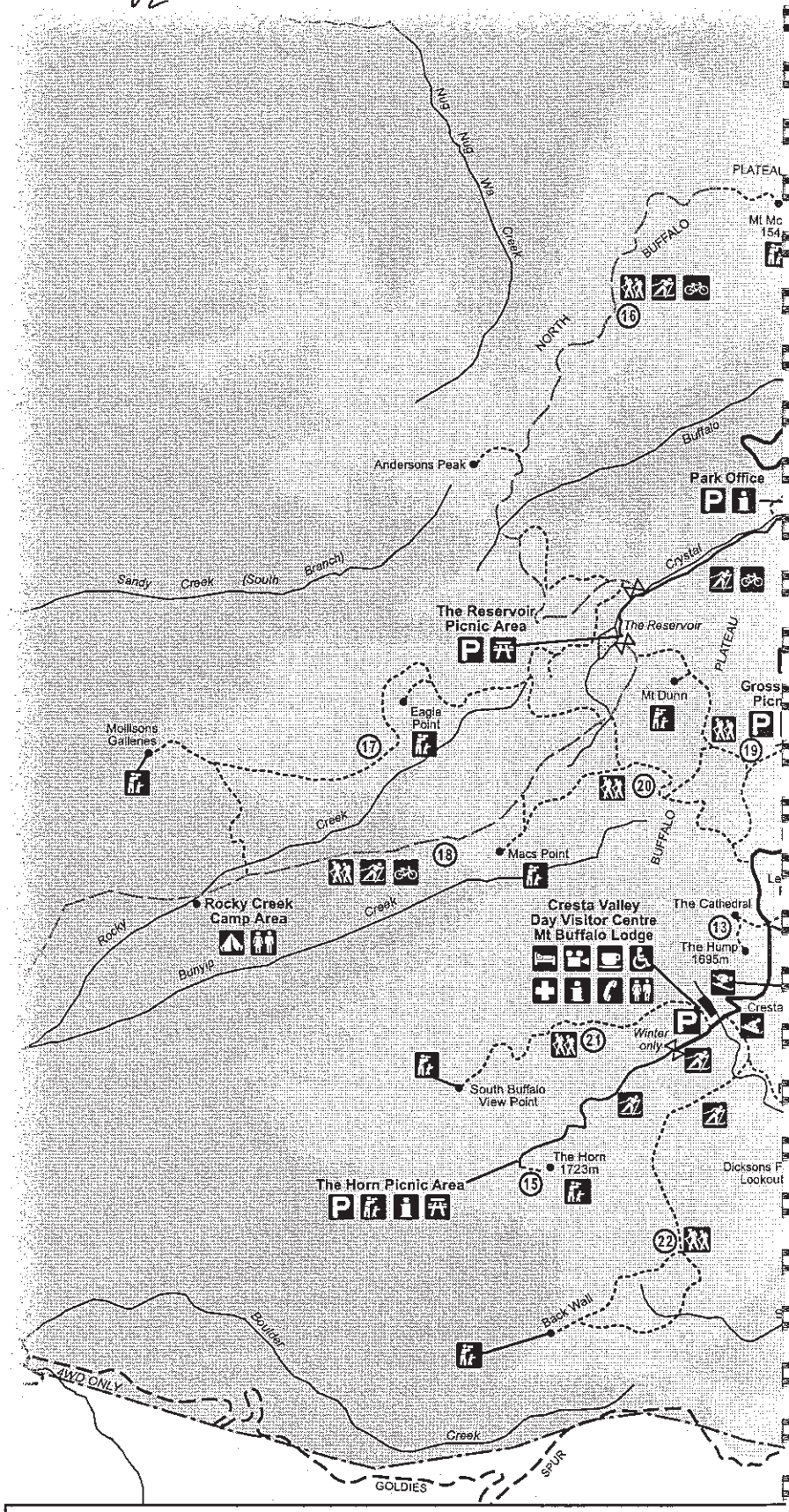
This steep track, commencing near the Snow Clearing Depot, terminates at a large rock slab giving fine views of Lake Catani below and the Alps beyond Mount Buffalo.

10. Lakeside Walk - 3km, 1 hour circuit.

Picturesque Lake Catani is best seen from this circuit track as it passes through several different plant communities, noticeably wetlands. Access is from various points.

11. Chalwell Galleries Track - 1.7km, 1 hour circuit.

Starting near the Campground, this track passes through the galleries which are a jumble of large granite rocks forming passages. Loop return back onto the gravel road.

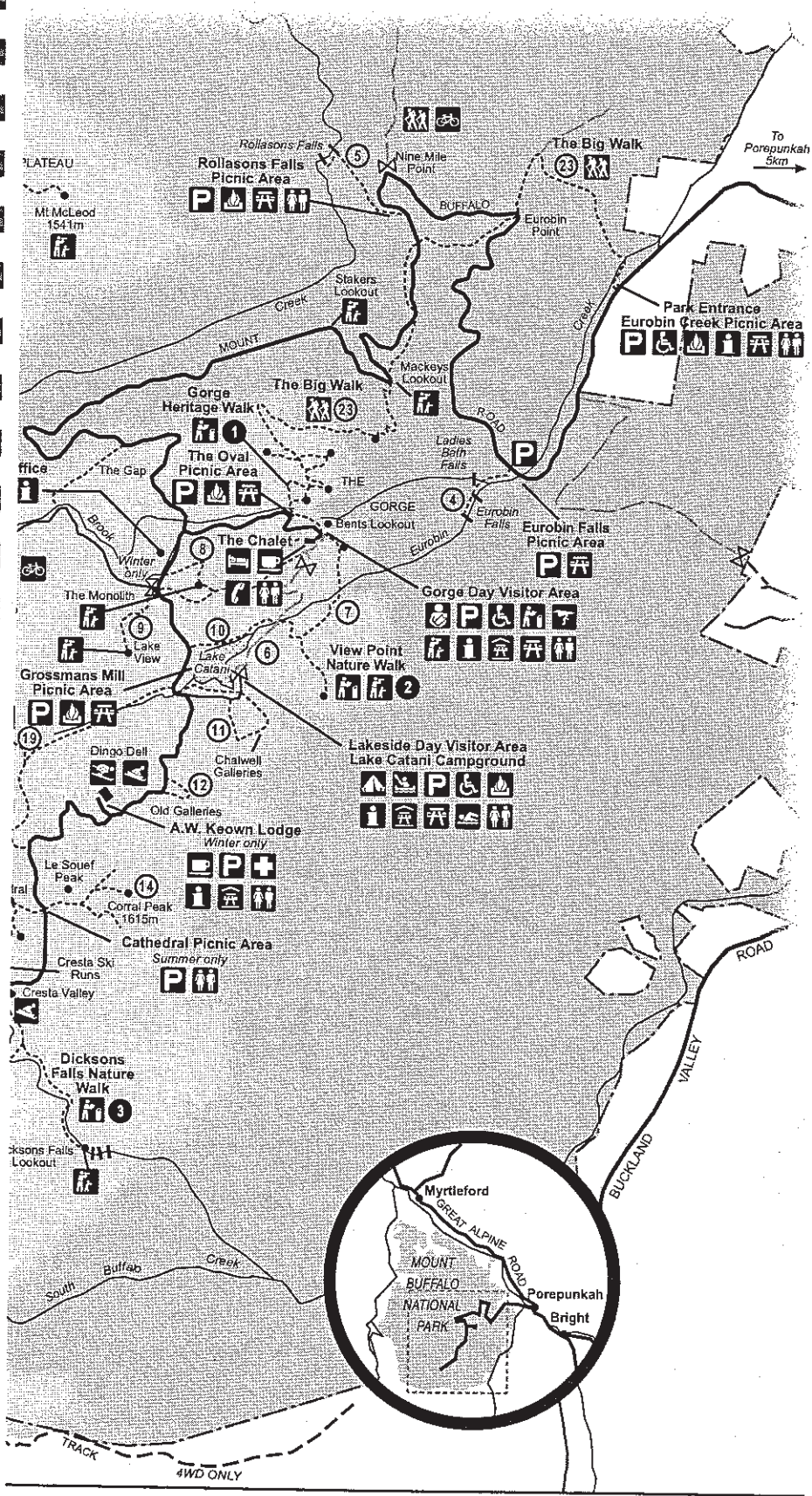


Mount Buffalo National Park

- Sealed road
- Unsealed road
- Vehicle track
- Management track only
- Walking track
- National Park
- Buffalo Plateau (Sub alpine area +1200m)
- Water body
- Gate
- Self guided walks
- Short/Long walks

Recreational Facilities

- Accommodation
- Audio-visual display
- Baby changing
- Bushwalking
- Cafe
- Camping
- Canoeing
- Carpark
- Cross cou
- Cycling
- Disabled a
- Downhill sk



12. Old Galleries Track - 1km, 30 mins circuit.

Similar to Chalwell Galleries, the Old Galleries offer a shorter walk through the awe-inspiring rock formations of Mt Buffalo. Short loop return back along the main road.

13. Cathedral - Hump Track - 2km, 45 mins return.

Starting at the Cathedral Picnic Area the base of this spectacular rock formation is accessed by turning right at a 'T' intersection. Turn left to gain the 1695m Hump summit for fine views of Cresta Valley and The Horn.

14. Corral - Castle Track - 3.5km, 1.5 hours return.

Le Souef Peak, Mahomets Tomb and the secluded Corral are also accessed from Cathedral Picnic Area. A side trip past The Sentinel and onto The Castle is worthwhile.

15. The Horn Track - 1.5km, 45 mins return.

The highest point of Mount Buffalo, at 1723m, is a must with 360o views of the plateau and Alps to greet walkers at the summit. Easy access from the Horn Picnic Area.

Longer Walks

These longer walks take you to more remote areas of the park. *Be sure to wear strong footwear, pack a snack, water and a jacket, be ready for sudden changes in the weather and always let someone know before you go!*

16. Mount McLeod Track - 16km, 6 hours return.

This track, starting near Reservoir Picnic Area, leads to the most remote part of the Park, North Buffalo Plateau. A side trip of 1.5km return to Andersons Peak is worth the effort. As an alternate return route try the Mount McLeod Shortcut Track which provides a more gradual climb onto the main plateau, linking back with Mount McLeod Track.

17. Mollisons Galleries Track - 18km, 6 hours circ.

Begin on Mount Mcleod Track, turning left after 300m. Detour to Og Gog & Magog and Eagle Point along the way, returning via a loop back along Rocky Creek Track.

18. Rocky Creek Track - 13km, 4 hours return.

From the Reservoir this track links in with Long Plain, Macs Point and Mollisons Galleries Tracks, finally terminating at the remote Rocky Creek Camp Area.

19. Long Plain Track - 8km, 3 hours return.

Reach Mount Dunn along this picturesque track from near Lake Catani. Continue 2km onto the Reservoir or try a loop out to Macs Point and back via Rocky Creek Track.

20. Macs Point Track - 7km, 3 hours return.

Start at the snow plain near the foot of the Cathedral. This track also links into Long Plain Track via Stanley Rocks and Giants Causeway. A longer circuit is via Rocky Creek Track returning along Long Plain Track.

21. South Buffalo Track - 8km, 3 hours return.

From Cresta Valley this track initially climbs a ridge then meanders though snow gum glades and small snow plains, terminating at the South Buffalo View Point.

22. Back Wall Track - 12km, 4 hours return.

Begin on Dicksons Falls Nature Walk, turning right after 500m passing by the historic Chinamans Wall. An alternative for the return walk is the Eastern Loop Track.

23. The Big Walk - 11.3km, 4 - 5 hours one way.

The longest on Buffalo, this track climbs the plateau from the Park Entrance to the Gorge Day Visitor Area. Detours are possible to Rollasons Falls and lookouts along the way. Spectacular views and waterfalls are a feature. A detailed parknote is available at the start of the track.

For further information

Mount Buffalo
National Park

Track information and camping permits:

Entrance Station:
PO Box 72A
Porepunkah, VIC. 3740
Phone: (03) 5756 2328
Fax: (03) 5756 2148

Rangers and information:

Park Office
PO Box 72
Porepunkah, VIC. 3740
Phone: (03) 5755 1466
Fax: (03) 5755 1802

Gang-gang Cockatoo
Illust: Sue Forrester

Relevant maps:

Mount Buffalo Plateau by Geoff Lawford

Eurobin & Buckland map sheet 1:25,000 topographic from Vic Map

Relevant codes:

Bushwalking Code
Car Camping Code
Bush camping Code

Useful guides:

Mount Buffalo Visitors Guide
Alps in Flower Field Guide

Caring for the Park

Help look after this park by remembering these points:

Take any rubbish home with you

All native plants, animals and landforms are protected

Dogs, cats and other pets are prohibited within the park

Firearms are also prohibited

Camping is permitted only in the designated areas

Fires are permitted only in fireplaces provided

No fires in the open on **Total Fire Ban** days

Leave the park as you found it

Things to see and do?

During summer relaxing activities such as walking, canoeing, swimming, picnicking, sight seeing, bike and horse riding appeals to most people. Rockclimbing, abseiling and hang gliding challenge the adventurous.

Over winter snow blankets the plateau and attracts cross-country skiers to 11km of market trails and extensive back country touring. Downhill skiing is available at Dingo Dell and Cresta Valley along with fine snowplay and tobogganing areas and a range of visitor facilities.

Picnic Areas

Mount Buffalo is perfect for that serene picnic among snow gums or a refreshing stop beside a lake. There are ten picnic areas with various facilities to choose from.

George Day Visitor Area

Perched on the Gorge edge, this large area has many facilities. A Café is located in the Chalet opposite. Tables, disabled toilets, picnic shelter, water and fireplaces.

Lakeside Day Visitor Area.

Right on the Lake Catani shore, this shady area is great on a hot day for a cool swim or canoeing. Tables, toilets, cold showers, water and fireplaces.

Other Picnic Areas

Eurobin Creek and Rollasons Falls Picnic areas have tables, toilets and fireplaces while Grossmans Mill and The Oval Picnic areas have tables and fireplaces only.

The Cathedral Picnic Area has toilets that are *only* open for busy holiday periods. Eurobin Falls, Reservoir and Horn Picnic areas have tables. *Note: nearest toilets to the Horn Picnic Area are at Cresta Valley or Cathedral Saddle.*

The best place to go:

Swimming and canoeing: best from the Lake Catani Jetty, accessed through the Lakeside Day Visitor Area.

Rock climbing and abseiling: guided activities are usually available from private operators in the Gorge area.

Downhill skiing: with five lifts and good day facilities, including ski school and patrol, based at Cresta Valley.

Cross country skiing: on 11km of marked trails starting at the information board adjacent to Cresta Valley carpark.

Tobogganing and snowplay: only permitted in the 'safe' designated areas at Cresta Valley and Dingo Dell. *Note Dingo Dell is only open when conditions are favourable.*

Sightseeing: almost unlimited! Lookouts at the Gorge and the Horn offer superb views of the Australian Alps.

Bike riding: restricted to vehicle tracks. Good rides are along the Reservoir Road and Gorge-Lake Catani Track.

Horse riding: only with a guide from Mount Buffalo Chalet and on limited tracks during the summer months.

Hang gliding: for experienced pilots only from the launch ramp 200m past the Gorge Day Visitors Area lower carpark.

Visitors with limited mobility

All of the toilets, except at Lakeside and Cathedral Picnic Area, are designed for wheelchair access. The Camp-ground also has a disabled hot shower/bathroom facility.

Eurobin Creek and The Horn Picnic Areas have wheelchair accessible tables, as does the Gorge Day Visitor Area which also has a disabled accessible lookout.

Staying overnight

There is car based camping at Lake Catani Campground. Bookings are mandatory for busy holiday periods. The campground is open from November to April and has excellent facilities. Book through the Entrance Station.

Remote bush camping is available for a limited number of hikers during the summer months at the Rocky Creek Camp Area. This is a minimal impact camping site designed for fuel stove use only and has a pit toilet. Remote camping is possible for a maximum of two nights only with a permit issued from the Entrance Station.

The historic Mount Buffalo Chalet offers traditional guest house stays and an ala carte restaurant, while Mount Buffalo Lodge has backpacker, motel and lodge style accommodation all year round with the ease of skiing to your door during winter. For more information and bookings call Mount Buffalo Chalet on (03) 5755 1500 and Mount Buffalo Lodge on (03) 5755 1988.

The Monolith as seen from Lake Catani
Illust: Sue Forrester

Driving up the mountain

While driving up Mount Buffalo, take your time and enjoy the changing environment and views. Please watch out for our native animals, especially early in the morning and at dusk. Wildlife is much more active at these times, especially wallabies, wombats, rosellas and lyrebirds.

Take extreme care driving during winter. The main road is often snow-covered from McKinnons Corner through to Cresta Valley. Snow chains must be carried during the declared ski season and fitted when and where directed.

The Reservoir, Lake Catani and Horn Roads are narrow and winding with gravel surfaces. Beware of dusty and rough conditions. Please drive slowly and carefully. *Note that these roads are seasonally closed during the wetter months.*

Like to know more?

Parknotes on skiing, tobogganing, camping, the Big Walk, flora and fauna are all available from the Entrance Station, Park Office and various pamphlet boxes.

Guide books, posters and maps are also for sale from the Entrance Station, Park Office and Mount Buffalo Chalet, or drop into the Park Office and chat to a Ranger.

An audio-visual show on the natural and cultural heritage of Mount Buffalo can be viewed in the Cresta Valley Day Visitor Centre, adjacent to Mount Buffalo Lodge.

Information shelters at various picnic areas throughout the park provide site specific information and orientation.

Revised November 2002

Variability in Stream Erosion and Sediment Transport (Proceedings of the Canberra Symposium, December 1994). IAHS Publ. no. 224, 1994.

Debris flows in northeastern Victoria, Australia: occurrence and effects on the fluvial system

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Abstract A large storm in October 1993, in northeast Victoria, produced more debris flows (about 30) than have been reported before in Australia. Such debris flows are associated with storms of at least 50 year recurrence interval. The debris flows were typically between 0.5 and 1 km in length, experienced flow velocities up to 10 m s^{-1}, and were most common on resistant granite and acid-volcanic lithologies with slopes greater than about 25°. The debris flows were of little significance to modern stream processes. Thirteen debris flows in one 35 km^2 drainage basin contributed about 10% of the total sediment mobilized during the flood. Five hundred metres of channel migration and widening in the stream contributed the same volume of sediment as the largest debris flow (about 2000 m^3). However, in the longer term the debris flows are a significant process because they deliver coarse colluvium (up to 1.5 m B-axis) directly to the modern stream and flood plain, and could produce lowering of the landscape at a rate of 5 m per million years.

INTRODUCTION

Record rainfall in northeastern Victoria, Australia (Fig. 1), on 4 October 1993 produced record floods in the larger streams. For example, over three hours the Broken River rose from a minor flood to the largest flood on record (Bureau of Meteorology data). The floods caused considerable erosion, with several of the smaller tributaries suffering dramatic widening and incision. Over $4 M (Australian) of Natural Disaster Funding has been allocated to the repair of stream erosion in the Ovens and Broken River drainage basins.

An unusual feature of the storm event was the initiation of more than thirty debris flows, which are known locally as "mud flows". Several of these flows cut roads. As we describe below, these flow events have many of the classic features of debris flows (Costa, 1984, 1988), and are clearly different from other mass-wasting phenomena reported in southeastern Australia, such as the relict periglacial scree slopes and "rock rivers" of the highlands (Talent, 1965); or the earth flows (slip-circle failures) in the Otway and Strzelecki Ranges. There are few reports of debris flows in Australia.

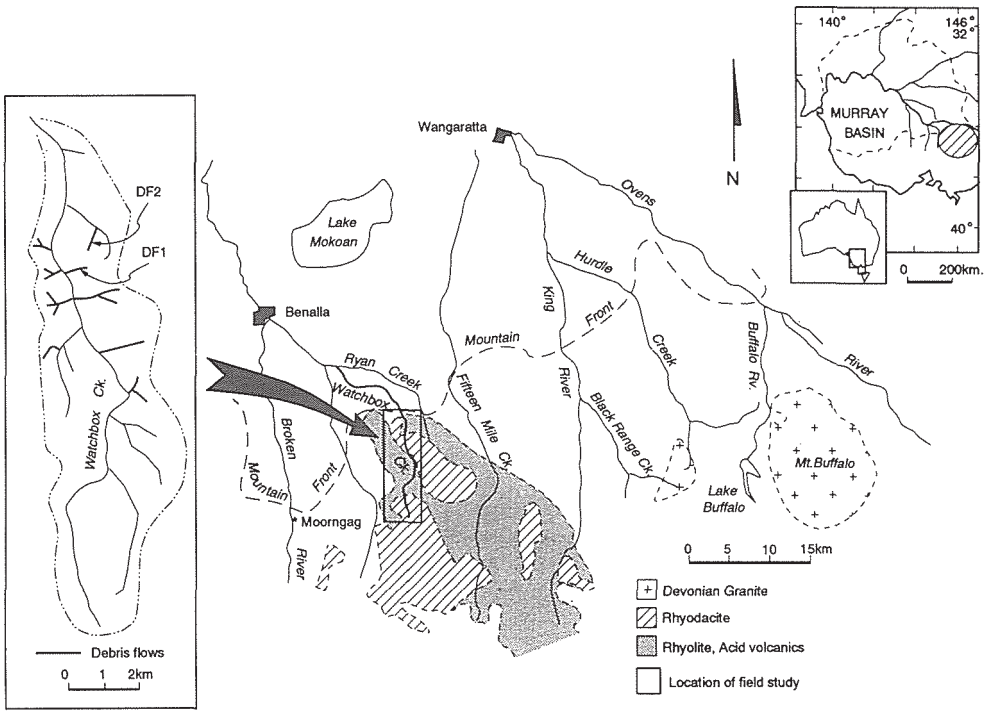

Fig. 1 Location of the study area in northeast Victoria, with detail of the Watchbox Creek basin.

Several debris flows have occurred on Mt Bellenden Kerr in wet-tropical Queensland. Wasson (1978) has described a single debris flow near Lake George in New South Wales, and another 2 km long debris flow occurred in Lilydale, Melbourne, in the 1890s (Shire of Lilydale, 1993). Thus, to our knowledge, this northeast Victorian flood event has produced an unprecedented number of debris flows in the European history of Australia.

In northeastern Victoria the debris flows are prominent effects of the floods, being visible from tens of kilometres away, and they are considered locally to have been major sources of sediment to the stream systems. This paper reports the characteristics and distribution of debris flows from the October 1993 storm event, specifically in the headwaters of the Broken River. In particular we:

(a) determine the distribution and frequency of debris flow events;
(b) describe the debris flows using two detailed case studies; and
(c) identify their importance in contributing sediment to stream systems, and their role in longer term landscape evolution.

Distribution of debris flows from the storm event

The storm event of 4 October triggered approximately 30 debris flows in the drainage basins of the Broken and Buffalo Rivers. The number of debris flows could be roughly counted from an aerial inspection after the floods. No official aerial photographs have

been taken of the river headwaters since the flood. All of the debris flows occurred in forested drainage lines that have only ever been selectively logged.

Debris flows typically occurred on steep, resistant rock types with slopes above 25°. Thus, the highest density of debris flows (approximately twenty were counted) occurred on the steep and resistant acid volcanic lithologies and Middle Creeks in the drainage basins of Ryans (Fig. 1). These debris flows cut four roads, and were a major immediate impact of the storm. The highest density of debris flows (15) occurred in the Watchbox Creek basin (Fig. 1).

There were also many debris flows on Mt Buffalo (Fig. 1), a granite pluton with almost vertical cliff walls. Debris flows were restricted to the eastern and southern aspects of the mountain, particularly in Sandy, Bunyip and Boulder Creeks. Boulders from debris flows choked Sandy Creek, causing a channel avulsion. This was one of the major impacts of debris flows in the region because the new avulsed stream-channel cut through prime tobacco land.

Finally, debris flows were less common on the most common lithology in the region, Devonian greywacke and sandstone. Only 10 debris flows were counted, with two occurring in the basins of Ryans and Black Range Creeks, and smaller flows along Boggy and Fifteen Mile Creeks.

Frequency of debris flows in the region

The recurrence interval of debris flows in the region was estimated by inspecting aerial photographs from 1963, 1975, and 1993. An area of about 750 km^2, covering all of the acid volcanic lithologies (basins of Ryans and Fifteen Mile Creeks), and some of the sedimentary lithologies was selected. It was hypothesized that debris flows, even 10 years old, would be visible on the photographs, and so their recurrence interval could be estimated. The granite region of Mt Buffalo was not considered in this analysis.

No relict debris flows could be identified on the sandstone lithologies. Thus the recent debris flows on this rock-type can be considered as rare events over the last 30 years. The only relict debris flows that could be identified on the aerial photographs occurred in a small portion of the acid volcanics, with eight flows in the basin of Watchbox Creek and five in a small basin to its west. All of the debris flows could be identified on all three series of photographs. They occurred before 1963, and thus had not been covered by vegetation over 30 years.

Therefore, the last debris flows in the region occurred more than 30 years ago, and these were more spatially confined than the recent event. Engineers from the Shires of Benalla and Oxley concur that there have been no debris flows in their shires in living memory. It is also important to note that the eight debris flows in Watchbox Creek that are visible on the 1963 photographs were freshly stripped-out again in the 1993 storm, and another five new flows occurred. In short, debris flows are rare in the region affected by the 1993 flood. It probably requires a storm of at least 50 year recurrence interval to produce debris flows throughout the acid volcanic region, and to produce any debris flows in the less-steep sandstone drainage basins. Debris flow scars remain visible for at least 30 years. Further evidence for the infrequency of debris flows is provided by the stratigraphic sequences exposed where creeks have cut laterally into alluvial fans deposited below debris flow chutes. We saw no evidence in the stratigraphy of the large, sub-angular boulders carried by the recent debris flows, again suggesting that such flows are rare events.

Description of debris flows

The remainder of this paper will discuss debris flows that occurred on the acid volcanic lithology of the Watchbox Creek drainage basin (Fig. 1). Thirteen debris flows occurred in the headwaters of Watchbox Creek (35 km^2 drainage basin), a tributary of Ryans Creek, which is itself a tributary of the Broken River (Fig. 1). The closest pluviograph to Watchbox Creek is 15 km to the west at Moorngag. This station has a 12 h duration, 50 year average recurrence interval rainfall of 7.5-8 mm h^{-1} (*Australian Rainfall and Runoff*, vol. 2., map 5.8). Bureau of Meteorology records for Moorngag on the night of 4 October showed a 12 h duration of 10 mm h^{-1}, suggesting a greater than 50 year recurrence interval for the storm event. Unofficial raingauges suggest that the storm was considerably more intense than this. For example, Mr Person's 250 mm raingauge in Watchbox Creek overflowed after 5 h between 2.00 a.m. and 7.00 a.m. on 4 October. This rainfall intensity of 50 mm h^{-1} is supported by other landholders in the region.

The drainage basin of Watchbox Creek is composed of Devonian rhyodacite, rhyolite and acid volcanics. All of the debris flows occurred in fully forested drainage basins (open forest of broad and narrow-leaf peppermint (*Eucalyptus dives* and *E. radiata*)) that have only ever been selectively logged. Thus, unlike many of the debris flows described in the literature, that occur following logging (see DeRose *et al.*, 1993; and review in Gresswell *et al.*, 1979) or grazing (Lehre, 1982), these are examples of geomorphic events occurring with their natural frequency. Two debris flows were investigated in detail (described here as DF1 (grid ref. DV267383) and DF2 (DV273393)) (Fig. 1), and three others were inspected. DF1 and DF2 will be described in detail, and then compared with the other flows.

Description of debris flow 1 (DF1)

DF1 (sub-basin area of 15 ha) has left a clear, bedrock channel about 700 m long and over 5 m wide (Figs 2 and 3). The maximum measured slope in the debris flow was 33°. Sediment was deposited in a fan adjacent to Watchbox Creek. The flow had many of the classic features of a debris flow, namely: poorly sorted, coarse levee and fan deposits (both matrix and clast supported); mudlines on marginal trees; prominent super-elevation of mudlines at bends; and removal of all trees in the centre of the flow-path (Costa, 1984, 1988). The failure could be more correctly classified as a debris flow that passes downslope into a "channel confined debris torrent" (Kelsey, 1982).

Unlike other debris flows (cf. Tsukamoto *et al.*, 1982; Benda, 1990) DF1 was not initiated from a colluvial hollow, but from a straight section of the catena, with planar cross-slopes. The head of the debris flow evacuated saprolite and core-stones directly from the weathered bedrock. Hence, the heads of these debris flows represent a direct path of downslope transport of the weathered material. It was not clear whether the debris flow was initiated by failure at the top that carried the remainder of the downslope material along, or by failure at the bottom that triggered failures progressively up the slope.

The debris flow had a maximum discharge of 145 $m^3 s^{-1}$, and a maximum velocity of about 9 m s^{-1}. Flow velocity was estimated with three independent methods (Costa, 1984) (Table 1). Superelevation was measured at three bends (Fig. 2), and velocity was

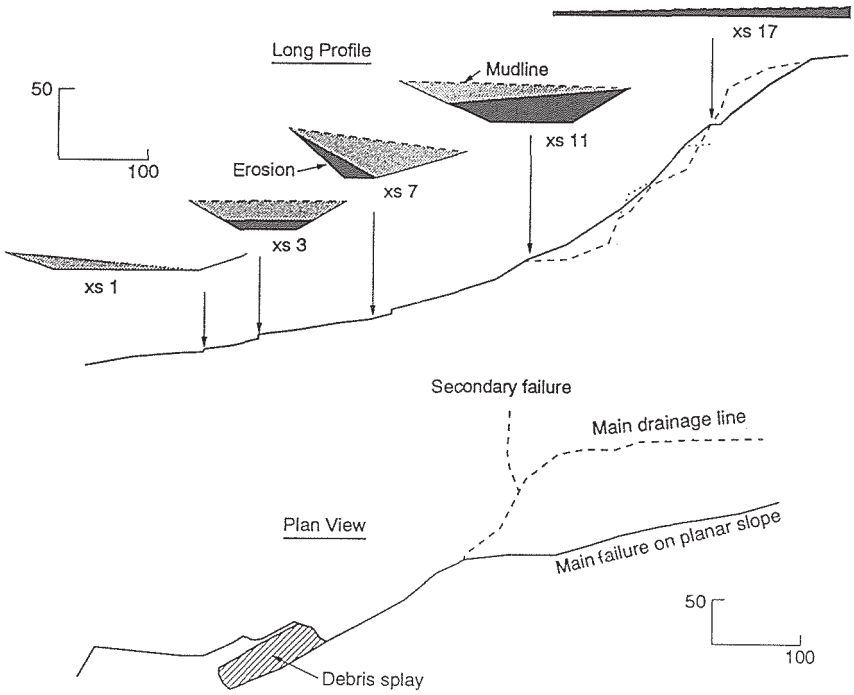

Fig. 2 Profile and plan-view of debris flow 1 (DF1). A sample of 5 of the 17 cross sections is shown.

estimated with the formula:

$$v = \sqrt{\Delta h g r_c \cos S / b} \tag{1}$$

where Δh = superelevation, $g = 9.81$, r_c = radius of curvature, S = channel slope, b = water surface width. In addition, velocity was estimated by measuring the diameter (d) of the five largest clasts ($v = 0.18d^{0.49}$), and by measuring the height of the stagnant head on the upstream and downstream side of trees

$$v = \sqrt{2gh/\alpha} \tag{2}$$

(where h = height of stagnant head, α = momentum correction factor).

There are problems using these equations, derived for normal water flows, for estimates of velocity in hyperconcentrated, non-Newtonian debris flows. Nevertheless, the results (Table 1) are very consistent at the order-of-magnitude level across the methods, indicating that the flow travelled between 4 and 9 m s^{-1}. Assuming that the erosion originated from the apex of the failure (Fig. 2), these velocity figures suggest that the front of the debris flow reached the apex of the fan about 1.5 minutes after initiation.

The instantaneous discharge carried by DF1 was probably over half of the peak discharge carried by Watchbox Creek during the flood. From the area and velocity estimated at cross section seven of DF1 (Fig. 1), discharge was estimated to be between 35 $m^3 s^{-1}$ and 95 $m^3 s^{-1}$. The lower estimate assumes that the debris flow only occupied the area evacuated by erosion, whilst the upper estimate assumes that the flow

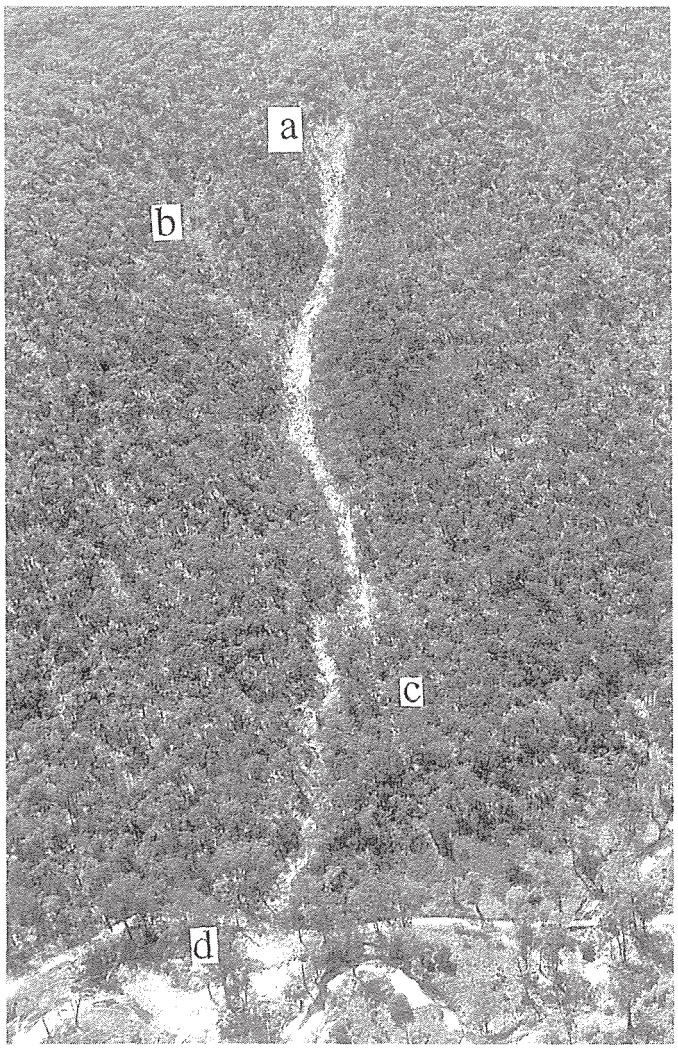

Fig. 3 Oblique aerial photograph of DF1. Note the following: the rotational slump at the head of the failure (point "a"); the main path of failure does not follow the main drainage line (point "b"); the debris splay visible through the trees below the sharp bend (point "c"); and the fan of material at the junction with Watchbox Creek (point "d").

occupied the full cross section delimited by the mudlines. For comparison, the peak discharge carried by Watchbox Creek during the flood, was estimated to be 110 $m^3 s^{-1}$ from Manning's equation. If basin area is considered to be proportional to discharge from the basin, then the discharge of Watchbox Creek can be used to estimate the water discharge that would normally be expected from the 15 ha basin of DF1 in the 1993 storm. Proportionally the basin area of DF1 should produce less than one cubic metre of water per second. Given the minimum discharge in DF1 of 35 $m^3 s^{-1}$ suggested above, it is likely that the debris flow would have contained less than 5% water, with the rest being sediment. The following approximate sediment budget suggests that less than a third of this large volume of sediment reached Watchbox Creek.

Table 1 Estimates of flow velocity in the debris flow.

Method	Position	Estimate
Superelevation	Cross section 14 (near the top) (Fig. 2)	8.9 m s^{-1}
	Cross section 7 (middle)	5.0 m s^{-1}
	Cross section 1 (apex of fan)	4.2 m s^{-1}
Five largest clasts	Bed of debris flow scar (mean diameter = 1.01 m)	5.4 m s^{-1}
	Debris splay (see below) (mean d = 1.4 m)	6.3 m s^{-1}
Stagnant head	Edge of fan (head = 2 m)	6.2 m s^{-1} (probably over-estimate)

Volume of sediment eroded and deposited

Sediment volumes were estimated from 17 cross sections surveyed across the debris flow (of which five examples are reproduced in Fig. 2). The area of material eroded at each cross section was estimated by projecting a line from the upper edge of the freshly eroded colluvium or rock, down to the edge of the old channel bed. The edge of the darker, organic-stained surface of the former channel bed could be differentiated from the freshly exposed rock surface. The proportion of silts and clays, and sand, at each cross section was estimated and compared with the grain-sizes deposited in different sediment stores in order to estimate the calibre of the material that was delivered to Watchbox Creek.

The areas of the 17 cross sections indicate that an order of magnitude more sediment was eroded from the channel margins as the debris flow passed down the drainage line, than was eroded from the alcove at the top of the debris flow (Table 2).

Sediment was deposited in four locations, in:

Table 2 Rough sediment budget for debris flows 1 and 2. Data come from field surveys as described in the text.

Zone (Defined in Fig. 2)	Erosion (m^3):		Deposition (m^3):	
	Debris Flow 1	Debris Flow 2	Debris Flow 1	Debris Flow 2
Erosion alcove at top of failure	500	750		-
"Barrel" of debris flow	7000	1500	190	500
Fan apex		1100		1500-2600
Debris splay	-		1400	-
Fan			3400	450
TOTALS	7500	3350	4990	2450-3500
Throughput to trunk stream			2510	0-900
% throughput			33%	0%-27%

(a) boulder berms within the eroded debris flow channel;
(b) coarse marginal levees;
(c) a "debris splay" (see below); and
(d) in the distal fan.

The majority of deposition (45%) was in the fan (Table 2), but a large volume (19%) was also deposited in an interesting feature which may be defined as a debris splay. Five hundred and fifty metres from the apex the debris flow met a sharp bend in the channel (Figs 2 and 3). This bend produced 2.5 m of superelevation, and as a result about 1400 m^3 of sediment was deposited over-bank on the un-failed slope beside the debris flow channel. The resultant splay was 110 m long, 20 m wide, and up to 1 m thick. It consists of a full range of particle sizes from silts and sands to 1.5 m diameter boulders (B axis).

This deposit is significant because it represents a mechanism for depositing large volumes of coarse material well above the channel. In this case the debris splay was over 6 m above the channel floor. The debris splay was deposited on a poorly sorted unit that may represent former debris splays. An initial bend in the path of a debris flow can thus produce debris splays that progressively build upward, producing a significant store of sediment in the valley.

Importantly, less than one third of the sediment eroded from DF1 reached Watchbox Creek (Table 2). The boulders deposited in Watchbox Creek from the debris flow could be differentiated from the existing bed load in the creek because they were more angular and iron stained. Although large boulders, up to 1.6 m in diameter, were deposited in the creek by the debris flow, none of the deposited particles travelled more than 100 m down the creek.

In order to compare the sediment yielded from DF1 with the sediment remobilized from the flood plain, the volume of sediment eroded by cutbank erosion in a 450 m stretch of Watchbox Creek was measured above and below the debris flow. The minimum volume of erosion was estimated from the length of tree roots exposed by the erosion. In this reach, 1800 m^3 was eroded from the flood plain by lateral erosion (58% gravel, 42% silt and clay). This was over two-thirds of the maximum 2500 m^3 of sediment delivered to the creek by DF1. Thus, about half a kilometre of bank erosion in the third-order stream mobilized as much sediment in the stream as was delivered by the largest debris flow in the valley.

This result can be extrapolated to the full length of Watchbox Creek. Of the 15 debris flows that occurred in the Watchbox Creek basin, DF1 was the only one where the deposited fan reached the trunk stream. Thus the maximum sediment yield to Watchbox Creek from debris flows would be less than twice the yield from DF1 alone, say 5000 m^3. Extrapolating the rate of flood plain erosion estimated in Watchbox Creek above, to the full 10 km length of Watchbox Creek suggests that at least 40 000 m^3 of sediment was liberated from the flood plain during the flood. This figure ignores channel incision. Therefore, it is unlikely that the debris flows introduced more than 12% of the total mobilized sediment in Watchbox Creek during the flood event, ignoring other diffuse basin sources.

Description of debris flow 2 (DF2)

DF2 occurred to the north of DF1, on the opposite side of the ridge, and flows into a

small tributary of Watchbox Creek that we have named Teachers Creek. Erosion and deposition were estimated from 16 cross sections just as in DF1. DF2 is about half the length of DF1 (450 m), but shares the following features.

(a) The debris flow was initiated on a planar portion of the slope (with a slope >25°), rather than in a drainage line or colluvial hollow. Thus, DF2 removed weathered material directly from the slope. The coarsest fraction of this material came from the head of the failure (>1.5 m boulders), whilst the bulk of the sediment came from colluvium at the margins of the flow.

(b) The 3300 m^3 of sediment removed from the slope was deposited in an alluvial fan, and only a small proportion of the fine fraction was delivered to Teachers Creek (Table 2). Widening and deepening within Teachers Creek produced an order of magnitude more sediment than did erosion from DF2. Further evidence that DF2 had little impact on the stream comes from channel dimensions in Teachers Creek. A survey of 26 cross sections along the creek, upstream and downstream of the toe of the DF2 fan demonstrated that the input from DF2 had no influence on either channel size or channel width-depth ratio.

(c) DF2 delivered coarser sediment to the flood plain/fan than do other processes. Adjacent streams could transport particles of less than 0.3 m diameter, whilst DF2 delivered 1.6 m boulders.

One contrast between DF1 and DF2 is that much of the sediment eroded from DF2 came from vertical stripping of the A horizon over a large area.

DISCUSSION

The debris flows initiated by the 1993 flood in northeastern Victoria are typical of debris flows described throughout the world in terms of slopes, depth of colluvium, and flow velocities (e.g. Kelsey, 1982; Tsukamoto *et al.*, 1982; Benda, 1990). The only possible differentiating characteristic is their initiation in planar portions of the hillside, rather than in colluvial hollows.

Debris flows are rare events in Australia, with this event in northeastern Victoria being the largest debris flow event described. It should be emphasized that all of these debris flows occurred in essentially undisturbed forested basins, and probably represent a "natural" geomorphic event. Therefore, we can conclude that debris flows will only be widespread in northeastern Victoria in high intensity storms of greater than 50 year recurrence interval. They are most likely to occur in highly resistant and steep lithologies, such as granites and acid volcanics. These lithologies do not make up a large proportion of the Australian Highlands. For example, they occupy less than 10% of the Broken and Ovens River basins upstream of the mountain front.

Despite being spectacular events that leave prominent scars on the landscape, the debris flows in northeastern Victoria deliver only a small volume of sediment directly to the stream system, and they cannot be considered a management problem in terms of increased stream sediment loads. The only damage done by debris flows was to deposit boulders on roads.

Even though debris flows in this region do not deliver large volumes of sediment directly to streams, in comparison to the sediment mobilized from the flood plain storage, they are geomorphically important. This is because they transfer coarse colluvial material, derived from resistant lithologies, directly into stores of sediment

that are accessible to erosion by larger streams. Thus, both DF1 and DF2 deposited coarse sediment in fans that will be eroded by lateral migration or avulsive channel change of the trunk stream. Other erosion processes move material more slowly. For example, soil creep will move coarse sediment directly onto the flood plain, whilst gradual erosion by tributary streams can move some coarse material onto fans. The largest clast that was observed to be delivered to the trunk stream by the floods, without a debris flow, was 0.3 m in diameter. By contrast, DF1 delivered 1.5 m boulders to Watchbox Creek. Of course, it is not clear whether the gradual processes of creep and stream erosion move a larger total volume of material than do the catastrophic, but rare, debris flows.

The debris splay reported here from DF1 is an interesting geomorphic feature. In this case, superelevation of the debris flow has been a process that can deposit very coarse material over 5 m above the channel floor. As the deposit grows deeper with successive debris flows it will become more effective at diverting the flow, thus producing a feedback mechanism that could lead to the deposition of several metres of sediment within a debris flow chute.

Finally, it is interesting to consider the possible role of debris flows in sculpting headwater slopes. All of the debris flows inspected in the northeast stripped the regolith to bedrock, and large areas of fresh bedrock were exposed where rocks in transit had struck the surface. In particular, the debris flow tended to smooth the floor of the channel by abrading any irregularities or protrusions. Although this form of erosion appears minor during one debris flow event, over millions of years it is significant. For example, in the upper end of DF1, about 5% of the bedrock surface was chipped to at least 10 mm depth. If it is assumed that debris flows occur every 100 years, then by extrapolation, approximately 10 mm would be removed from the floor of the flow every 2000 years. Assuming the frequency of debris flows remained the same, then over the 2 million years of the Pleistocene debris flows could have eroded the drainage line a distance of 10 m. This would translate to a lowering of the basin divide by 5 m per million years, which is consistent with long-term denudation rates throughout south eastern Australia (Bishop, 1985; Gale, 1992).

A weakness in this extrapolation is the possibility that debris flows become less frequent as the drainage line is eroded. Debris flows in the northeast did not occur in drainage lines that were deeply incised. That is, there were no debris flows where the side slopes into the drainage line were very steep. In these drainage lines the colluvial material is removed before it builds up in the stream, or on its margins. This could be in part related to the size of the basin, but it could also be related to the more efficient delivery of colluvium to the drainage line by the steeper side-slopes. This would imply that debris flows become less frequent as the drainage line is incised. This proposition has implications for the relationship between the evolution of stream channels and the evolution of the catena into the stream. Unfortunately the sample size of debris flows in this region is probably insufficient to test the proposition quantitatively.

CONCLUSIONS

A large storm in October 1993, in northeast Victoria, produced more debris flows (about 30) than have been reported before in Australia. Such debris flows are associated with storms of at least 50 year recurrence interval. The debris flows were

typically between 0.5 and 1 km in length, experienced flow velocities up to 10 m s^{-1}, and were most common on resistant granite and acid-volcanic lithologies with slopes greater than about 25°. These characteristics are typical of debris flows that are common elsewhere. The only possible differentiating characteristic of the debris flows investigated on the acid-volcanic lithologies is their initiation in planar portions of the hillside, rather than in colluvial hollows.

The debris flows were of little significance to modern stream processes. Thirteen debris flows in one 35 km^2 drainage basin contributed approximately 10% of the total sediment mobilized during the flood. Five hundred metres of channel migration and widening in the stream contributed the same volume of sediment as the largest debris flow (approximately 2000 m^3). However, in the longer term the debris flows are a significant process because they deliver coarse colluvium (up to 1.5 m B-axis) directly from the hillside to the modern stream and flood plain, making it available for later transport. In addition, erosion of bedrock by the high velocity debris flows could produce lowering of the landscape at a rate of 5 m per million years. It is probable, however, that the frequency of debris flows declines as drainage lines incise.

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Schleiger, N. 1998. Studies in the structure of Mount Buffalo Granite. The Victorian Naturalist 115, 175-185.

Note: The following paper, included in the original field guide, has been omitted from this on line file for copyright reasons:

Gillbank, L. 1992. Alpine botanical expeditions of Ferdinand Mueller. Muelleria 7, 473-489.

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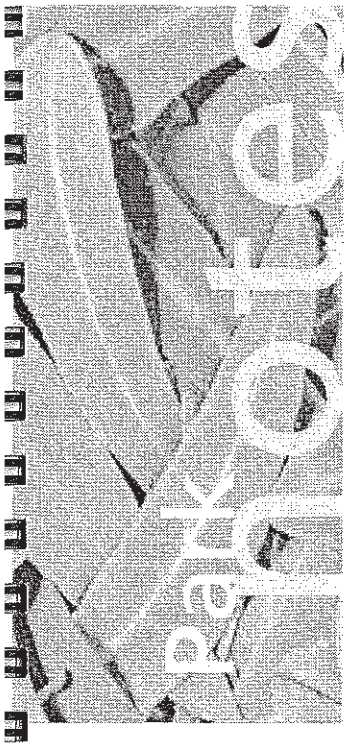
Lawler, S., Burston, J., Cockayne, B., Smedley, N. and Massingham, P. 1997. Environmental determinants of the distribution of the Buffalo Sallee Eucalyptus mitchelliana. The Victorian Naturalist 114, 278-281.

Note: The following paper, included in the original field guide, has been omitted from this on line file for copyright reasons:

Marion, A. 1998. Special protection zone management within Mount Buffalo National Park. The Victorian Naturalist 115, 169-174.



Mount Buffalo National Park

2003 Bushfire

Due to severe lightning storms on January 8 2003 several bushfires were ignited in north east Victoria. One of these fires was at Anderson Peak in the Mt Buffalo National Park. The fire slowly spread to surrounding areas of the park.

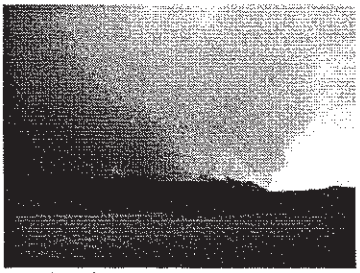
The Mt Buffalo Chalet, Mt Buffalo Wilderness Lodge and Lake Catani camp ground were closed on January 13th. The Mt Buffalo Tourist Road was closed to the public shortly afterwards. This was to ensure the safety of the public and fire personnel.

On the afternoon of Friday January 17 2003, the fire reached the Mt Buffalo Plateau.

Due to the hard work of Parks Victoria, DSE, CFA and Hancock firefighters, the chalet, lodge, camp ground, rangers' office and residences were saved. There was however some damage to other assets on the mountain including bridges, walkways, walking tracks and signage.

Within three weeks of the fire starting most of the area within Mt Buffalo National Park was burnt. Luckily there are some pockets of vegetation that escaped the fire and most of the tree canopies remain intact.

By early February several fires across north east Victoria, NSW and ACT had joined forming a fire front over 800 kilometres long and spanning 3 states. Over one million hectares were burnt, much of this in national parks and state forests.



Mt Buffalo from Porepunkah roundabout
Photo: Charlie Pascoe 17/01/03

Back burning to halt spread of fire
Photo: Charlie Pascoe 22/01/03

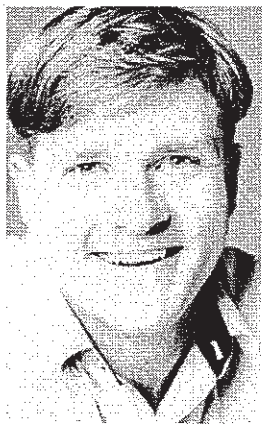
After the fires

The enormous task of assessing the full impact of the fires is continuing. Some of the tasks to be undertaken by the rehabilitation team include:

- Clearing all public access areas and walking tracks of fallen trees and debris
- A risk assessment and mitigation of standing trees in public access areas
- Assessing and repairing damage to services infrastructure
- Assess repairing damage to built assets – bridges, boardwalks, buildings and shelters, etc.
- Monitoring regrowth of fragile vegetation, including rare and threatened species within previously identified Special Protection Zones.

Consequently areas of the park will be closed to public while they are assessed. As we are able to secure these areas they will be progressively opened to the public. Our prime objective is safety: for staff and visitors to the park and the environment.

Parks Victoria and the rangers at Mount Buffalo National thank you for your patience and co-operation during these difficult times and apologise for any inconvenience caused.



Parks Victoria Ranger

"Victoria has all the outdoors you could wish for – mountains, forests, beaches and bushland, all preserved in our parks. Our natural landscapes have been here longer than anyone knows, and together we can make sure they're here forever."

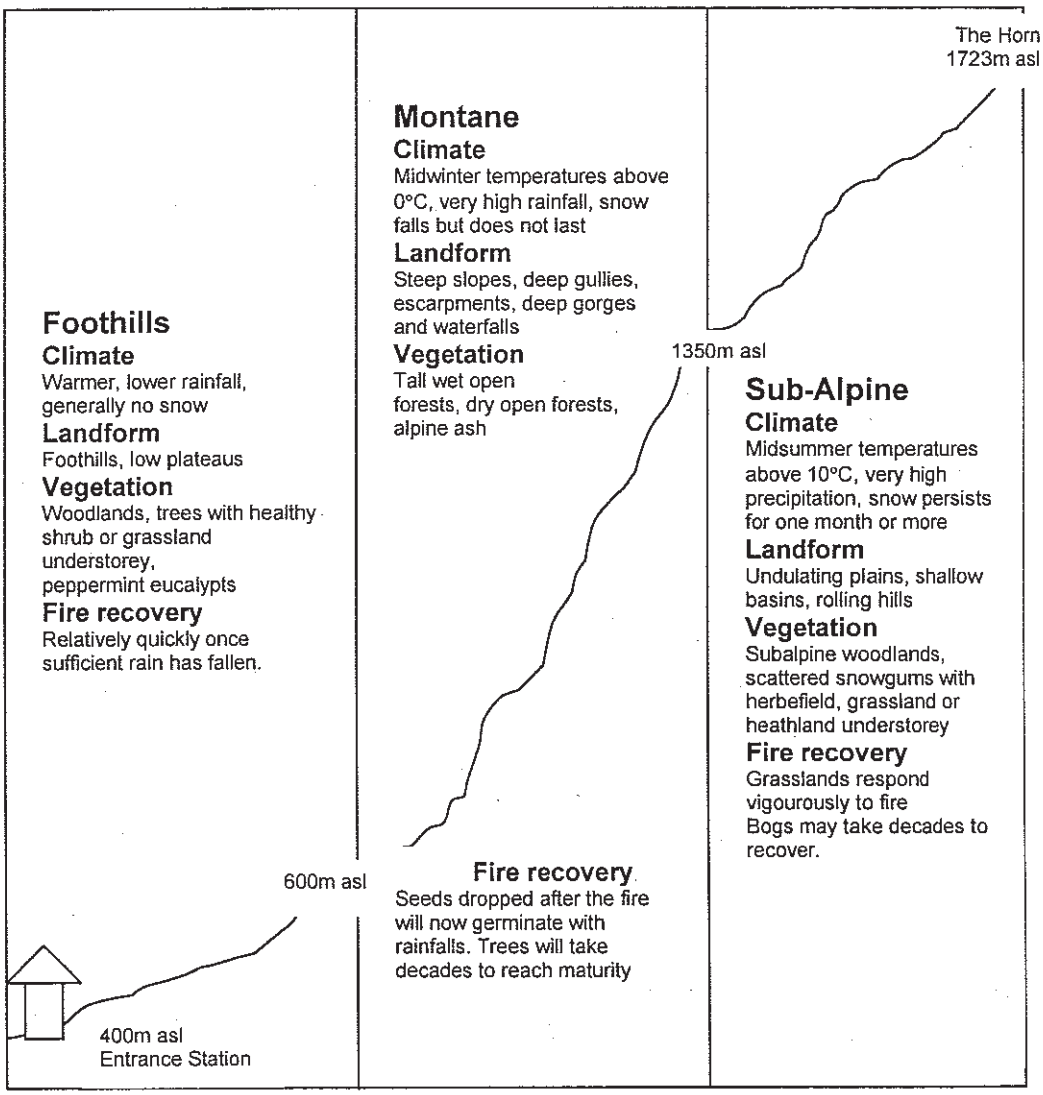
For more information call the Parks Victoria Information Centre on 13 1963 or visit our website at www.parkweb.vic.gov.au

Healthy Parks Healthy People

Parks VICTORIA

The next 12 months

During the next 12 months visitors will observe the initial stages of recovery of the three altitudinal zones. In general the intensity of the fire was moderate as will be observed by the removal of the ground and middle layers of plants but not the crowns.
Sufficient numbers of wildlife should have survived in unburnt areas of the park to allow recolonisation of affected areas.



What's Open

Areas of the park will progressively be opened as they are made safe for public access. The Mt Buffalo Tourist Road is open to the Horn car park. Visitors can also access the Gorge car park and picnic area including toilet facilities, and the Horn Picnic area. Mt Buffalo Chalet and the Mansfield Café are also open for business.

Please check with the Parks Victoria Information Centre on 13 1963 for up to date information about what's open within Mt Buffalo National Park, or call Mt Buffalo staff on 03 5756 2328. For information about Mt Buffalo Chalet call 1800 037 038.

For further information contact:

Parks Victoria Information Line:

Phone: 13 1963

Camping Permits, Bookings & Information:

Entrance Station
PO Box 72A
Porepunkah VIC 3740
Phone: (03) 5756 2328
Fax: (03) 5756 2148

Rangers and Information:

Park Office
PO Box 72
Porepunkah VIC 3740
Phone: (03) 5755 1466
Fax: (03) 5755 1802

Relevant Maps:

Mount Buffalo Plateau 1:30,000 topographic by Geoff Lawford

Eurobin & Buckland sheets 1:25,000 topographic, Vic Map

Relevant Codes:

Car Camping Code
Bush Camping Code

Relevant Guides

Mount Buffalo Visitor Guide
Alps in Flower Field Guide
Camping in Victoria Guide

Caring for the Park:

Help look after this park by remembering these points

Take any rubbish home with you

All native plants, animals and landforms are protected

Dogs, cats and other pets are prohibited within the park

Firearms are prohibited

Camping is permitted only in the designated areas

Camp fires are permitted only in fireplaces provided

No fires in the open on Total Fire Ban days

Use rubbish bins provided

Do not use soap, toothpaste or detergents near lakes or streams

Leave the park as you found it

Note: Extracts from the following book, included in the original field guide, have been omitted from this on line file for copyright reasons:

Webb, D. and Adams, B. 1998. The Mount Buffalo Story: 1898-1998. Melbourne University Press.

Note: Extracts from the following paper, included in the original field guide, has been omitted from this on line file for copyright reasons:

Calder, M. and Calder, J. 1998. The scientific value of Mount Buffalo National Park. The Victorian Naturalist 115, 164-168.

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Celebrating the Parks : Symposium on Parks History
Mt.Buffalo, Victoria, 16-19th April 1998
Ed : E.Hamilton-Smith

BATTLES AND VICTORIES IN THE VICTORIAN ALPS: AN HISTORICAL PERSPECTIVE OF MOUNT BUFFALO AND ALPINE NATIONAL PARKS

Peter Jacobs & Gillian Anderson
Parks Victoria

Introduction

The Alps are a place of extremes in:

- **landscape**; rolling high plains, alpine summits, deep river valleys, impenetrable rocky escarpments...
- **weather**; icy winds, wild electrical storms, torrential rain, clear blue skies, hot sun, blinding snow, white outs...
- **communities of plants and animals**; tall mountain forests, lyrebirds & potoroos, woodlands of hardy snow gums, flame robins, herbfields of fragrant heaths and colourful wildflowers, open plains of tussock snow grass, red and blue alpine grasshoppers, mountain pygmy possums, ravens...
- **human occupation and land use;** Aborigines for thousands of years, graziers, miners, scientists, explorers, adventurers, developers, conservationists, tourists...

In December 1989, after at least 50 years of stormy debate, heartache and planning, Victoria's largest and most magnificent national park, Alpine National Park came into being. Less than ten years later In 1998, Mount Buffalo National Park, just across the valley, celebrated it's centenary. Why is the history and use of these parks so different?

To answer that question it is necessary to go back to the 1880s when the two park histories of Mt Buffalo and the Alps diverged.

After thousands of years of occupation, the Aboriginal population had declined to almost nothing, suffering from the massacres and disease that came with white settlement. But Mount Buffalo started on a path of protection while the Alps continued on an often conflicting journey of exploitation and appreciation of its wild beauty, grandeur and natural resources.

MOUNT BUFFALO NATIONAL PARK

Early Exploration, Mining and Settlement

Hume and Hovell named Mount Buffalo in 1824 whilst on an expedition from Sydney to Corio Bay. Whilst passing through the nearby Wangaratta

district they maintained it resembled a giant sleeping Buffalo.

In 1845, Buckland, a squatter, took up the Junction Run , the first grazing lease in the area near Porepunkah. Thomas Goldie, his manager took up residence 10 miles up the Buckland Valley. In the 1850s and 1860s, People with the names of Manfield, Weston, Brady and Carlilse started to settle the area, and whose names will play a key role in the future of Mount Buffalo.

Gold was discovered by Purdoe in the Buckland Valley in late 1853, causing a major rush. By 1854, over 5000 miners were on the Buckland goldfields, at the foot of Mount Buffalo.

Renowned artist, Nicholas Chevalier visited the area in the late 1850s returning in 1864 to paint Mount Buffalo from One Mile Creek, near Porepunkah to enter into a competition run by the National Gallery (Melbourne) for the best picture by a local artist.

First Visits

Thomas Goldie, who stayed in the area following Buckland's brief occupation, and several other local settlers in the Buckland valley, used the Goldies Spur route to bring cattle up on to the plateau (Weston 1986).

On February 26 1853, Ferdinand Mueller, later Baron von Mueller recently appointed Director of the Melbourne Botanical Gardens and John Dallachy, Superintendent of Melbourne Gardens, climbed the Horn, and stayed on the plateau until 4 March, on expedition to collect alpine plants for the Botanical Gardens (Waters 1967), He was probably led there by Buckland (Weston 1986).

Their visit was the first recorded ascent of the Horn, however it is likely that Goldie and others preceded them in the previous eight years (Weston 1986).

They named and collected several new plants such as:

- *Grevillea victoriae*: After Queen Victoria
- *Kunzea muelleri*: After Mueller himself
- *Acacia dallachiana*: After John Dallachy

Mueller was a tireless collector and explorer in his own right, and his efforts ensured Victoria's high mountain flora was reasonably well documented very early in the colonies history (Gillbank 1992).

In 1854, settlers James Samuel and brother John climbed Buffalo via the Goldies Spur track and spent several days exploring (Waters 1967). No doubt they became known for their knowledge of the mountain, and in 1856, James led a party of miners to the Horn and Gorge.

This was claimed to be both the first tourist party for those seeking to see the reputed beauty of the area (Wilkinson 1929), and simply a expedition to seek new areas for mining.(Webb & Adams 1998). Whatever the reason, there was no gold on the mount but James Manfield claimed the right to be the first guide (Wilkinson 1929) and began a career for both himself and family in guiding on Mount Buffalo.

The "Birth of Tourism"

In 1873, Bill Weston climbed Mount Buffalo pioneering a rough route from the north side. By 1874 passengers could travel by train to Wangaratta and Mount Buffalo was now coming within reach. In 1875, Bill Weston led a group of doctors from Melbourne who wished to holiday in the area to the plateau via his new route. They were so enchanted it became an annual event.. He constructed a log cabin for them in January 1879, which was the first recorded building on the plateau and sometimes referred to as the "Doctors Hut" (Weston 1986).

The second hut built on the mount was a temporary affair, commissioned by the member for Ovens, Mr. Smith of Beechworth, for a trip he organised in 1886 for a vice regal party including Victorian Governor Loch. He was trying to promote the plateau as a tourist destination. (Allom et.al.). Thomas Goldie built the hut of oil paper and hessian, located near the bottom of the current Cresta Poma. The Governor fell ill and never made it to the hut (Weston 1986).

In 1887, the Bright Alpine Observer in an article strongly opposing the anticipated alienation of part of the Buffalo plateau into pastoral blocks stated that Buffalo was destined to become a popular holiday resort for metropolitan tourists. Furthermore this government would be in of further dereliction of its responsibilities if it allowed another natural feature of interest to pass out of the hands of the State.

Also in 1887, a DR J F Wilkinson came to practice in Bright. His desire to promote the tourist potential of the area was strong and he discussed the issue with other like minded people. They included Mr. WA Staker, a commercial traveler and frequent visitor to the mount, Rev WL Fenton, the local presbyterian minister, Mr. Harry Smith, bank Manager and shire secretary, Mr. Chauncey. They formed a committee and thus inaugurated the Bright Tourist Club and promotion Committee, later known as the Bright Alpine Club, to promote development of the district as a tourist resort (Wilkinson 1929).

Staker was president, Wilkinson secretary and the rest formed a committee. At the inaugural meeting, they urged the reservation from selection, sites at Mount Buffalo, Hotham and other places (Bardwell 1974). They levied business to build tracks and promote the area.

In the Bright Alpine Club publication *The Illustrated Guide to the Victorian Alps*, it states 'the tourist should spend two or more days on the summit camping out. The complete isolation from the world of business, the exhilaration the wildness and magnificence of the surroundings brings the tourist in close sympathy with nature' (Bright Alpine Club 1887). Bardwell (1974) suggests that their promotion of mountaineering, fresh air and vigorous exercise was unique at the time and could be interpreted as a precursor to wilderness philosophy.

In 1888 a letter was sent to the Secretary for Lands from the Bright Tourist Club and promotion Committee requesting that certain land at Mount Buffalo be reserved as a public Park, naming The Horn, The Hump and The Falls in the application, however there was no formal action (File). The club

continued to be busy raising funds and promoting the area. Wilkinson encouraged a local resident and cattlemen, Carlisle, to build a hospice to accommodate people on the mountain.

In 1890, James Manfield built the Temperance Hotel, later known as Buffalo House at the foot of the Gorge. It as advertised that visitors would be met at Porepunkah station and driven to the Hotel. From there the Manfields would guide people up Stakers track with camping gear to camp on the plateau (Hoy 1965). In December 1891, Carlisle opened his Hospice, built under the rights of a miners claim, catering mainly for summer guests. It had a bathroom and toilet and fully licensed bar.

The beginnings of a National Park

Meanwhile, pressure for a park was growing. Since the last letter in 1888 to the Secretary for Lands seeking a reserve on Mount Buffalo, increased activity around Eurobin Falls was of concern to the Bright Shire. Miners were taking timber for mines at Chiltern and Rutherglen and visitors were removing shrubs and ferns for gardens. The roads were being torn up by timber traffic making it difficult for tourists. The Shire Secretary and Alpine Club Secretary again wrote to the Secretary of Lands seeking a reserve to protect this 'far flung beauty spot' (File). The minister took it more seriously this time and sought comment.

The Conservator of Forests, George Perrin supported the national park proposal however John Wallace MP angrily put forward concerns that the land was needed to cut lathes for mines and wanted the reserve stopped. Mining interests referred to 'such nonsensical purpose as a public park' (File). The wishes of the Bright Alpine Club prevailed however and on 31 October 1898, 2880 acres were reserved as a site for a national park and gazetted on 4 November 1898.

Manfields move up the Mountain

Manfields realised that tented camps were no match for Carlisle's new Hospice. Like Carlilse, James Manfield Jnr, son of J S Manfield also took out a miners right under the belief he too had the right erect a house for accommodation. He subsequently built a house overlooking the Gorge probably in 1899, commonly known as the Alpine Lodge. The park declaration in 1898 however, specifically excluded such occupations under Miner's Right. Carlisle, having constructed his hospice prior to the park declaration felt he was excluded from that condition (File). A storm erupted.

Lyndon Smith as secretary of the Bright Alpine Club, wrote to the Secretary for Lands bringing his attention to Manfield's actions and Carlisle wrote to local member Isaac Isaacs, complaining of the unfair competition. The Bailiff warned James Manfield Jr. that if he did not remove the structure, proceedings would be taken against him (File). Manfield then wrote back to the Minister claiming ignorance of the law, but maintaining that he had a duty to look after tourists. He presented a petition of support for himself signed by nearly one hundred residents of the Ovens Valley, which was presented to parliament.

The outcome was that both James Manfield Jnr. and Carlisle were granted a licence under Section 99 of Land Act 1890 to occupy three acres each at their respective sites, but no long term commitment and no compensation when they are asked to leave (File).

Another more substantial cottage was then built on Manfield's three acre entitlement. Alice Manfield tells of when she and her brother Bill built a new cabin on a site near Bents Lookout in 1902 (Hoy 1965).

More Development: Roads, Chalets and Park Expansion

The need for a better road soon became obvious. Following a deputation sent by Bright Shire to Melbourne seeking financial assistance for a road to Buffalo and other nearby alpine attractions, local MLA, Alf Billson demanded in parliament immediate action to improve roads leading to Victoria's mountain resorts. (Webb & Adams 1998). In a glowing description of the plateau given in 1907 by E J Dunn after his geological survey, he called it the Garden of the Gods This induced Sir John Mackey, Minister of Lands to visit. He was so impressed he convinced the Premier, Sir Thomas Bent, to provide money for a new road. It was opened by the Premier on October 9 1908. It generally followed the route of the original Stakers track.

In his speech the Premier expressed his intention of continuing the governments policy of opening up the States tourist spots to tourism (Allom et. al.). The Premier must have been greatly impressed as he also proceeded to extend the land for a national park to 23,100 acres, gazetted on 14 October 1908, and announce that a new solid stone chalet overlooking the Gorge was to be built by the government.

Regulations for the Care, Protection and Management of the National Park were gazetted on 25 November 1908 under section 199 of the Land Act for the "*Good order and decency therein and for the collection of tolls, entrance charges and other charges for entering therein or thereupon*" (File).

The Premier's stone chalet did not eventuate. The public works department instead proposed a cheaper wooden structure. A lake on the plateau was considered essential for fire protection and to drive machinery, so in 1908 a contract was let to dam Eurobin Creek along Long Plain (Webb & Adams 1998).

After many delays and the costs blown out from 4000 pounds to 7000 pounds, The Chalet was completed and leased privately to John Newton. It opened in July 1910, however poor roof design made habitation difficult with most guests leaving disgusted. It was no Hilton, with a lack of lining, leaking roofs and broken windows. Most guests came to meals wearing coats and rugs and then moved smartly to the fireplace (Waters 1967).

The beginning of a Monopoly

The government set its sights on other accommodation houses on the plateau that provided competition. They attempted to close Carlisle's Hospice and Manfield's Chalet.

In 1909 Carlisle wrote to the Minister for Public Works seeking compensation

for lost trade as a result of the decision to build the Chalet. Carlisle died in 1913 and three years later his wife accepted a Lands department offer of £575 to surrender the Hospice and it was demolished in 1917. The government then gazetted regulations to prevent any further occupations by way of a miners right in areas reserved for a national park (Allom et.al.).

Manfields were given orders to vacate their site in 1910, soon after James Manfield Snr died (Hoy 1965). The site was cleared and Jane Manfield paid £50 compensation. There was a public outcry however. In October 1910 the Alpine Observer printed a "plea for justice for the Manfields", also mentioning injustices done to Carlisle. The writer asked was it fair that people who did so much to encourage visitors to Mount Buffalo should now become victims of a government monopoly (Webb & Adams 1998).

Eventually the strength of public opinion forced a compromise. The government granted Manfields two sites on the other side of the Gorge. One for Bill Manfield on which he built his new Alpine Lodge near Reeds Lookout, and the other for Alice and her mother Jane, on which they replaced Manfields Chalet with Manfields Bungalow. Manfields Bungalow stayed in the family until it was destroyed by fire in **1930**. Manfields Alpine Lodge took guests until 1930. It remained as a residence and refreshment room, but Manfield was instructed by the committee of management to remove it in 1935 and it was demolished two months later and moved to Bright. (Management Committee). The Chalet now had the park to itself.

First Rangers and a Committee of Management

Mr. Jock McKinnon, overseeing road works for the public works department, was appointed a bailiff in September 1909 to collect agistment and camping fees and hire tents, following a report from Chief District forester Maurice Griffin, of unsupervised grazing activity earlier that year (File). Bill Weston was the bailiff from 1912-1922 and C Wilcox was appointed to help him in 1915 (File). Mr. Edmiston is recorded as being a ranger in residence in 1921.

A Management Committee was formed by the Board of Land and Works in 1918 to manage the Park under section 184 of the Land Act 1915. The original committee comprised Joseph Reed (Secretary of Lands), Alexander Lang (Forests) , Augustus Peverill (Under Secretary of lands) and William Keast (Victorian Railways). The committee in the early days mainly dealt with issues over management of the road. These issues were complex with the government tendering rights for commercial carriage of visitors, battles between horse drawn carriage and motor cars, and the need to regulate up and down traffic due to the narrow nature of the road. Bailiffs seemed to spend most of the time staffing the gates along the road.

The Grazing Era

Buckland probably introduced cattle to the plateau in 1847, accessing the area from the south along Goldies spur, and other graziers fro the Buckland followed (Weston). Westons, Hughes, Carlisles, and Brady started bringing up cattle from the north side after the first track up from that side in 1888. They

were still grazing cattle when the Chalet was built in 1910. Chalet Management complained about stock fouling drinking water supplies. (Webb & Adams 1998). Grazing ceased in 1923 following railways commissioner, Hal Clapp's intervention (Weston 1986).

It was clear however that the management Committee supported "controlled grazing". Grazing was reintroduced in 1938 and continued sporadically as the committee believed it was necessary for fire prevention and "illegal grazing was impossible to control so it may as well be licensed". The Field Naturalist Club of Victoria complained to the Committee about the resumption of a grazing lease in 1939 (Stewart 1942). In 1942, the Victorian Naturalist published an article written by HCE Stewart titled "Botanical Paradise or Cattle Run?", complaining about the impact cattle grazing and fires lit by cattleman were having on Mount Buffalo. They later sent a deputation to the Minister for Lands Bill Everard, but still failed to convince the Committee to cancel grazing licences.

In 1950 the FNCV again attacked the government over the deplorable damage caused by cattle at Mount Buffalo National Park. Pressure again mounted and another deputation was sent to the Minister for Lands Sir Albert Lind The committee were put under more pressure, but they still resisted. The last grazing licence fee was collected in 1956, but there is no evidence that grazing was ever officially terminated by the committee. It seems likely that the new National Parks Authority, formed in **1956**, may have influenced the Committee not to reissue licences.

Victorian Railways come on the scene

Hal Clapp was Chairman of the Victorian Railways in 1920 and took a keen interest in tourism. Influenced by his time spent with the North American railways and knowledge of resorts at Banff and Yosemite where railways ran hotels in or near parks at the end of the line, he took interest in Mount Buffalo, knowing it was fed by his railways and that the Railways would benefit from every passenger carried to The Chalet.

Sight unseen, he convinced the government to allow the railways to take the lease over in 1924 from the current lessee, Hilda Samsing. There was no public call for tenders. The Chalet was then run by the Railways Refreshment Service and a major improvement program was promptly undertaken when it was realised what a poor state the Chalet was in. Despite improvements the Chalet rarely recorded a profit and was criticised as an exclusive hideaway for wealthy Victorians and a resort for elderly invalids (Webb & Adams 1998)..

The Recreation Era

It was a response to some of these criticisms that both the Committee of Management and Chalet Management saw the need to offer opportunities to take part in adventure activities on the Plateau. Mount Buffalo was heavily promoted by the Victorian Railways for mountain scenery, horse riding and snow sports.

Guide Alice Manfield had entertained guests on walks since the 1890s through to the 1920s, and horseriding was starting to be established. The Chalet was hiring ice skates for skating on Lake Catani and in 1918 and

Cathedral and Horn Huts were in place for skiers and walkers to be able to access more remote parts of the park (Committee of Management). Fred and Ernie Chalwell were two locals adept at outdoor sports. They were employed at the Chalet to take horse trips across the plateau, and introduce people to winter sports such as ice skating, skiing and tobogganing.

In 1930, Mr. Bert Keown, the Superintendent of the Railways Refreshment Services, was given full responsibility for the development of Mount Buffalo as a snow resort and summer hiking and horse riding paradise (Webb & Adams 1998). He was also railways representative on the Committee of Management

The 1930s were a busy time for the Committee of Management endeavoring to improve facilities for visitors. Huts were upgraded and new tracks were surveyed and built. Lookouts and signage were improved. During the depression 'Susso' gangs were employed to work on roads completing The Horn Road in 1933.

Despite the flurry of activity, minutes of the committee note in 1935 that Government is not sympathetic to making money available for Tourist work. It was noted in 1936 that the rangers salary was 180 pounds per annum. The ranger at the time was Harry Harrison living in a ranger's house at Mackey's Lookout (Chick 1998).

The committee noted on several occasions in the later thirties their concern to keep the Park natural. *'While endeavoring to cater for the public under winter conditions, in providing buildings, etc., the Committee has not lost sight of its desire of not civilising the plateau and would keep to the spirit of rough grandeur by encouraging the walker and tourist rather than making it a paradise for the motorist. Having buildings as far as practicable conform to the natural surroundings and not despoiling the landscape. In keeping it in a state of nature as much as possible tracks rather than roads would be provided'.*

This would appear to reinforce the vision of the Bright Alpine Club forty years earlier, and perhaps these words noted in the minutes were a result of concern over pressure for more development by the Railways. There was a *'desire to have buildings to conform with the rough nature of the country'*. The excellent stone shelters built by the Committee at The Gorge, Campground (1940) and Horn (1938) are today testimony to these sentiments.

This period also brought about a heightened interest in skiing on Mount Buffalo. In the early thirties, the railways department applied to clear some slopes for skiing at 'The Grand Skiing Grounds', Cresta. A tractor hauled skiers to slopes at Lakeslide, Cathedral and Cresta ski runs. Bert Keown, in an attempt to put Buffalo at the forefront of skiing destinations, enlisted Chalet engineers to construct a motorised ski tow at the foot of the Cresta Run. In his enthusiasm, Keown overlooked the need for the approval of the Management Committee. The tow opened in August 1937, and was the first motorised ski lift in Australia. It was extended the following year, but ceased to again operate (Webb & Adams 1998).

The world was now at war and other priorities took precedence. Scarce fuel could hardly be used to run a ski lift, a device for the privileged. Mount Buffalo made short but sweet history.

The war made the forties a difficult time as visitation was down and funds were tight. Bert Keown continued however to press for improved facilities and turned his sights to Dingo Dell. He convinced the management committee to allow him to clear slopes and erect skiers shelters and conveniences. Dingo Dell was opened in 1940 and a lift was installed under the direction of the management committee in 1949, but due to problems was not operational until 1951. The ranger was responsible for the lift's operation under the direction and authority of the management committee.

Chalet employees continued to cut new tracks and improve others. Bert Keown was determined to ensure the Railways maintained presence and influence over Mount Buffalo, despite continued Chalet losses.

In 1948, the park was increased in size to 27280 acres and formally gazetted a national park, rather than a site for a national park as it was previously known.

The post war began a resurgence of interest in skiing and increased competition between Victorian resorts (Peach 1976). From the mid 1940s to 1950s, skiing occupied most of the funds and labour of the committee (Committee of Management). The State Development Committee Report of 1950 recommended improving huts, roads and rail to the mountain and improved facilities at the main ski fields, identifying Cresta as a suitable site for a resort. As a result a new ski lodge was opened in 1954, at Dingo Dell, Keown Lodge. It then announced that future development in the Park should be concentrated on the Cresta Run (Committee of Management), presumably for those seeking more challenging runs, but little happened for ten years.

The Committee of Management attracted criticism for being too slow to embrace development at Mount Buffalo, and incompetent in not seeking professional advice on skifield expansion. It was however only a decade since they made the statement about "not despoiling the landscape". They may in fact have been purposely resisting those that wanted to profit from the potential of the mountain and wanting to avoid a monopoly of the mountain by the Victorian Railways. They may have also recognized the limited and fickle nature of the ski season that was already sending skiers to higher resorts with a more reliable snow cover and the folly of investing scarce funds into such an enterprise. In the Australian Ski Yearbook, an article on skiing at Mount Buffalo argues *'It would take twenty feet of snow to cover boulders on many otherwise excellent slopes, but far from twenty, Buffalo is lucky to get two feet!'*.

The National Parks Authority

In 1956 a National Parks Act was put in place for the management of National Parks, previously administered under the Lands Act. The new Act set up a National Parks Authority (NPA) charged with coordinating the management of parks across the state. Interestingly, an amendment in 1958 provided for areas in parks to be leased to private developers. The committee

however resented NPA personnel encroaching on its territory and it appears they were quite uncooperative. (Webb & Adams 1998).

The lack of knowledge at the time is also apparent by the note in the first Annual Report of the NPA in **1957** that "wombats and wallabies are the only native mammals that are at all commonly seen, but a survey would probably reveal rarer species worthy of special protection" (File). The report also noted that at The Chalet, a staff of 80 or 90 provide accommodation for 184 guests! These high staff levels were probably welcomed by guests, but perhaps part of the reason the Chalet was unprofitable.

It also appears that the lack of proper construction of many tracks and the impact of many horses was starting to show. In 1964, the committee resolved that it was most dissatisfied with the poor and neglected condition of the Park as a whole and unless rapid improvement was made, the Committee will have no option but to resort to drastic action.

Development at Cresta was slowly evident throughout the late fifties, with a proposal put up in 1960 to develop a small chalet there designed for future expansion. It was resolved later that year that this would best be done by private authorities because of the expense (Committee of Management).

Resort development

In 1962 the NPA reported that the ski field facilities at Dingo Dell were poor and there were management problems with instruction and skiers. They also noted that the Cresta skifields were still largely ungroomed despite many years of discussion and effort. The NPA called for private development of the ski slopes, and the management committee were irate (Webb & Adams 1998). They were defensive of their past efforts and resented the NPA interfering. Nevertheless, the NPA proceeded with calling for expressions of interest.

A partnership of businessman Sir Rupert Clarke and former Chalet ski instructor, Ollie Polasek, were successful in being awarded a lease of ten acres at Cresta to develop a resort. The proposed development was to be in three stages.

1/ Accommodation, restaurant and ski lifts;

2/ A public lake and Egg Rock Hotel;

3/ Sub lease for private condominiums.

Tatra Inn was completed in 1964, with a chairlift to service the slopes. The developer, Tatra Development P/L had its frustrations with the bureaucracy. Mr. Polasek said to the Management Committee that 'unless Tatra is excluded from the rules and regulations of the National Parks Authority and the area declared a holiday resort, we have no hope of succeeding and the development will be discontinued' (Management Committee). A two story motel then followed with the Cresta Poma and a T bar.

The VNPA journal attacked the proposal for a lake in June 1967 and accused the NPA of blatant derogation of its duty under the Act if it were to allow the lake. In 1971 approval was given to construct the lake, but a storm erupted in the press in 1972 with a flood of letters to the editor, mostly condemning the idea. The case put by Mr. Polasek was that the lake would be

one of great beauty, and of historic interest. It was also for fire protection and for recreation, including skating, fishing and swimming. (Polasek 1972). Meanwhile in a government report on the development of snow resorts in Victoria by D.G Handley, it was recommended that the expansion of the Tatra lease not proceed.

In 1972, the government put a freeze on further development by Tatra developments while considering changes to their lease. Despite insistence by the developers that they be allowed to continue with developments previously agreed to, the government stood firm. In 1975 the government purchased Tatra Holiday and Ski Resort for $987,000. In regard to the proposed expansion, The Minister, Mr. Borthwick said 'such a development is no longer in keeping with community wishes. It would seriously damage the natural environment' (Webb & Adams 1998).

The birth of the National Parks Service and the end of the Era of the Committee of Management

Meanwhile, the Committee of Management had been continuing to manage Dingo Dell with a new pomalift opened in 1966. They were busy with tracks and facilities and it seems that they had little involvement in the Tatra development. A new National Parks Act was enacted in 1975, and a new National Parks Service (NPS) in place, replacing the old NPA and Committees of Management. Park management was becoming more complex, there were more parks to manage and there was a need to centralise policy and management. In 1975 the Committee of Management was disbanded after nearly 60 years of service to the Park.

The National Parks Service as Resort Managers

The newly formed National Parks Service took over management of the Park. With the resumption of the Tatra Lease, the NPS quickly needed to put a management arrangement in place for Cresta Valley.

The NPS leased the motel, restaurant and ski school to private interests but all the outdoor operations were managed by the NPS. A large workforce was needed, and the NPS presence on the mountain climbed from two rangers to a Park Manager, Ranger-in-Charge, Resort manager, several rangers, mechanics, fitters, carpenters, maintenance crew, accountants administrative officers and all the support crew for the ski season such as ski patrollers, lift operators and fees collectors etc. A work force of up to 60 was employed in the ski season.

Following previous years of indecision, the NPS had a clear direction. In a visionary article for Ski magazine (Ski 1978) the then NPS Director, Mr. John Brookes, was asked where Mount Buffalo would be in ten years, i.e., 1988. He said the emphasis will be on family recreation, providing good skiing facilities at minimum cost to visitors, 50 % lower than other major resorts. Development will be minimal and needs to be regulated to protect the environment for summer. He said there are no plans to increase on mountain accommodation, but there are plans to upgrade day visitor facilities over the next three years. An Entrance Station was opened in 1979 to charge a park entry fee.

The resorts continued to demand most of the attention of park managers. The

complex task of running a ski resort was time and money consuming and the lessee of Tatra Inn was not always totally satisfied with the standard of the outdoor operations, on which they relied for business.

The Tatra Lessee left in 1988. By this time the new Department of Conservation, Forests and Lands had absorbed the NPS and was considering whether it was really its core business to be running the operational aspects of a ski resort.

The busy seasons of the late seventies and early eighties were becoming a memory only. Once where there were 1200 cars and fifty buses on the mountain, a good day now was 300 cars and a dozen buses. Dingo Dell was once known as the best beginner area in the State, and the full carpark on weekends were proof. The larger resorts soon improved road access for buses and their facilities for novice and beginner skiers. Dingo Dell slowly lost the market niche.

The LCC and Final additions to the National Park

In 1980, the Government accepted the recommendations of the Land Conservation Council (LCC), and the Park was extended to include most of the foothill country adjoining the plateau, to the Buckland, Ovens and Buffalo Rivers below. The park was now 31000 hectares and had new issues to deal with, such as the interface with private land in the valleys.

The End of the Railways Era

At the Chalet change was also in the wind. Criticism by government members of V Line management of the Chalet was growing, of its neglect, financial losses and poor service. In 1985 Victour properties, a private company set up by the government, paid one million dollars for the Chalet lease and on taking over started to implemented efficiencies. Its replacement, Victorian Snow Resorts reported improvements in standards and profit by the 1988/89.

Resorts leased to Private Interests

By the early nineties, the Government started to look at more private involvement in what was government business. In 1992, the whole operation at Cresta Valley was leased, but this arrangement lasted only one year. In 1993, the Chalet was privately leased. The Chalet lessee also took over the lease for the skifields at Cresta and Dingo Dell. The Chalet lease provided for lease payments to be offset by capital injection into building improvements. Subsequently the Chalet has been given a substantial facelift, power efficiencies put in place and a room renovation program well underway.

With management improvements and a new interest in nature based ecotourism and heritage style accommodation, tourism awards replaced criticisms.

A challenge still lies in the ski fields. A succession of poor ski seasons and the need for capital injection into an area that at 1500 metres in altitude can be marginal and susceptible to global warming scenarios makes for some serious thinking on its future.

A new focus for Park Management

Resort management had made it difficult for park managers to concentrate their time, effort and funds into total park management. Since 1992 this changed. Staffing levels dropped to the core. The first Management Plan for the park was in place and day to day resort operations were left to private interests, while parks staff still maintained an important business relationship and partnership with the lessee.

All year round visitation had been increasing but many of the facilities were tired and worn out. Environmental and cultural site management had lacked a strategic approach, mainly responding to issues as they came up.

Major capital works programs improved visitor facilities and interpretation around the major visitor sites of The Gorge, The Horn and Dickson's Falls. The entrance area also being upgraded to improve the sense of arrival and provide quality pre visit information. Rangers developed environmental and cultural site management programs and major pest plant programs were put in place. Visitor surveys monitored outcomes.

The Centenary

1998 marks the centenary of the first site for a national park back in 1898 around The Gorge and Eurobin Falls. It is a chance to reflect on 100 years of park management. Over the one hundred years activity at Mount Buffalo has been frenetic, bureaucratic and a reflection of Victorian life in the twentieth century. At the end of the day however to the best of our knowledge the park is in good condition and meets to a high standard the objectives of the National Parks Act.

Traditional park values of care and protection were instilled in the park's management from the start and the respect that people today have for the park has its roots in those traditional values that more recent parks don't have. Potentially damaging activities were controlled and prohibited early in the life of the park. The park now receives 250 000 visitor days per year, but by good planning and perhaps the constraints of the environment, 95% of those visitors only physically visit 5% of the Park. Vast remote and natural areas still exist that receive in many cases fewer visitors than 50 years ago. The main visitor sites are well hardened to accept that visitation and thanks to the foresight of the Committee of Management buildings are generally sympathetic to the outstanding natural landscape.

The one legacy of the past that is apparent and still needs attention is the damage done by horses to tracks during the decades that horses were promoted on the plateau. Limited riding is still permitted and the need for quality and expensive work is ongoing.

Nevertheless, Mount Buffalo is close to the hearts of many Victorians and in a Statewide survey in 1997, Mount Buffalo National Park had the highest level of satisfaction in the community compared to all other major parks in the State. What a wonderful achievement in the build up to the centenary ! The centenary year itself would be the largest promotional event that the park has ever had and an opportunity to raise

community awareness of the importance of national parks and the place that Mount Buffalo has on a world scale in the history of park management.

ALPINE NATIONAL PARK

Grazing

By the 1900s grazing was well established in the mountains. Pioneer graziers came from the Monaro (NSW) as early as the 1830s to settle the country around Omeo, others advanced up the Murray and it's tributaries to graze the Bogong High Plains in the 1850s and the Gippslanders had arrived in the alpine pastures by the 1860s. (Stephenson 1980)

JB Plain near Mt Hotham was named after James Brown, one of two stockmen who reputedly were the first to graze cattle on the High Plains. In search of grass after the great fire of Black Thursday 13 February 1851, Brown and Wells followed routes used by local aborigines and successfully linked Omeo and Cobungra with the North East. Cattle still graze in this country today.

Names of early graziers such as Treasure, Pendergast, Bryce, Fitzgerald, Wallace and McNamara will always be synomonous with the mountains. Stories about the exploits of the cattlemen have become folklore and their bush huts reminders of harder but perhaps more romantic times.

Mining

Gold was first discovered in the Alps in the early 1850s. The boom and bust pattern of mining left sites in the mountains such as Grant, Crooked River, Talbotville, Howqua Hills and Buckland Junction virtual ghost towns by the late 1890s. Grant, in its boom years supported a population of 3000 and had a church, police station, 4 banks, numerous stores, 15 hotels and a newspaper - the Crooked River Chronicle published once a week. It was laid out as a town in 1865 but 10 years later described as a deserted village.

Even though mining in the mountains had declined by the turn of the century, it remained influential because of the tracks established with government funds to enable miners to move with safety between one location and another. (Johnson 1996)

Hospices such as the one at St. Bernard, originally built to cater for the needs of miners travelling between the goldfields of Omeo, Dargo and Harrietville also in later years provided accommodation for skiers and 'adventurers'.

Walking and Skiing

Early recreation in the Alps expanded rapidly from the 1890s onward, reaching a peak in the 1920s and 1930s.

As well as catering for tourism parties at Mount Buffalo, the Bright Alpine Club also promoted trips to Mt Hotham and St. Bernard, Fainters, Mt Bogong and the High Plains.

In the 1930s the first large scale commercial tour parties were organised by the Victorian Railways. 'Skyline Tours', as they were named, offered both horse riding and walking tours, to males only, in the most scenic parts of the Alps.

The influence of the Ski Club of Victoria (SCV) in exploring and promoting the skiing potential of the

high country should also not be underestimated. The members devotion and enthusiasm in pioneering such a new and challenging sport was rewarded with the construction of Cope Hut, the *Menzies of the Plains,* in 1929.

Timber

Before 1939, clearing that occurred in the Alps was for the needs of the miners rather than the logging industry. Needless to say this was quite extensive in many places as huge amounts were required for fuel and shafts.

However the loss of high quality Mountain Ash forests close to Melbourne during the massive 1939 fires led to a search for a new source of timber in the Alps. Sawmills in the new towns of Heyfield and Mansfield were upgraded to handle the larger log volume now required. (Johnson 1996)

The Vision

The intrusion of roads for logging operations into previously untouched mountain country led to concern amongst conservationists about the future of the Alps. It had long been the desire of conservationists to have a national park in the alpine region located along the Great Divide. (Johnson 1996)

Extending beyond Victoria, conservationist, visionary and 'Father of Wilderness', Myles Dunphy proposed a Snowy Indi Primitive Area, straddling the head waters of the Murray River, as far back as 1935.

Victoria did not act on these and other proposals, but NSW did. After years of effort and agitation by Dunphy, in 1943 Kosciusko State Park was set aside by the NSW Government. This area became Kosciusko National Park in 1967.

Whilst Myles Dunphy was drawing attention to the value of wilderness protection, Masie Fawcett was quietly changing nearly a century of entrenched attitudes toward grazing in the high country. By the 1940s the Soil Conservation Board and Forest Commission recognised that the environmental cost of sheep and cattle grazing was high - the quality of water, soil and forests was deteriorating rapidly.

Some of the more elevated and exposed areas, such as Mt Hotham and Mt Bogong were reduced to open gravel beds with occasional grass tussocks scattered about forlornly. (Johnson 1974)

The work of Masie Fawcett, although paramount in the 1940s and 1950s was but a precursor to the volumes and volumes of scientific research that has taken place since into the impacts of grazing alpine Victoria. It is interesting to note that this evidence has been largely disregarded by both Governments and graziers.

The concept of a Victorian Alpine National Park was first put forward in detail in 1949, when a sub-committee of the then Town and Country Planning Association proposed a park of over 500,000 ha in the State's north eastern highlands.

In 1951-52 yet another Parliamentary committee recommended the creation of a National Parks Authority and in reference to the Alpine National Park : *'This should include an area embracing the headwaters of the Macalister, Jamieson, Howqua, King, Rose, Buffalo, Buckland, Ovens, Kiewa,*

Mitta, Murray, Dargo, Wellington and Avon Rivers. The area would reach to the New South Wales border, and the New South Wales Government might be approached to extend the Kosciusko State Park to join the Victorian Alpine Park. The combined areas would provide a magnificent reservation which would rival any park in the world' (Johnson 1996).

Around this time naturalists Phillip Crosbie Morrison and J. Ros Garnet were also exerting public pressure for the need for more national parks as well as a National Parks Authority to manage them.

In September 1952 the Victorian National Parks Association (VNPA) was created to focus the public cry for a National Parks Authority. Crosbie Morrison was President and Ros Garnet, Secretary.

In 1956, after numerous deputations and meetings between the VNPA, other conservationists and the Government of Premier Henry Bolte, the National Parks Act was proclaimed.

The early days of the National Parks Authority were somewhat lean. Crosbie Morrison was appointed as the first Director and started work with only a secretary and a typist. It was a great tragedy when this able and enthusiastic man died in office one year later. He had lived long enough to see his goal achieved but not enough to see its promise fulfilled.

A Promise Unfulfilled

The late fifties and sixties were a difficult time for conservation. By the late 1950s and early 1960s opposition to the practice of clearfelling Alpine Ash coupes and the subsequent problems of erosion and siltation led once again to calls for an Alpine National Park.

The National Parks Act (1956) though precluded any commercial activity in national parks - an unforeseen twist that prevented the dedication of any more parks. The new wave of prosperity meant that the land must not be 'locked up', a use may be found for it in the years to come!

The Government had a real commercial stake in the alpine region. It wanted the water of the Alps, and it wanted no interference with its plans for dams, powerlines and pipelines through the region. It wanted the timber of the Alps, and almost all the Alpine Ash within the State occurred in these mountains. And it almost certainly did not want to upset the cattlemen, already restive over the activities of the Soil Conservation Authority. (Johnson 1996)

So although the region was mostly crown land and suitable for a large national park, the Government was not interested.

But the debate continued. The VNPA and Federation of Victorian Walking Clubs presented a detailed submission for an Alpine National Park to the State Government in 1969. The result of many years of labour, this proposal for a 4000 square kilometre park attempted to avoid any areas zoned as forest reserved as a natural resource.

In 1974, a comprehensive case for an Alpine National Park, extending from Mount Baw Baw to the NSW border was put forward by Dick Johnson in his very successful book, The Alps at the *Crossroads*. It was the culmination of the work and knowledge of many

people that helped convince thousands of Victorians that the Alps are a unified region worthy of protection.

However all these efforts over many years did not succeed in creating a national park in the Victorian Alps. The proposals put forward were generally considered not to be feasible, because some uses and activities in the Alps seen as being important to the State, were not compatible with the concept of a national park. Activities such as timber harvesting, mining, commercial developments associated with the skiing and tourism industry and cattle grazing.

The influence the cattlemen had with the Government was achieved years earlier when they supported reforms to remove sheep from the alpine runs. The ground they lost when Mt Bogong (1955), and Mounts Feathertop, Loch and Hotham (1958) were eliminated from the snow leases was regained in the sympathy they commanded with the politicians. (Johnson 1996)

Alpine Walking Track

During the 1960s recreational walking moved from the domain of the 'eccentric', who were constantly called upon to justify their strange sojourns into the bush. The combination of environmental awareness and concern for personal fitness meant that bushwalking had become an acceptable pastime.

But what a different environment it was for walking, especially in the mountains. The intrusion of logging roads into untouched wilderness such as the Wonnangatta was only just beginning. And recreational four wheel driving was still relatively uncommon.

A glance at a guide to bushwalking in the Victorian Alps published by the Melbourne University Mountaineering Club in 1974, shows how much the recognised routes of the 1990s have changed due to the development of roads and loss of remoteness.

Since the late 1960s the idea of a long distance walking track through the Victorian Alps had been brewing in the minds of members of the Federation of Victorian Walking Clubs and staff of the Forest Commission and Tourism Authority. Developed in the 1970s the Alpine Walking Track succeeded in linking the Victorian high country from Walhalla to Tom Groggin on the NSW border.

The value of this marvellous track was that it traversed country of such wild scenic character and untamed magnificence. To retain for the track the very features which made it wonderful demanded protection of all those lands through which the track passed. The track had turned into a park and the cause was given new impetus. (Johnson 1996)

Land Conservation Council (& Alpine Area Working Group)

In 1973, the Land Conservation Council (LCC), the State Government authority established to recommend to the Government on the use of public land, commenced its investigation of the alpine area.

When the LCC released its proposed recommendations for the alpine area in 1978, it met with considerable opposition from many fronts. The LCC proposals were thought by some to be ahead of their time, by others to be sidestepping the hard decisions of what lands were to be parks and what were

to be forests. The Council proposed an Alpine Reserve, which aimed to minimise the fragmentation of management based on different land tenures administered by various authorities.

The First Alpine Parks

Forced back to the drawing board, the LCC final recommendations in 1979 allocated public land between Government departments in the traditional manner, with the control of the Alpine Resorts of Falls Creek, Hotham and Buller remaining outside the national parks. This situation is different to Kosciuszo National Park where the park encompasses the alpine resorts.

But they also included giant steps forward in recommending a number of significant, but isolated parks - Wonnangatta-Moroka, Bogong and Cobberas-Tingaringy national parks, the Avon Wilderness and Wabonga Plateau State Park.

Public participation on this issue had grossly exceeded that for any other study area with a total of 10,000 submissions. Roughly one third supported the parks and about two thirds opposed them, being mainly commercial interests and single interest groups. (Johnson 1996)

The parks were proclaimed in 1981 after considerable last minute lobbying from the timber industry and the introduction of the concept of 'once only logging'. Surprisingly this 'breakthrough concept' was proposed by the VNPA to see the parks put in place. This practice (of once only 'nuclear bombing') still continues in some sections of the Alpine National Park.

The new parks also necessitated a change to the National Parks Act (1975) to allow for mining, logging, hunting and grazing. It was a high price to pay for protection.

The LCC Special Investigation

The new Labor Government, with one of their election platforms being a contiguous Alpine Park, requested the LCC undertake a special investigation of the alpine area, with a view to extending the park system. It was a difficult exercise as commercial stands of alpine ash were to be excluded from the park whilst some logged country was to be absorbed.

In 1983, the LCC recommended linking and extending the existing parks into a large contiguous, if not strangely contorted, Alpine Park of 600,000 ha. But even though the recommendations were accepted by the Cabinet of the Cain Government, it was still another 6 years, a bi-election and snap general election, before the park was proclaimed.

Nunawading

The timber industry might have been relatively accepting of the recommendations but the cattlemen were far from happy. The Nunawading bi-election (1985) was crucial, as victory for the Liberal opposition in the Legislative Council would mean defeat for the Bill to create an Alpine National Park. The cattlemen rode through the streets of Melbourne and wowed everyone. The bi-election was lost, the Liberals were indebted to the cattlemen and the struggle for an Alpine National Park appeared to be never ending.

Alpine Planning Team

In 1986 Joan Kirner established the Alpine Planning Team to develop management plans for the park. Consultation with both the public, interest groups and relevant agencies was long and arduous as well as two rounds of submissions per plan.

An Alpine Advisory Committee was also brought together to discuss and comment on the issues raised by the draft plans - often resulting in long drawn out debates and compromises to park values, as representatives of like minded groups joined forces.

The community face of opposition to the Alpine National Park was the Public Land Council (PLC), an amalgamation of single interest groups such as the Mountain Cattlemen's Association, Four Wheel Drive Association and Deer Hunting Association.

The Alpine National Park (1989)

During the LCC review into the East Gippsland forests some Liberals, in particular the Shadow Minister for Conservation, Forests and Lands, Marie Tehan, realised the importance of the green vote.

When the Bill to incorporate the East Gippsland forests within the national parks came forward Marie Tehan managed the seemingly impossible and the Liberals passed the bill to the outspoken rage and disbelief of the millers of Orbost. The Liberals now needed to maintain a green profile to save face.

After a snap election and narrow Labor victory in 1988, the new Minister Kay Setches decided the time had finally come to reintroduce the Alpine Bill for the autumn session of 1989.

Eventually, after considerable political jostling, point scoring and haggling on both sides of Parliament the Bill was passed on the 25 May 1989. Last minute negotiations resulted in 7 year grazing licences for the cattlemen.

The Alpine National Park was dedicated by Kay Setches, the Minister for Conservation, Forests and Lands, on the 2 December 1989 on the Snowy Plains.

It was a pleasant day after a particularly stormy night. The 8 Alpine Trekkers arrived safely from Canberra - 30 days and over 700km of walking, bike & horse riding & 4W Driving behind them - the jeering and booing of the PLC in front of them! The reaction of the PLC though went mostly unnoticed.

The achievement of the trekkers symbolised the far greater significance of the Australian Alps national parks and the MOU which had been signed in 1986 by the relevant State Ministers. The MOU agreed to pursue co-operative management and develop complementary policies to protect the scenery, water catchment, plants, animals and cultural heritage of the Alps.

Kay Setches also launched three of the four proposed Alpine National Park Management Plans, the Bogong Unit plan having already been released for comment. These comprehensive, detailed and innovative plans were later passed by Parliament in 1992.

A Decade Later

The Alpine National Park has been in place nearly ten years but still viewed by many as a frontier, if not 'multi use' park. The traditional park values, so strongly reflected in the management of Mt Buffalo are not evident within the Alpine National Park. Several issues highlight the differences...the apparent vastness of the park and the power of economics over conservation.

Park Management Structure

When the Alpine National Park (ANP) was declared the Department of Conservation, Forests and Lands (CFL) operated under a multi functional regional structure. ANP management was spread between 6 regions and at least ten operational areas! Operational Area Supervisors were responsible for not only park management but also the management of commercial forests (hardwood and pine plantations), fire control and suppression, crown land & assets, and flora and fauna. A co-ordinated approach to management of the ANP was exceedingly difficult, if not impossible.

The dysfunctional park management structure established by CFL has been difficult to shake. Only now, nearly 10 years, 4 departments and 1 corporation later will we see the ANP managed as a single entity within one Park Management District with one Chief Ranger to oversee operations.

Another CFL legacy difficult to change has been the lack of resourcing. Even as a new park establishment funds were never allocated. Today one of the highest profile areas of the park, Mt Bogong and the High Plains only attracts a total of $3000 operating budget.

Wilderness

years after Myles Dunphy proposed the Indi Primitive Area, the LCCs recommendations for wilderness zones were passed by Parliament. The ANP contains 5 wilderness areas. It is testament to the continued political influence of the cattlemen (cattle continue to be grazed in some wilderness zones) and single issue lobby groups (the Indi and Cobberas wilderness zones were reduced significantly in size to allow vehicle access to continue in the Davies Plain area) that our wilderness zones do not meet earlier expectations.

Recreation

The growth of four wheel driving and the influence of the lobby group has meant that a significant number of old forestry tracks have remained open once operations have ceased. In addition to the 1500 kilometres of 4WD tracks that need to be maintained it is interesting to note that it is virtually impossible to walk within the park for more than one day without crossing a road open to the public.

The acceptance of deer hunting coupled with an inability to manage the activity has resulted in the loss of another traditional park value. The use of firearms in parks is unacceptable to many but the submissions received during the planning process supporting deer hunting was exceptionally high and could not be ignored.

Horse riding has a long association with the Alps, especially the Bogong High Plains. Numbers of horse riding parties are growing steadily with high social and environmental impacts, especially along the unhardened

walking tracks of the exposed ridges, summits and snow grass plains.

Resorts

The growth of the skiing industry has over the years resulted in a never ending demand for more and more developments on the resort boundaries. Impacts have been both direct (environmental) and indirect (visual, displacement of walkers and cross country skiers). In 1997 285 ha was excised from the Alpine National Park at Falls Creek and added to the resort.

World Heritage

The concept of World Heritage status for the Australian Alps has been around for a long time. Geoff Mosley, a proponent of the need to preserve the Alps, prepared a submission for the VNPA, which was formally accepted by the Victorian Government in 1988.

Unfortunately at this stage, although NSW and the ACT recognise and support the nomination for World Heritage, it appears the Victorian and Federal Governments do not. And so there is, as Dick Johnson so eloquently states, yet again, on the horizon, a further step: the consolidation of the Alpine, Kosciuszko and Namadgi national parks to form one huge upland World Heritage Area covering two states and most of the ACT. And as with the Victorian Alpine park, this goal may be just as hard to achieve, but just as precious in that achievement. (Johnson 1996)

Conclusion

Having explored the differences between the history of Mount Buffalo and Alpine National parks, and the outcome in terms of the values and management of each park today, what can be learnt from history?

Mount Buffalo National Park manifests traditional values in park management. While there were some exploitive uses earlier, much of the history of the park has been devoted to visitor management issues. The Park has always been loved by all. Subsequently, visitor use is well controlled and there are few controversial issues as most see Mount Buffalo as a "Jewel in the Crown". The development of these values are probably due to:

Pre exploitation era: The Park was set aside was well before major resource exploitation and debate started to occur in the Alps earlier this century;

Support of the local community: The Bright Alpine Club had a major role in the initial reservation and hence there was a sense of ownership by that community;

Tourism potential and business support: As business realised the tourism potential and more people visited the Park, it was obvious there would be little support for any activity that might impact on the outstanding values of the area and hence effect tourism. The development of The Chalet and other accommodation houses early this century helped to put a place for Mount Buffalo in the hearts and minds of the community.

Icon Status: The high numbers of visitors, fascination with the Chalet and the parks natural wonders gave the park icon status within the community.

Exposure: Mount Buffalo is easily viewed from the surrounding area and any exploitive activity would be highly visual and hence gain little support.

Traditional park values are not manifested in the Alpine National Park. While Mount Buffalo was being loved and pampered during most of the twentieth century, the Alps was fighting for its life. The multi use and exploitive culture of a frontier still exists. This could be attributed to:

Era of Reservation: By the time a campaign had really started to establish a national park in the Alps exploitive uses were already becoming well established. It was not an era of conservation having power over economics.

Community support: The Alpine National Park concept did not gain the local community support to the extent that Mount Buffalo did. It didn't capture their hearts as it was less known and remote at the turn of the century. Later in the twentieth century many surrounding communities relied heavily on timber harvesting. Non traditional park activities such as off road driving and deer hunting were becoming established recreations, aligning themselves with the culture of the cattleman rather then the conservationist.

Tourism and Business: Tourism was relatively restricted and access was difficult. This constrained business and visitation was limited. Vast areas received few if any visitors for many years.

Vastness and Remoteness: The area was so vast that there was a feeling that there was room for every activity to take place without conflict. Few saw the impact that timber harvesting and road building was having in remote corners of the Alps. The vastness may have in fact worked against the park concept as it was difficult for one person to grasp the nature of the whole area.

By time the government became serious about establishing a Park in the Alps, public policy had moved into a consultative era where there was a perceived need to satisfy all views and desires. Therefore the Alpine National Park today reflects most of the past uses in the Alps and continues to be viewed as a frontier.

What can be learnt from history? Do we accept the unacceptable to achieve the park and fight the battles later or should we hold out for the 'jewel in the crown' that may never be obtainable? This is the question that still haunts the protagonists for the Alpine National Park. It has been asked, what is the logic in clearfelling an ancient tall wet forest only to then add a field of stumps to the park when the chainsaws have stopped, or to have herds of cattle tramping over fragile and unique ecosystems.

The answer is that the forest would have been logged anyway, so at least we can save the next generation of trees, and the community was not ready to accept wholesale eviction of the cattlemen. Grazing exclusions have eventually extended over large areas.

The vision however is still only partly realised.

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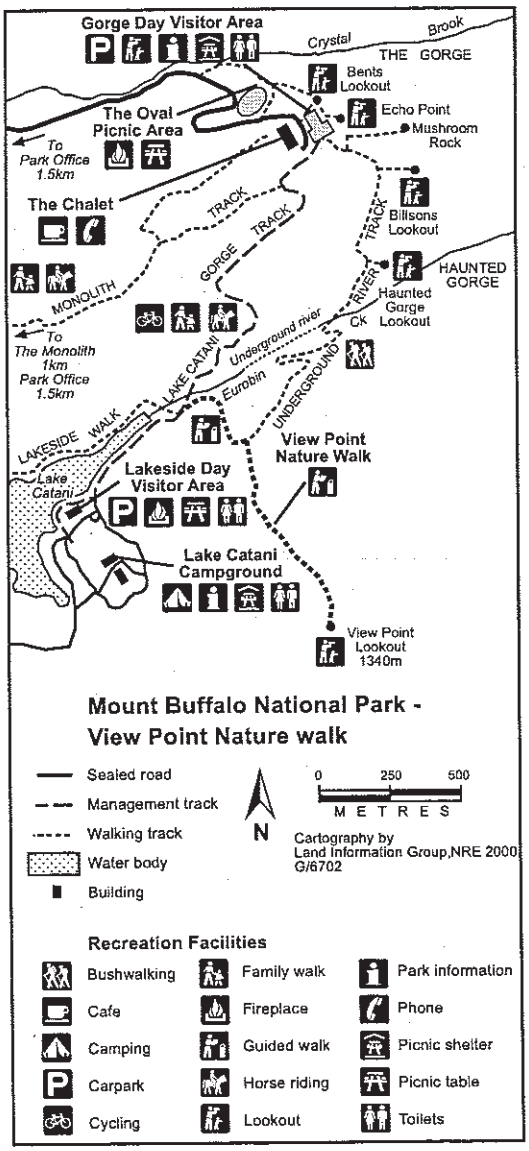
Mount Buffalo National Park

View Point Nature Walk

View Point Nature Walk is designed to familiarise visitors with some of the sub-alpine plant communities found on Mount Buffalo plateau. The nature walk, at an altitude of about 1250m, is a 4km return walk taking approximately an hour and a half to complete. Numbered posts along the track mark the various natural features and correspond with the numbers and information within this guide. The walk concludes at the spectacular View Point Lookout at 1350m.

Start adjacent to the footbridge over Eurobin Creek 200m below the Lake Catani dam wall. It is possible to incorporate the nature walk as part of a longer 2.5hr circuit by continuing along the Underground River Track through to the Gorge Day Visitor Area, then returning via the Gorge - Lake Catani Track.



What is a plant community?

A plant community is simply a group of plants growing together in a common environment. Some of the important factors governing which plants grow in a particular community include rainfall, temperature, wind, soil, steepness, direction of slope, amount of sun and other competing plants in the area.

Not only do all of these factors affect plants but plants also affect most of them!. They alter soil and rainfall patterns and change conditions of light, wind and temperature for other plants. Different types of plants also largely determines what animals may be present.

Kookaburras, Jacky Winters, Magpies and White-naped Honeyeaters prefer Snow Gum forests, where-as Olive Whistlers, Crested Shrike-tits and White's Thrushes favour Alpine Ash forests. Mammals, reptiles and other animals display similar preferences.

When talking about plant communities and their relationship with other organisms, remember that these factors are often quite complex and inter-related.

1. Tea-tree community

The first plant community we'll examine is down in the gully. The most important or dominant plant is the large dark green bush; Mountain Tea-tree *(Leptospermum grandifolium)*. It is only found along streams where there is continuously flowing water.

Mountain Tea-tree - *Leptospermum grandifolium*

The seeds of the tea-tree could fall anywhere but unless they land on a moist creek bank they would probably struggle to grow and may not be able to produce viable seed. Growing under the tea-tree are ferns and mosses which also rely on and are well adapted to growing in wet, shaded conditions.

Parks Victoria Ranger
David Foster

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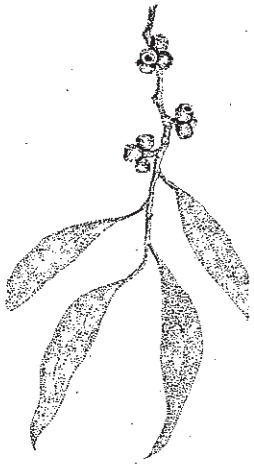
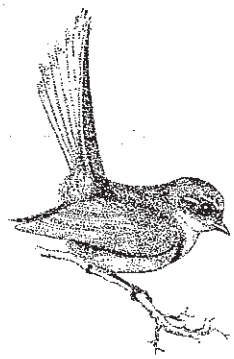


Buffalo Sallee - *Eucalyptus mitchelliana. Illust; Sue Forrester*

Red Wattlebird - *Anthochaera carunculata. Illust; Sue Forrester*



Grey fantail - *Rhipidura fuliginosa. Illust; Sue Forrester*

Alpine Oxylobium - *Oxylobium alpestre. Illust; Sue Forrester*

2. Dry heath community

Above the track is a very rocky granite slope. The plant community growing there is dry heath. By contrast to the previous stop, conditions for the plants to grow here are severe. There is little soil, much exposure to the sun, wind and higher temperatures with limited water available because of the high run-off over the rocks.

The heathy shrubs of the community can only grow in the cracks and crevices of the rock where soil and moisture can collect. Dry heath plants include Violet Kunzea *(Kunzea parvifolia)* with reddish twigs and purple tufted flowers, Lemon Bottlebrush *(Callistemon pallidus)* the flowers having the same name, and Shrubby Platysace *(Platysace lanceolata)* with white umbrella type flowers.

One of the eucalypts found growing on these rocky slopes is Buffalo Sallee *(Eucalyptus mitchelliana)*. Similar in form and habit to the common Snow Gum *(Eucalyptus pauciflora)* but with thinner, shiny leaves and pointed buds. It is very interesting because it is found growing nowhere else in the world but Mount Buffalo!

3. Snow Gum & Mountain Gum Forest

You are now walking through a Snow and Mountain Gum forest. This vegetation type is common at higher altitudes on Mount Buffalo as the trees are able to survive cold winters, when snow can lie on the ground for months.

The Snow Gum is the small multi-stemmed tree that has large, thick leaves with parallel veins. Mountain Gum *(Eucalyptus dalrympleana)* is the tall grey-barked single trunked tree, its long pointed leaves have veins branching from a large central midrib. *(ie' long rib up the leaf centre)*

A forest is generally made up of differing tree and plant layers or storeys. This includes the tree canopy, ie. tree tops, one or two understorey layers and a ground layer. Alpine Oxylobium *(Oxylobium alpestre)* is the most common understorey shrub here. It has oval shaped light green leaves and orange pea flowers. You will also find the spiky Gorse Bitter-pea *(Daviesia ulicifolia)* and the tufted Grass Trigger-plant *(Stylidium graminifolium)*.

Birds can be found in all layers of the forests community. Thornbills and Pardalotes live in the canopy, Red Wattlebirds *(Anthochaera carunculata)* and Grey Fantails *(Rhipidura fuliginosa)* rely on the understorey, while the ground layer is important for the elusive Superb Lyrebirds *(Menura novae-hollandiae)*.

4. Sphagnum Bog

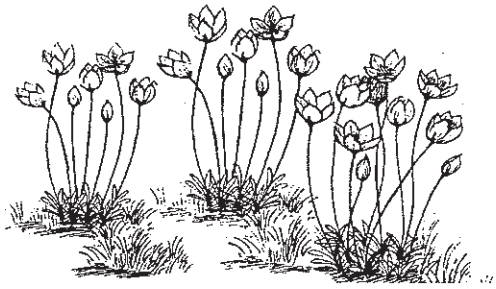
There has been a sudden change in the vegetation. No trees! This situation is caused by water draining into the valley and the soil becoming waterlogged. Oxygen is unable to reach the tree roots causing them to 'drown'.

The low wet area is termed a bog and instead of trees the dominant plant is Sphagnum Moss *(Sphagnum sp.)*. You can see it growing beside the bridge. Sphagnum Moss is different from other moss types, containing many hollow cells that fill up with water during wet winter months.

During summer when there is less rain, the water slowly drains from the moss. In this way the bog acts as a huge sponge to keep mountain streams flowing through-out the year. This is very important in providing permanent clean water for plants, animals and people.

Sphagnum does not collect water for the benefit of organisms. It soaks up and stores water for its own use as it needs abundant water to grow. The moss grows as a hummock shape, growing up out of the water, where it eventually becomes dry enough for other plants to grow.

This is what has happened in this bog area. Spreading Rope Rush *(Empodisma minus)* the dark green plant with thin stems, has grown across the top of the moss. The predominance of rope rush also indicates that this bog is gradually drying out.



Mountain Gentians - *Chionogentias polysperes*

Other plants prefer wet, boggy conditions. These include the common plants near the footbridge, Mountain Heath-myrtle *(Babbingtonia utilis)* and spiky-leaved Candle Heath *(Richea continentis)*. The rich yellow half spheres are Billy Buttons *(Craspedia glauca)*. The dainty, shiny yellow flower is Granite Buttercup *(Ranunculus graniti-cola)* and the cream-white flowers with pale pink centres are Mountain Gentians *(Chionogentias polysperes)*.

As you walk on, note the spongy soil under your feet. It is peat, developed from the accumulation and rotting of bog plants. It is very important to always remain on the track especially near these wet and very fragile Sphagnum Bog areas.

5. Pioneering communities; plant succession

This is a good place to examine how a plant community develops from bare rock, such as granite.

The natural colour of granite at Mount Buffalo is white or yellow. However, most of the rocks have a grey or green lichen covering. Lichen is a combination of an algae and a fungus living in what is called a symbiotic relationship, in which both benefit from each other. The fungus has shape and provides a place for algae to grow. The algae can manufacture food, via photosynthesis, which can be utilised by the fungus. The relationship works so well that it enables the lichen to grow on bare rock.

Typical boulder formation with shrubs and herbs around the base

Soil begins to form around the lichen. Dust is trapped and the lichen produces substances that break down the rock. When enough soil has collected, mosses can then colonise. Mosses are thought to break down and crack the rock with root-like rhizoids, although cracks are largely formed by physical factors such as heat, water and ice.

Dust and other material washed off the rock collects in the cracks. Grasses enlarge cracks by forcing their roots down into them. Tremendous water pressure builds up in the roots to force the rock apart. Shrubs and even trees can also establish in the cracks. Can you see each stage in the succession here? What do you think this area will be like in 50 to 100 years time?

6 Snow Grass community

Down in the valley on your right is a grassy clearing. It was once a bog similar to the one seen earlier but it has now dried out. Growing in place of Sphagnum Moss and Spreading Rope-rush is Snow Grass *(Poa sp.)* which prefers less waterlogged situations than the bog plants.

7. Alpine Ash forest

Alpine Ash (*Eucalyptus delegatensis*) is the major tree in this forest. It has thick stringy bark at the base and smooth white bark on the upper part of the trunk and branches. Because of this it is also called 'Woolly Butt'.

Looking up into the valley, you'll notice that the Alpine Ash is growing in an even-aged stand. There are no old standing trees, though there is an occasional stump or fallen log. These observations suggest that at some stage a 'hot' wildfire burnt through here killing all of the mature trees. These trees have grown since the fire. Mother Shield Ferns (*Polystichum proliferum*) tend to grow in the damp areas amongst the grassy ground cover and indicate a mature Alpine Ash forest.

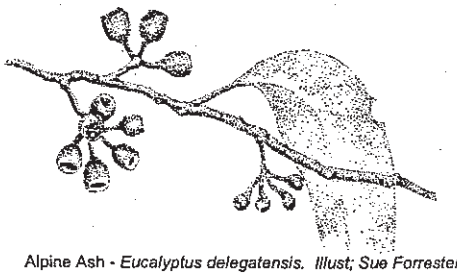
Mother Shield Fern - *Polystichum proliferum*

8. Wildfire and Alpine Ash

The cross section of the log here reveals growth rings. One growth ring corresponds to one years growth of the tree. During winter, cold temperatures inhibit the trees growth with chemicals such as tannins accumulating to form the thin dark line. Warmer temperatures in spring and summer stimulate growth, and the trunk expands producing the wide, light coloured part of the ring.

There are some 50 growth rings on this log, indicating the log and surrounding trees to be about 50 years old. The fire which killed the mature trees was the fierce 1939 bushfires which burnt out much of Mount Buffalo plateau.

Fire is an important ecological factor as many plants rely on occasional fires to stimulate growth and reproduction.



Alpine Ash - *Eucalyptus delegatensis. Illust; Sue Forrester*

The severity and frequency of fire often determines the composition of a plant community. Acacia's such as Alpine Wattle *(Acacia alpina)* are stimulated by fire and respond very quickly en-masse after an area is burnt.

9. Competition between eucalypts

Look back into the forest you have walked through. You'll notice that the Alpine Ash is growing in an almost pure stand. Snow Gums and Mountain Gums could grow very well in the valley, but when the conditions are right Alpine Ash is such a vigorous grower that it out-competes all other trees. The perfect conditions for Alpine Ash are a well drained soil, plenty of rain and some shelter. They also need the cold temperatures produced by at least four weeks snow on the ground to germinate their seed.

On the slope above you some Alpine Ash are growing, but conditions are much less favourable. Soil is scarce and water runoff is high. The trees growing there are small and stunted with some dying as a result of a drought in 1984/85 followed then by a wildfire in 1985.

Mountain Gums can also grow on this hill as they are hardy enough to cope with conditions and do not have significant competition from the Alpine Ash.

10. Viewpoint Lookout; natural and man-made communities

After you have taken in the view, look at the Snow Gum and Alpine Ash forests on the plateau and then look down the mountain slope to the valley. You may notice a change in the vegetation, at least in the colour of the tree canopy. Near the top of the slope the Alpine Ash and Snow Gums grade into peppermint forest.

All of the foliage was burnt on these trees in the 1985 fire, however, the Broad Leaved *(Eucalyptus dives)* and Narrow Leaved Peppermints *(Eucalyptus radiata)* found on these drier slopes have adapted well to fire. New growth sprung from dormant buds on the tree trunks has produced the mantle of thick foliage that you now see.

Down in the Buckland Valley, which you are overlooking, there are some very different plant communities. Apple orchards, tobacco crops, pine plantations and vineyards have been introduced as well as improved pasture for cattle and sheep grazing.

Look back at Lake Catani, another example of changes caused by people. Before the dam that formed the lake was built, the valley was a Snow Grass plain and a Sphagnum Bog. Now it is an aquatic environment.

Retrace your steps back to see and learn more about other interactions with plant and animal communities.

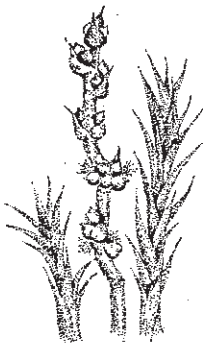
11. A tree and a rock

The close relationship between trees and rocks is well shown by the Mountain Gum wrapped around the granite boulder. When the tree was a young sapling it was blown about by the wind, causing it to rub on the granite.

Scar tissue developed to produce a callus. As the tree grew the trunk expanded and the tree rubbed onto the boulder. More and more scar tissue developed in an attempt to protect the exposed wood until it was eventually surrounding the rock. The tree is still enveloping the boulder today.

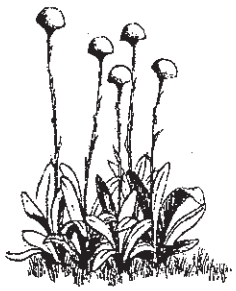
Alpine Wattle - *Acacia Alpina. Illust; John Truscott*

Ringtail Possum – *Pseudocheirus peregrinus. Illust; Sue Forrester*



Candle Heath - *Richea continentis. Illust; Sue Forrester*

Gang-gang Cockatoo - *Callocephalon fimbriatum. Illust; Sue Forrester*



Billy Buttons - *Craspedia glauca. Illust; Sue Forrester*

For further information:

Mount Buffalo National Park

Track information and camping permits:

Entrance Station:
PO Box 72A
Porepunkah, VIC. 3740
Phone: (03) 5756 2328
Fax: (03) 5756 2148

Rangers and Information:

Park Office:
PO Box 72
Porepunkah, VIC. 3740
Phone: (03) 5755 1466
Fax: (03) 5755 1802

Relevant Maps:

Mount Buffalo Plateau
1:30,000 topographic
by Geoff Lawford
Eurobin & Buckland mapsheet
1:25,000 topographic
from Vic Map

Relevant Codes:

Bushwalking Code
Car Camping Code
Bush Camping Code

Useful Guides:

Mount Buffalo Visitors Guide
Alps in Flower Field Guide
Wildlife Watching in Victoria
The Victorian Naturalist – *Mount Buffalo Centenary Edition 1998*

Caring for the Park:

Help look after this park by remembering these points

Take any rubbish home with you

All native plants, animals and landforms are protected

Dogs, cats and other pets are prohibited within the park

Firearms are prohibited

Camping is permitted only in the designated areas

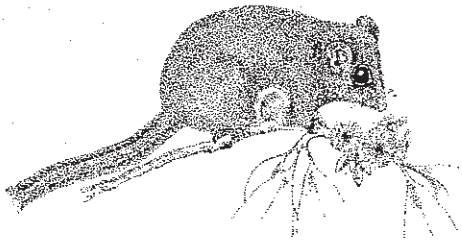
Camp fires are permitted only in fireplaces provided

No fires in the open on Total Fire Ban days

Leave the park as you find it

12. Inter-relationships of plants & animals

The old Mountain Gum stumps to your left are remnants of the 1939 fire. They are a very important part of the forest community, as they provide shelter and nesting sites for a large number of animals including possums, gliders, antechinuses (marsupial mice) bats, owls, frogmouths, kookaburras, parrots, tree-creepers and many insects which the other animals feed on. Without the old trees there would be fewer animals resulting in an unbalanced ecosystem.



Feathertail Glider - *Acrobates pygmaeus. Illust; Sue Forrester*

If one group of organisms were removed from a community, other members of the community could suffer or change. For example, if bats were lost, the number of mosquitoes would increase causing more irritation to other animals, upsetting their feeding patterns

The loss of insectivorous animals such as antechinus and tree-creepers could mean an increase in insects which attack living trees. The holes at the tree base may be shelters for spiders, lizards or Spotted Pardalotes.

Dusky Antechinus - *Antechinus swainsonii. Illust; Sue Forrester*

13. Plant and insect co-existence

The shrub with the large, much divided leaf is Elderberry Panax *(Polyscias sambucifolia)*. During spring and summer, caterpillars build nests on the bush by drawing leaves into a bundle and sticking them together with silk thread. Inside, the caterpillars can feed, safe from predators. Wherever the Elderberry Panax grows the caterpillar is found. The caterpillar does not appear to be found on any other shrubs.

We have found that the caterpillar has adapted to feeding on the Panax, but Panax has also adapted to caterpillars. By the end of January the bushes are nearly devoid of leaves, but by then the caterpillars have ceased feeding and the shrub puts on a burst of growth before flowering.

14. Reacting to an invader

Behind you is a large Mountain Gum with many bulges, the cause of which is not known with any certainty. One theory is that insects penetrated the young tree and injected chemicals into young buds, causing the tree to produce masses of cells in a reaction similar to cancer. Less likely possibilities are that the bulges are caused by virus infections or fungi.

15. 'Dust to Dust' the cycle of life

The inside of this stump has been chewed out by the larvae of borer beetles. The grubs chew through the wood and excrete a fine-particle dark brown material. Examining this material you can see one of the ways in which logs are broken down to form soils.

Fungi and bacteria assist in this breakdown process, returning minerals stored in the wood to the soil . New plants use these minerals, so continuing the cycle of life in the forest.

Discovering more of Mount Buffalo

We hope this walk has helped you to understand a little more about the Mount Buffalo sub-alpine environment. If you have time, why not look at some of the other plant and animal communities in the Park. The aquatic community at Lake Catani and the Snow Grass plains offer a contrast to the communities you have seen here.

The Gorge Heritage Walk is a 1.5km self guided walk which through in-situ plaques brings to life the efforts of the early pioneers in the development of tourism and the declaration of the National Park over 100 years ago.

Numerous lookouts and waterfalls are a feature of this walk as it traverses the rim of the spectacular 1330m Gorge. The walk starts at the top of the carpark in the Gorge Day Visitor Area, opposite Mount Buffalo Chalet.

Dicksons Falls Nature Walk is a 2km one way self guided nature walk with in-situ interpretive plaques. These plaques are designed to help visitors discover the sub-alpine plants and animals which have adapted to the colder conditions found in the higher areas of the plateau.

The walk terminates at Dicksons Falls Lookout with spectacular views off the edge of the plateau into the Buckland Valley and out towards the Australian Alps. Dicksons Falls Nature walk starts opposite the Cresta Valley Ski Fields near Mount Buffalo Lodge.

Silver Snow Daisy - *Celmisia asteliifolia*

While out at that end of the park, take the opportunity to watch the Mount Buffalo audio-visual show which screens on request within the Cresta Valley Day Visitor Centre, adjacent to Mount Buffalo Lodge.

The audio-visual will take you on a journey beginning with the first inhabitants of the area, the sighting of Mount Buffalo by explorers, discovery of gold, subsequent exploration of the plateau, the rise of tourism and the establishment of one of Victoria's first national parks.

Converted for Website January 2000

Note: Extracts from the following book, included in the original field guide, have been omitted from this on line file for copyright reasons:

Webb, D. and Adams, B. 1998. The Mount Buffalo Story: 1898-1998. Melbourne University Press.