# A RECONNAISSANCE OF THE CORINNA-PIEMAN HEADS AREA, TASMANIA—SOILS

By

K. D. NICOLLS

(C.S.I.R.O., Division of Soils, Hobart)

## ABSTRACT

The climate of the Pieman Heads district is wet and cool enough for formation of acid peat soils (moor podzol peats) in extensive areas of restricted drainage and button grass vegetation. Under timber the soils are better drained and less organic. Morphological descriptions and analytical data are given for the peats. The sand dunes along the coast between the Interview and Lagoon rivers are mostly young and contain appreciable carbonate (shell fragments) but some are old enough to have developed groundwater podzol profiles. The agricultural potentialities of the area are slight.

## INTRODUCTION

In connection with an expedition of Victorian Boy Scouts to Corinna in January, 1954, the soils of the area were examined along the Waratah Highway between Long Plains and Corinna, and along two reconnaissance traverses based on the Scout camp at Rupert Point. The first of these traverses was along "Bulman's Track" from Pieman Heads to the Interview River, with several short side-traverses; and the second from Pieman Heads passing one to two miles to the eastern side of the timber belt between the Pieman and Interview rivers, crossing the Interview river three miles inland and thence to the coast via Bulman's mine workings. The coast itself was traversed between the Interview and Lagoon rivers, where sand dunes extend up to a mile inland. Reference may be made to the map in the accompanying paper on geology by Spry and Ford.

Aerial photographs were used in the field, and for interpretation in the laboratory. Soil samples from two profiles sampled by the normal procedure from pits, and 17 samples collected from auger borings, were examined by routine methods in the laboratory.

The geomorphic units of the Pieman Heads area described in the accompanying paper by Twidale, persist northward beyond the Arthur river. The soils and geomorphology of this coastal belt between the Lagoon and Arthur rivers are the subject of another report (Nicolls 1955). The "peneplain" described therein is a continuation of the "plateau" of Twidale's paper, and its peaty soils are similar to, though rather less organic than, those near Pieman Heads.

## CLIMATE

The following information is extracted from published (1936), and unpublished data of the Hobart Meteorological Bureau.

A station at Pieman Heads recorded rainfall in the years 1918-1940, during which time the average annual total was 53·3 inches . From this and limited other data, it is probable that rainfall on a strip of country two or three miles wide along the coast from the Pieman northward to the Arthur river averages between 35 and 55 inches per annum, with the northern end rather drier than the southern and the coastal fringe considerably drier than the inland side. The ranges which run parallel to the coast six to eight miles inland greatly increase the precipitation so that Balfour eight miles inland and Corinna seven miles inland have annual rainfall averaging 77 inches and 72 inches* respectively. These figures are all from old records, as there are no stations now recording in the area. At Waratah, 27 miles N.E. of Corinna, elevation 2000 feet, rainfall in the standard period 1911 to 1940 averaged 87·1 inches per annum. The monthly distribution of rainfall at Pieman Heads is given in Table I. About three inches of rain falls in each of the five driest months.

TABLE I

*Monthly Distribution of Rainfall at Pieman Heads, Inches.*

(No. of Years: 22)

| | | | |
|---|---|---|---|
| January | 2·89 | July | 5·90 |
| February | 2·87 | August | 6·56 |
| March | 2·95 | September | 5·21 |
| April | 4·65 | October | 4·53 |
| May | 4·94 | November | 3·46 |
| June | 5·94 | December | 3·32 |

Average per year 53·3

Temperature data for the area are meagre but Cape Sorell, on the coast 40 miles south of Pieman Heads has a mean annual temperature of 54°F, with a mean maximum of 65° in February and a

* Figures for rainfall given here are averages for the actual years of record, and in the case of Balfour and Pieman Heads are close to the values corrected to the standard 30 year period 1911-40. For Corinna however, the corrected figure would be approximately 82.

mean minimum of 45° in July. Limited data from Marrawah three miles inland from the coast at a point 50 miles north of Pieman Heads, indicate that this station has about the same summer temperature as Cape Sorell but is about 2° colder in winter. Temperature in the Pieman Heads area is probably intermediate. The area is exposed to the drying effect of the prevailing strong westerly winds but cloudy overcast conditions are general.

## SOILS

(*a*) *General.*—The climate is wet and cool enough for peat formation and on the plateau with its highly siliceous parent materials and drainage restricted by low slopes and by growth of button-grass, (*Gymnoschoenus sphaerocephalus*) most of the soils conform generally to Stephens' (1953) description of the rather varied group of Moor Podzol Peats. Deeper weathering of granite, with growth of timber vegetation, freer internal drainage and greater evapotranspiration lead to less organic soils in the timber belt between the Pieman and Interview rivers. The sand dunes, even where stabilized are mostly young enough to have retained shell fragments despite the severe leaching. The drifting sands are highly calcareous. One stabilized dune however is old enough to have developed a groundwater podzol profile. The terrace remnants between the coastline and the plateau are of small extent along this part of the West Coast, and the soils on them were not examined.

(*b*) *Button-grass Peats.*—Most of the soils of the non-timbered parts of the plateau belong to this group. They are alike in restricted drainage and a surface accumulation of peat, but the lower horizons and depth of the profile vary somewhat with the parent material. The mineral matter is usually fine sandy, coarse sandy or gritty, only a few profiles having much clay though occasionally there is a clay horizon. An organic hardpan, weakly to moderately cemented, is a frequent feature in the deeper profiles, contributing to the restriction of internal drainage.

In general the peaty surface horizon is black or dark brownish-grey, well humified, and about nine inches thick. The horizons below also contain appreciable organic matter and are grey-brown or darker in colour. The cemented organic pan if present is usually at depths between 24 and 36 inches and only a few inches thick, resting upon hard weathering rock, siliceous hardpan, or occasionally clay. In few profiles was it possible to bore with the soil auger deeper than 36 inches. Hardpans apparently cemented by silica were encountered in the gravelly deposits near Pieman Heads and in road cuttings of the Waratah highway six miles from Corinna.

Detailed descriptions of the two profiles sampled from pits are as follows. Profile H 72 differs somewhat from the generalised description above, in that it is shallower and consists entirely of peat over rock.

PROFILE H 71.

On a gently sloping surface of low relief, with restricted drainage. Elevation approximately 350 feet, on plateau alongside track 1¾ miles S.E. of mouth of Interview river (grid co-ordinates E 300800, N 876900). Button-grass dominant vegetation at sample site, with scattered small clumps of eucalypts nearby. Parent material granite, probably with some admixture of sandy marine sediments. Whole profile wet when sampled. Living roots concentrated in top foot but persisting in fair amount to 20 inches.

| Horizon | Depth (inches) | Description |
|---|---|---|
| $A_0$ | 0 | Black, coarse sandy peat, well humified, massive and coherent. Indistinct change to |
| $A_1$ | 6½ | Brownish-black highly organic coarse sandy loam, massive and coherent, with 14% angular quartz grit. Indistinct change to |
| $A_1$ | 11 | As above but lighter coloured and less organic, 2% grit. Fairly sharp change to |
| $A_2$ | 15½ | Very dark brownish-grey slightly organic coarse sand with 6% grit, single grain structure, just coherent. Indistinct change to |
| $A_2$ | 19 | Grey-brown slightly organic coarse sand with 9% grit, single grain structure, loose. Fairly sharp change to |
| B | 26 | Mottled very dark-brown and greyish-brown sandy organic hardpan, massive and coherent, with 6% grit. Sharp boundary to |
| C | 33 | Hard decomposing granite. |

PROFILE H 72.

Beside Waratah Highway and Trig. station on Long Plains, 19 miles by road N.E. of Corinna (grid co-ordinates E 331000 N 890600). On moderate slope just below crest of a long ridge with open vegetation not more than two feet high, predominantly button-grass. Elevation 1400 feet, relief high, external drainage free but internal restricted by rock. Parent material quartzite and phyllite. Whole profile wet when sampled.

| Horizon | Depth (inches) | Description |
|---|---|---|
| $A_0$ | 0 | Very dark grey-brown peat, mainly humified but with coarse root mat. Massive and coherent. Indistinct change to |
| $A_0$ | 6 | Very dark grey-brown well humified peat, massive and coherent, with 1% angular quartz grit. Indistinct change to |
| $A_0$-$_1$ | 12 | As above with 4% grit. Sharp but irregular boundary to |
| C | 17 | Weathered quartzite and phyllite. |

Analytical data for peaty surface samples from several parts of the area are given in Table II, and for profiles H 71 and H 72 in Table III. Analytical procedures are standard ones in use by C.S.I.R.O., Division of Soils, mainly as described by Piper (1942).

TABLE II.

Analytical Data for Surface Samples from Button-Grass Peats.

| Sample | Depth inches | pH | Chloride NaCl % | Loss on ignition % | Organic carbon * C % | Nitrogen N % | C/N ratio * |
|---|---|---|---|---|---|---|---|
| T 626 .. .. | 0–3 | 4.2 | 0.03 | 23 | 10.0 | 0.41 | 24 |
| T 631 .. .. | 0–6 | 4.1 | 0.05 | 72 | 30 | 0.99 | 30 |
| T 635 .. .. | 0–6 | 4.3 | 0.03 | 34 | 14 | 0.65 | 22 |
| T 638 .. .. | 0–3 | 4.4 | 0.01 | 33 | 14 | 0.42 | 33 |
| T 639 .. .. | 0–6 | 4.4 | 0.01 | 27 | 11.5 | 0.45 | 26 |
| T 640 .. .. | 0–6 | 4.3 | 0.04 | 33 | 14 | 0.55 | 26 |
| H 71.1 .. .. | 0–6½ | 4.3 | 0.03 | 38 | 18 | 0.67 | 27 |
| H 72.1 .. .. | 0–6 | 4.2 | 0.02 | 43 | 20 | 0.78 | 26 |

* Walkley-Black values.

All percentages are on the oven dry basis. pH is by glass electrode in 1 : 5 suspension.

These button-grass peats, as elsewhere in Tasmania, are strongly acid, though pH does tend to rise somewhat in the lower horizons. Hydrogen dominates the exchange complex, and levels of exchangeable calcium and magnesium are very low.

The small but measurable amounts of chloride present in these coastal soils are presumably due to cyclic salt. A higher figure of 0·15 per cent was obtained for a surface sample from the forested area of the plateau three miles from the coast, where the soil was fairly dry. Cyclic salt probably accounts too for the relatively high proportion of sodium, and perhaps also for the high proportion of magnesium, among the exchangeable metal cations.

Since the peats contain very little clay (Table III)) the figures for loss on ignition are a measure of organic matter. In common with other peats, the ratio of carbon to nitrogen is wide, averaging 27 for the eight surface samples when calculated from Walkley-Black values. (As W.B. values for organic carbon are lower than those determined by dry combustion, the C/N ratio as usually expressed would be around 35 for these peats.)

In the two typical profiles examined, "total" phosphorus (extracted by boiling HCl) is very low. This and the very small amounts of exchangeable calcium illustrate the infertility of these soils.

(*c*) *Other soils of the plateau.*—In the areas of open vegetation on the plateau there are some soils with much less organic surface horizons. In places this may be due to the burning out of a former peat cover, as the area has been subject to frequent fires both in the time of the aborigines and since, despite its heavy and well distributed rainfall. In other cases drainage may be sufficiently good so that peat does not accumulate. While most of the soils of the plateau are sandy, there are finer textured soils on the more argillaceous sediments in some places, notably about four miles east of the mouth of the Interview river.

In the timber belt two to three miles inland between the Pieman and Interview rivers, the soils have better drainage and one profile examined, a deep loose gritty sand, was almost dry to a depth of 30 inches. There is a fair surface accumulation of forest litter but the soils are generally less organic than those under button-grass.

A distinct profile having much of the character of a krasnozem, was examined under eucalypt forest on one of the long narrow low ridges which mark the basic dykes. This was a deep friable clay with crumb to fine angular blocky structure, brown to reddish-brown near the surface but yellow-brown below 20 inches.

(*d*) *Soils of the Sand Dunes.*—South of the Interview river the coastline is rocky and presumably steeply shelving so that no dunes form to landward of it, but the sandy beach from the Interview river northward has provided sand for dunes extending up to a mile inland. Here and further north beyond Sandy Cape there is evidence of two or more cycles of dune formation and stabilization. The drifting sands are rich in shell fragments, one sample containing 26 per cent by weight of carbonate (expressed as $CaCo_3$). Some dunes, mainly close to the shore, have been stabilized by native grasses and on these there is little profile differentiation. Two surface samples had respectively three and four per cent organic matter in the $A_1$ horizon, with much lower ratios of carbon to nitrogen than in the button-grass peats. Carbonate in various parts of two profiles ranged from five to 23 per cent (as $CaCo_3$) with pH above eight at the surface. In view of the strongly leaching climate, these data indicate that these dunes cannot long have been stabilized. By contrast, one dune

## TABLE III.

### Analytical Data for Two Button-Grass Peat Profiles.

| Sample | Depth inches | pH | Chloride NaCl % | Loss on ignition % | Organic Carbon* C % | Nitrogen N % | Phosphorus P % | Exchangeable cations † m.e. % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Ca | Mg | K | Na | H |
| Profile H 71, near Interview River | | | | | | | | | | | | |
| H 71.1 .. | 0 – 6½ | 4.3 | 0.03 | 38 | 18 | 0.67 | — | — | — | — | — | — |
| H 71.2 .. | 6½–11 | 4.6 | 0.01 | 13.9 | 7.1 | 0.28 | 0.006 | 1.5 | 2.6 | 0.54 | 0.71 | 18.4 |
| H 71.3 .. | 11 –15 | 4.7 | 0.01 | 8.0 | 4.1 | 0.14 | — | — | — | — | — | — |
| H 71.4 .. | 15½–19 | 5.0 | 0.01 | 1.1 | 0.6 | 0.02 | — | — | — | — | — | — |
| H 71.5 .. | 19 –26 | 5.3 | 0.01 | 0.7 | 0.5 | — | 0.002 | 0.21 | 0.33 | 0.04 | 0.06 | 1.2 |
| H 71.6 .. | 26 –33 | 4.7 | 0.01 | 10.2 | 5.2 | 0.13 | — | — | — | — | — | — |
| Profile H 72, Long Plains | | | | | | | | | | | | |
| H 72.1 .. | 0 – 6 | 4.2 | 0.02 | 43 | 20 | 0.78 | — | — | — | — | — | — |
| H 72.2 .. | 6 –12 | 4.2 | 0.01 | 21 | 9.6 | 0.34 | 0.004 | 1.1 | 2. 3 | 0.26 | 0.38 | 29.0 |
| H 72.3 .. | 12 –17 | 4.2 | 0.01 | 20 | 9.8 | 0.30 | — | — | — | — | — | — |

* Walkley-Black values.
† m.e. % = milliequivalents per 100 g. oven dry soil. Exchangeable hydrogen is to pH 7.0.

### Particle-size Analysis of Mineral Matter‡.

| Sample | Coarse sand | | Fine sand | | Silt plus clay |
|---|---|---|---|---|---|
| | 2.0–0.84 mm. % | 0.84–0.19 mm, % | 0.19–0.072 mm. % | 0.072–0.02 mm. % | less than 0.02 mm. % |
| H 72.2 | 6.1 | 36.6 | 34.8 | 12.1 | 10.3 |
| H 71.2 | 21.6 | 50.3 | 22.9 | 5.2 | |
| H 71.5 | 23.0 | 54.8 | 17.7 | 4.5 | |

‡ Expressed as % of total mineral fraction after removal of organic matter with hydrogen peroxide. Separation at 0.02 mm. by decantation, other separations by sieving.

All percentages are on the oven-dry basis. pH is by glass electrode in 1 : 5 suspension.

half a mile from the shore showed a typical groundwater podzol profile, indicating stabilization for a considerably greater period.

The height of one representative dune near the shore was measured as 175 feet. This and the finding of complete shells one inch in diameter on a drifting dune at about 100 feet elevation, testify to the strength of the dune-forming winds.

## POTENTIAL LAND USE

Up to the present time the only agricultural use of the land north of Pieman Heads has been the winter grazing of cattle under the control of the Department of Lands and Surveys. The value of this grazing is doubtful. Even if its soils were more attractive, the isolation of the area would mitigate against agricultural development Only under extreme economic pressure would such development be worth consideration on the plateau with its shallow, poorly drained and strongly acid peaty soils, where very heavy initial dressings of lime would be required to raise pH sufficiently. The soils of the timber belt are probably better but the cost of clearing would be prohibitive. The stabilized sand dunes, and the drifting sands once stabilized, could support sown pastures if suitably fertilized, but would need careful management to avoid over-grazing and renewed movement of sand. Small areas on the terrace between the plateau and the coastline might be suitable for similar development if a future need for it should arise. With many more suitable areas available elsewhere in the State, there appears to be no such need at present.

## ACKNOWLEDGEMENTS

Thanks are due to the Victorian Boy Scouts Association for organization of the camp and assistance with the traverses; and to other members of the Division of Soils, Mr. A. M. Graley and Mrs. E. M. Emms who carried out the laboratory analyses and Mr. A. Skoda who assisted with the field work. Unpublished climatic data were kindly made available by Mr. J. Walpole of the Hobart Meteorological Bureau.

## REFERENCES

———————, 1936.—Commonwealth of Australia, Bureau of Meteorology. Results of Rainfall Observations made in Tasmania. Govt. Printer, Melbourne.

NICOLLS, K. D., 1955.—The soils, geomorphology and climate of an area between the Lagoon and Arthur rivers, West Coast of Tasmania. C.S.I.R.O., Division of Soils, Divisional Report 7/55.

PIPER, C. S., 1942.—Soil and Plant Analysis. The University, Adelaide.

STEPHENS, C. G., 1953.—A Manual of Australian Soils, C.S.I.R.O., Melbourne.