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A NOTE ON PRESENT DAY CRYOPEDOLOGICAL PHENOMENA IN NORTHERN NEW SOUTH WALES, AUSTRALIA

Abstract

Frost soil formation was seen to be commonplace above 1400 metres in the Point Lookout area of the New England National Park, New South Wales, during a cold spell in June—July, 1966. The relationship of certain of the cryopedological phenomena to the Australian „gilgai" is discussed. Since the site is located 30°30′ south it is possibly the northernmost occurrence of current cryopedological activity in Australia.

It has recently been suggested that although fossil periglacial phenomena are thought to be present in northern New South Wales current frost action and periglacial activity is now limited to the very highest altitudes on the Snowy Mountains (N.S.W.), the Victorian Alps and Tasmania (Galloway, 1965). It will be shown, however, that frost soil formation, albeit on a small scale, is not uncommon during the winter months in the highest parts of the New England tablelands (N.S.W.) where ground frosts are recorded between March and October.

Little attention has been paid to the recording of soil temperatures in relation to frost soil phenomena in northern New South Wales with the notable exception of Davis and Warner (1963). Their preliminary study of soil temperature measurements, carried out in 1962, was inspired by the possibility that needle ice and minor heaved structures might be formed on the highest summits of the Northern Tablelands (above 1400 metres). Their results demonstrated that although there were frequent surface temperature oscillations around freezing point in the chosen sites around Guyra (Fig. 1) only a handful of frost cycles were recorded within the surface soil and that these produced only slight morphological activity. It was suggested that the chosen winter (1962) was relatively mild (records gave a partial verification of this) but it appears that a more important reason for the apparent lack of needle ice was the small amount of soil moisture present in the selected sites at that time. The joint authors admit that the much higher moisture availability of the eastern scarp of the Northern Tablelands would probably be more conducive

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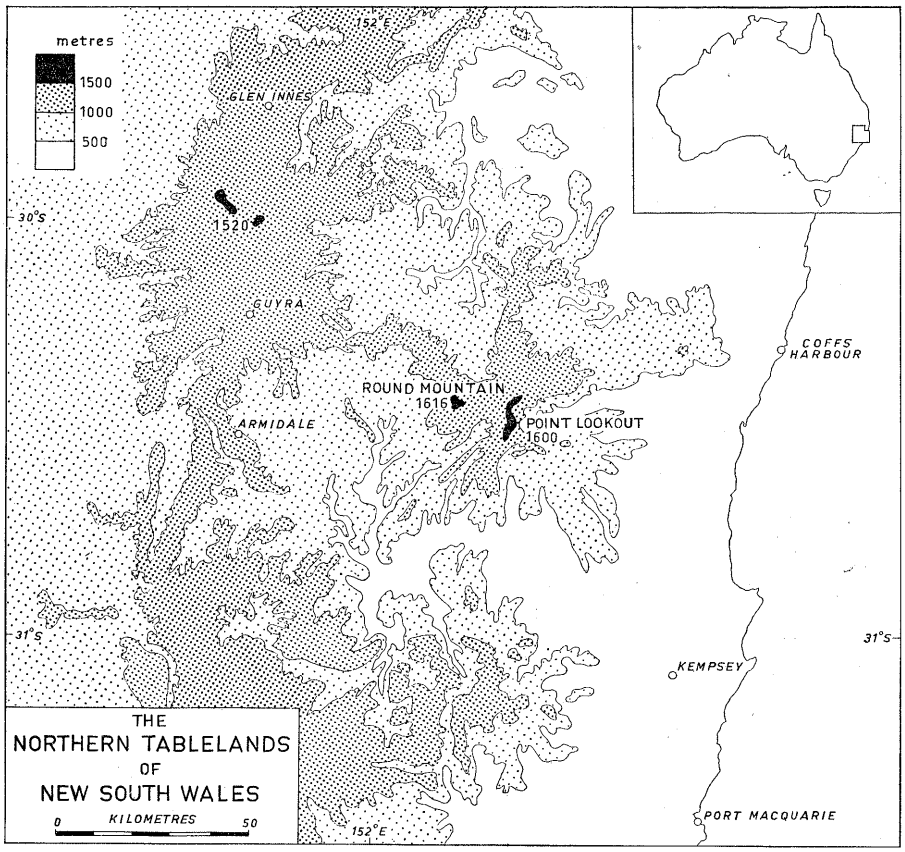

Fig. 1.

to the formation of needle ice and small-scale frost structures. Bearing this in mind the present author made a number of excursions to the New England National Park in the winter of 1966 during a short visit to the University of New England (Armidale).

Some seventy kilometres south east of the Guyra district the scarp edge of the Northern Tablelands rises to the highest summits of northern New South Wales, namely Round Mountain (1616 metres) and Point Lookout (1600 metres). The mean annual precipitation also rises eastwards from a figure of 86 cm. at Guyra to that of 198 cm. at Point Lookout[1] which is only some fifty kilometres from the Pacific Coast.

Both Round Mountain and Point Lookout are covered in natural forests right to their summits although a certain amount of clearing has

[1] Figures relate to the period 1915—1944 for Guyra and 1937—1944 for Point Lookout.

taken place in both localities. Despite Round Mountain being slightly the higher of the two eminences no cryopedological activity has been recorded on its summit which is composed of a deeply weathered basalt cap on a granite dome. This is probably because the summit is thickly carpeted with grass, mainly *Poa* sp. (snow grass), together with a scrub of eucalyptus seedlings, regenerating from the felled trees. The vegetation cover leaves few patches of bare soil in which cryopedological processes could be seen to operate, although it might repay the establishment of soil thermographs for a longterm study. A drawback, however, would be its relative inaccessibility for regular recording. Point Lookout, on the other hand, exhibits larger areas of relatively open grassland, good access roads and several patches of bare earth. It is in this locality that frost soils were seen during the winter of 1966.

The summit area of Point Lookout is composed of Tertiary basalt which weathers typically into Krasnozem soils of generally heavy texture, although alpine humus soil has a limited development here because of the low temperatures and high precipitation (Mc Garity, 1963). The characteristic vegetation cover is a scattered tree layer of *Eucalyptus pauciflora* (snow gum), *Nothofagus moorei* (Antarctic beech) and *Eucalyptus dalrympleana* (broad-leaved ribbon gum) with a dense herb layer of tussock grass (most commonly *Poa* sp.). The flora certainly suggests an approach towards an extreme environment and if one accepts the calculations of Galloway (1965) the present day tree-line may be less than 500 metres above the summit.

Following a series of very low night temperatures in June-July 1966 [2] it was noted that extensive patches of frost-heaved soil had formed on most areas of bare ground above 1400 metres. Pipkrakes were widespread, but were more marked on the south-facing (shaded) slopes (Plate 1). On shaded sections of the path leading to the highest lookout small pipkrakes (1 cm.) were seen although in other localities near the summit cairn needles up to 3 cm. in length were measured. A few examples of multi-layered needle-ice have been reported on several occasions, always on slopes where frost soils were constantly moving down-hill. One example demonstrated that frost had penetrated below the surface to a maximum depth of 15 cm. during the cold spell in question. Small fans of displaced frost soil had formed at the base of all exposed slopes but these were quickly obliterated by a rainstorm which terminated the cold spell in early July. The lowest altitude at which frost disturbance was noted in 1966 occurred near an abandoned timber mill at 1400 metres, where, in a small roadside quarry, a large patch of frost-heaved soil covered the quarry floor.

[2] The lowest air temperature recorded at Point Lookout during this period was −10 °C.

It had the typical „frothy" raised surface which has been likened to *pebble dash* (Derruau, 1962) and may have been an incipient small-scale *champ de boue.*

The most striking of the cryopedological phenomena seen in 1966 was on another area of flat ground at an elevation of 1520 metres near the junction of the roads to Point Lookout and Banksia Point. Here, in the patches of relatively bare ground between the tussock grass, small hummocks of pipkrakes were to be found (Plate 2). Each feature was roughly circular to polygonal in plan and 30—40 cm. in diameter. The distal point of some needles still retained fragments of surface soil when the phenomena were discovered although it was clear that during the earlier stages in their development most of the soil particles had fallen between the pipkrakes. Large soil fragments and small stones lay at the periphery of the needle ice hummocks and it seemed reasonable to conclude that they had been displaced as the frost hummock heaved upwards. There were, however, an insufficient number of stones to form any patterned ground after the disappearance of the hummock. The majority of the needles were up to 4 cm. in length and an interesting characteristic was their slightly curvilinear form. This could be explained if they had developed perpendicular to a surface which had gradually bulged upwards into a dome before collapsing (Fig. 2). The hummocks were much smaller than the typical Australian gilgaies (Hallsworth, Robertson & Gibbons, 1955) although their ground plan was similar to a small-scale gilgai network. Although gilgaies are though to be absent in the tablelands of New South Wales, because of the higher effective rainfall and lower summer temperatures, the striking similarity between gilgaies and patterned ground produced by frost foils has provoked comment (Costin, 1955). The latter author compares the processes involved in the creation of both phenomena: the swelling and shrinking of the subsoil is a result of alternate wetting and drying in one case and of alternate freezing and thawing in the other. It may be significant that the pattern of the frost hummocks at Point Lookout was obviously influenced by the differential growth of vegetation, for this is thought to be a subsidiary factor in gilgai formation. The similarities between desiccation cracking and frost disturbance in northern New South Wales are striking enough to suggest that there may be factors common to both processes.

When one considers that Point Lookout is located 30°30′ south it seems likely that it exhibits the northernmost example of significant cryopedological activity in Australia at the present time. Only one summit in Queensland rises higher than 1400 metres (Mt. Bartle Frere, 1610 me-

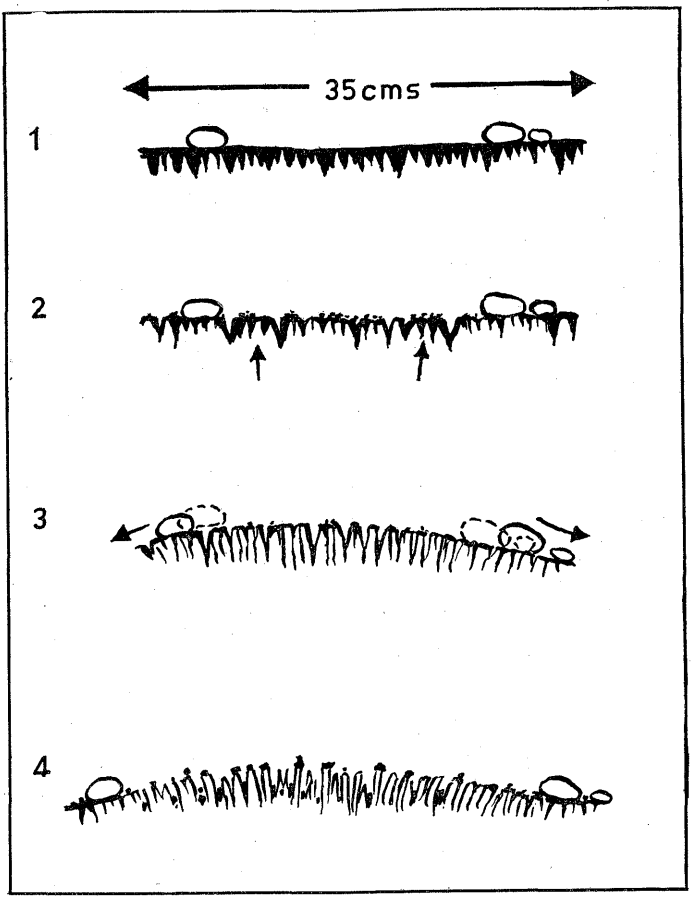

Fig. 2. Postulated stages in the evolution of a pipkrake hummock

tres) and because it is located only 17°30′ from the equator it is unlikely that it will be affected by cryopedological processes. A prolonged study by means of thermograph measurement would appear to be justified at Point Lookout for only then will it be possible to demonstrate the true magnitude of the periglacial activity in this critical area.

ACKNOWLEDGEMENTS

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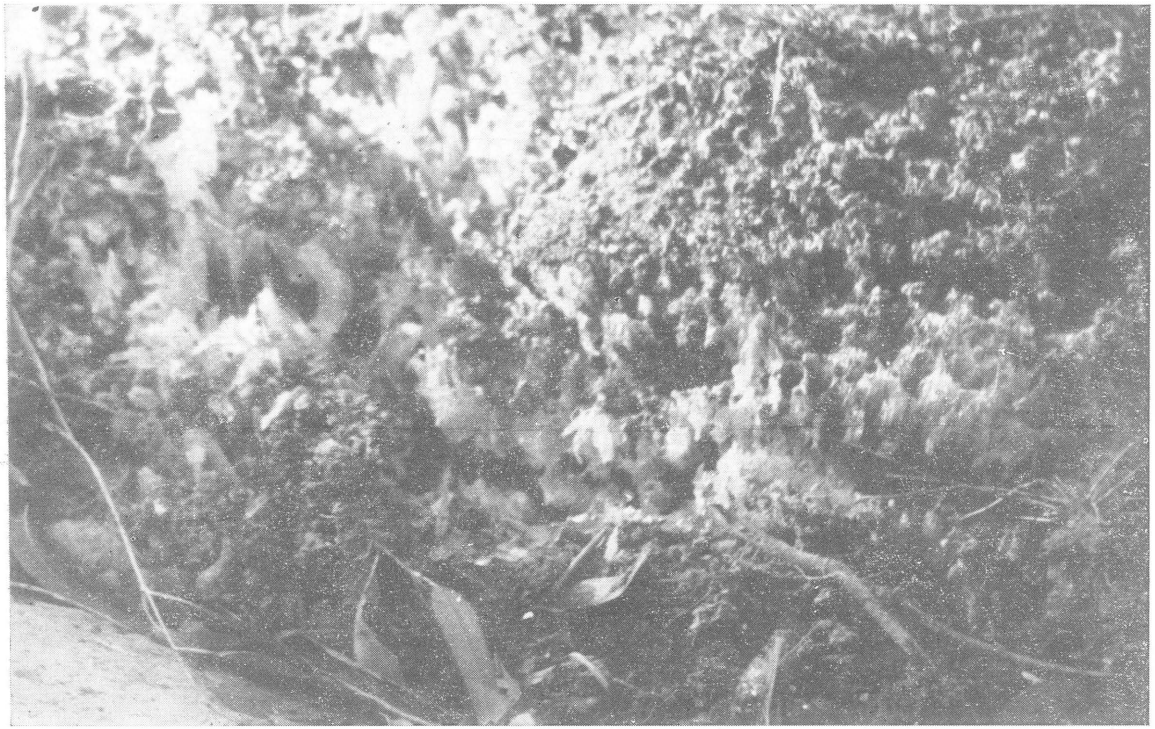

Pl. 1. Pipkrakes on a shaded slope

The needles are 3—4 cm in height and extend underneath the heaved soil in the top right-hand corner of the photograph

Pl. 2. Hummocks of pipkrakes
Note stones lying at periphery and the curved form of the needles