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TECHNICAL REPORT 9/1992

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PROFILE DESCRIPTIONS OF QUATERNARY BASALTIC VOLCANOGENIC SOILS OF THE MOUNT GAMBIER AREA, SOUTHEAST SOUTH AUSTRALIA

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INTRODUCTION

The volcanoes of southeast South Australia form the western extension of the Newer Volcanics province of Victoria, and comprise two distinct groups: a northern Pleistocene group of 15 eruption centres in the Mount Burr range, and a southern Holocene group of two isolated eruption centres at Mounts Gambier and Schank (Fig. 1). All the volcanoes are basaltic and are formed predominantly of explosively-erupted fragmental (pyroclastic) products including ash, lapilli, and scoria; lava is less common and is rarely soil-forming (Irving & Green, 1976; Sheard, 1978; 1983a, b; 1986; 1990). Mounts Gambier and Schank are aged about 4000—5000 years old and are the youngest volcanoes on the Australian mainland (Fig. 2) (Barton & McElhinny, 1980; Barbetti & Sheard, 1981; Blackburn *et al.*, 1982; Sheard, 1990). They were erupted through consolidated calcareous sands of the Bridgewater Formation, and the resultant pyroclastic deposits may contain up to 25% of non-volcanic material, chiefly limestone fragments (Sheard, 1990).

A project to study some of the soils associated with these volcanoes was initially proposed by G. J. Churchman, R. H. Merry, and R. W. Fitzpatrick (CSIRO Division of Soils, Adelaide), and was begun, in August 1991, by the author as a CSIRO Visiting Scientist on sabbatical leave from the University of Waikato, Hamilton, New Zealand. Other scientists involved include M. J. Sheard (Geological Survey of South Australia, Adelaide) and another CSIRO Visiting Scientist, W. H. Hudnall (Louisiana State University, Baton Rouge, U.S.A.).

The project aims to characterise a range of soils developed on these volcanogenic materials, with emphasis on their clay mineralogy and classification. From a global perspective, it is rare to find soils derived from basaltic pyroclastic parent materials forming in a xeric moisture regime with moist, cool winters and warm, dry summers, and a calcareous (alkaline) weathering environment (Mizota & van Reeuwijk, 1989; Parfitt, 1990), and so the influence of these factors on allophane and layer silicate clay formation is of particular interest. The classification of the soils is also of importance because the fourth edition of *Keys to Soil Taxonomy* (Soil Survey Staff, 1990) contains the new soil order of Andisols (Parfitt & Clayden, 1991), a grouping for which many of the soils are likely to qualify.

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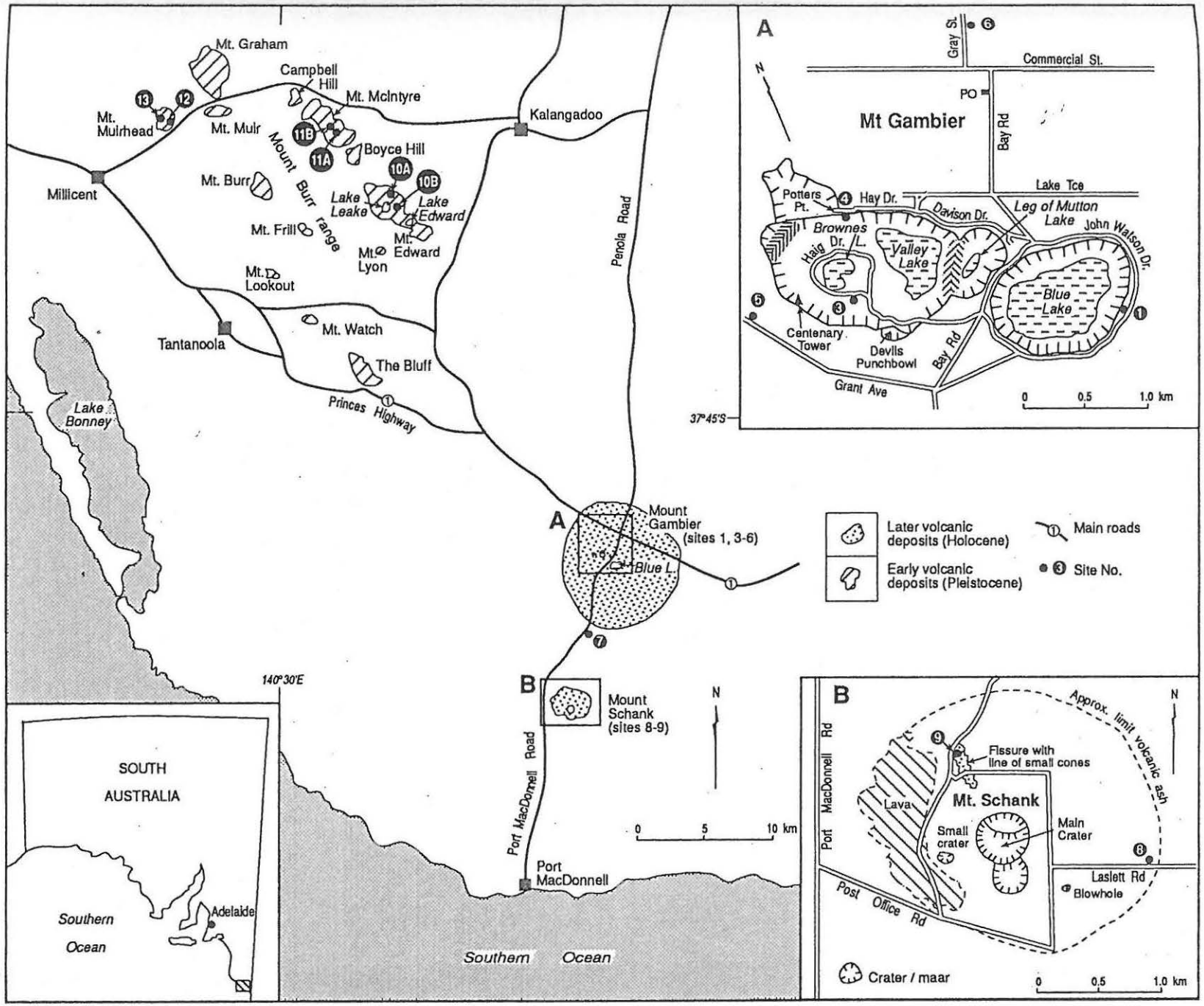

Fig. 1. Volcanic centres of southeast South Australia (after Sheard, 1990) and locations of soil profile sites.

Previous detailed profile descriptions of the volcanic soils in the area are limited (Stace *et al.*, 1968, pp. 132-3) but district surveys and general descriptions include those of Stephens *et al.* (1941), Blackburn (1959; 1983), Hutton *et al.* (1959), and CSIRO (1968). Exploratory mineralogical work on clay fractions from Mount Schank is reported by Wada & Greenland (1970) and Hamblin & Greenland (1972), and chemical and other analyses at various sites are described by Stace & Rogers (1954), Tiller (1957), Clarke (1965), and Hutton (1974).

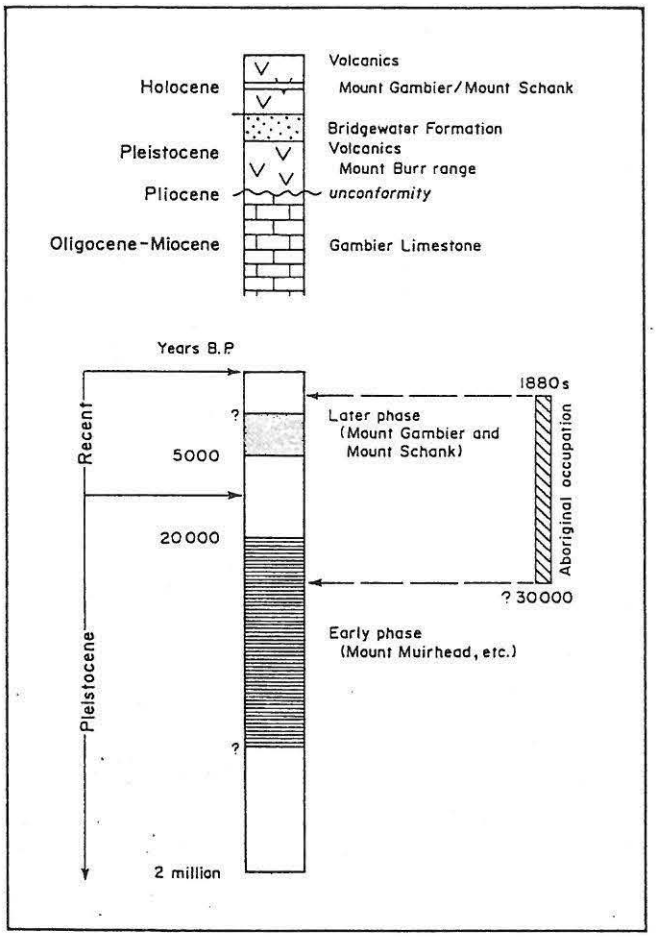

Fig. 2. Generalised stratigraphy and chronology of the early (Pleistocene) and later (Holocene) volcanic groups of southeast South Australia (from Sheard, 1990, p. 42).

We have studied 14 pedons in total: eight at Mount Gambier (6 soils) and Mount Schank (2 soils), and six in the Mount Burr range at Lake Leake (2 soils), Mount McIntyre (2 soils), and Mount Muirhead (2 soils) (Fig. 1). This technical report contains descriptions of the soil profiles including details of site characteristics and provisional classifications to subgroup level in *Soil Taxonomy*. The soil descriptions largely follow Taylor & Pohlen (1979) and provisional horizon nomenclature is based on Soil Survey Staff (1990); colours are from Munsell notation.

A companion report (Lowe *et al.*, 1992) contains detailed chemical analyses, and selected physical and mineralogical properties, of the soils described here.

Pedon 1

PROFILE DESCRIPTIONS

A. Mount Gambier and Mount Schank area

Soil Pedon Site 1 (Rotary Club Lookout)

Location:	Section on W side of John Watson Drive 5 m N of steps to Rotary Club Lookout, Blue Lake (Mt. Gambier)
Grid reference:	54HVD808107 (Gambier SA *7022-2 & Part 7021-1* 1: 50 000 Zone 54H)
Lat.-Long.	37° 51' S, 140° 47' E (approx.)
Parent material:	Basaltic airfall tephra (ash and lapilli tuff beds) erupted from Blue Lake volcano; includes limestone and flint etc. accessory lithics from Mt. Gambier Limestone
Landform:	Approx. 10 m below rim of Blue Lake maar
Vegetation:	Roadside scrub
Elevation:	110 m a.s.l.
Slope/Aspect:	15° facing SE
Rainfall (1*):	Mean annual rainfall (mm): 747 Monthly min.-max. (mm): 12 (Feb), 109 (July) Mean annual raindays: 192
Temp. (2*):	Mean annual temp. (°C): 13.3 Mean daily min.-max for year (°C): 7.7, 19.0
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	?Mollic Vitrixerand§

→ Pachic Calcixeroll (Soil Taxonomy 1999)

Horizon	Depth (cm)	Description
Ap1	0-25	Black (10YR 2/1) moist, very dark greyish brown to dark brown (10YR 3/3 to 3/2) dry, gritty silt loam with sparse gravel; friable; greasy to slightly sticky and slightly plastic; moderately to well developed fine granular structure crushing to crumb; many fine roots; indistinct boundary
Ap2	25-50	very dark brown (10YR 2/2) moist, dark brown (10YR3/3) dry, gritty silt loam with sparse gravel; very friable, very soft; moderately developed crumb structure with some granules; many fine roots; indistinct wavy boundary
A/B	50-60	very dark greyish brown to dark brown (10YR 3/2 to 3/3 moist), gravelly sandy loam; friable to very friable; porous; weakly developed medium crumb structure crushing to fine crumb; some coarse roots; some bioturbation; distinct boundary
Bk1	60-75	dark greyish brown to greyish brown (10YR 4/2 to 5/2) moist, greyish brown (10YR 5/2) dry, gravelly loamy sand (gravel layer at 70-75 cm); very friable, soft; non-sticky, non-plastic; weakly developed fine crumb structure crushing to single grain; very few roots; distinct wavy boundary
Bk2	75-115	greyish brown (10YR 5/2 to 2.5Y 5/2) moist, pale brownish grey (2.5Y 6/2) dry, gravelly sandy loam to loamy sand with stones; firm to dig but friable and soft (porous) in hand; very weakly developed subangular blocky, near massive, structure; some pieces of limestone and basalt up to c. 5 cm in diameter, especially at c. 110 cm depth; distinct irregular boundary

Site 1 contd

Bk3	115-130	greyish brown (2.5Y 5/2 moist) sandy loam to sandy silt loam (silt from carbonate influence?) with gravels; very firm; like sloppy concrete when wet; massive to weakly developed blocky structure; moderately cemented; common thin veins of white secondary $CaCO_3$; few fine red-stained roots; becomes massive and firmer, grading into BCk horizon
BCk	130-160	near dark greyish brown (10YR 4/2 moist) gravelly loamy sand; very firm, difficult to dig cleanly; massive breaking to single grained when disturbed (crumbly); protrudes slightly from profile face; some limestone and basalt pebbles up to c. 10 cm in diameter; distinct boundary
Ck	160-220	approximately dark brown (10YR 4/3 moist) gravelly sand; single grained; weakly bedded ash and lapilli tuff on
Cr	220 on	very firm lithified tuffs (very hard to dig) at road level.

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* Numbers refer to meteorological stations as follows:

Meteorological stations:

1, 026085 Mt. Gambier Caravan Park (Bureau of Meteorology, 1986)
2, 026021 Mt. Gambier Aerodrome (Bureau of Meteorology, 1975)
3, 026020 Mt. Gambier Post Office (Bureau of Meteorology, 1986)
4, 026067 Mt. Schank (Jethia) (Bureau of Meteorology, 1986)
5, 026014 Lake Leake (Yurnga) (Bureau of Meteorology, 1986)
6, 026019 Mt. Burr (Forest Reserve) (Bureau of Meteorology, 1975)
7, 026022 Mt. McIntyre (Bureau of Meteorology, 1986)
8, 026019 Mt. Burr (Forest Reserve) (Bureau of Meteorology, 1986)

† Soil Survey Staff (1990)

§ Alternative new subgroup proposal (provisional) could be Calcic Mollic Vitrixerand (or Calcic Vitrixerand). If fails Andisols, then likely to be Vitrandic Haploxeroll.

Pedon 3

Soil Pedon Site 3 (Brownes Lake)

Location:	Profile at NE end (left) of shallow section (in small quarry) exposed about 5 m back from SE side of road near sharp bend on Haig Drive about 100 m from junction with Davison Drive (Mt. Gambier)
Grid reference:	54HVD788117 (Gambier SA *7022-2 & Part 7021-1* 1: 50 000 Zone 54H)
Lat.-Long.	37° 51' S, 140° 46' E (approx.)
Parent material:	Coarse, bouldery vitric basalt lava spatter from Brownes Lake volcano (cf. fine spatter at Site 4); the basalt spatter represents final stage of magmatic activity
Landform:	On crater floor of Brownes Lake near base of steep cliffs marking southern walls of crater
Vegetation:	Roadside scrub
Elevation:	25 m a.s.l.
Slope/Aspect:	Near flat
Rainfall (1*):	Mean annual rainfall (mm): 747 Monthly min.-max. (mm): 12 (Feb), 109 (July) Mean annual raindays: 192
Temp. (2*):	Mean annual temp. (°C): 13.3 Mean daily min.-max for year (°C): 7.7, 19.0
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	Mollic Vitrixerand§

→ Humic Vitrixerand (Soil Taxonomy 1999)

Horizon	Depth (cm)	Description
Ap1	0-20	Near black (10YR 2/1) moist, very dark brown (10YR 2/2) dry, silt loam with sparse gravel and stones; very friable and soft; moderately developed crumb structure; profuse roots; indistinct boundary
Ap2	20-35	black (10YR 2/1) moist, very dark brown (10YR 2/2) dry, slightly gritty silt loam with gravel, becoming gravelly and stony towards base; very friable, very soft matrix; moderately developed crumb structure; many roots; distinct wavy boundary
B/A	35-45	very dark brown (10YR 2/2) moist, dark brown (10YR 3/3) dry, with sparse yellowish red (5YR 4/8 moist, 5YR 5/8 dry) mottles, sandy silt loam with gravel; slightly firm in place but friable in hand; some roots; distinct boundary
Bw1	45-60	near brown (7.5YR 5/4) moist, brown (10YR 5/3) dry, with a few yellowish red (5YR 4/8 moist, 5YR 5/8 dry) mottles 3-4 mm across (pieces of weathered basalt?), gritty clay loam with gravel; friable; slightly sticky and slightly plastic; weakly developed blocky structure; few roots; distinct boundary
Bw2	60-80	brown to dark brown (7.5YR 5/4 to 4/4 moist with pinkish tinge) slightly gritty sandy loam (nearly makes sandy clay loam); firmer in place than Bw1 but crumbles easily in hand; slightly brittle; weakly developed subangular blocky structure; few roots; sharp irregular boundary
Bsm	80-82	strongly cemented Fe pan 1-2 cm thick comprising 2-3 mm dark brown to dark reddish brown (7.5YR 3/2 to 5YR 3/3 moist) cemented sand on 5-6 mm dark brown (10YR 4/4 moist) cemented sand on strong brown (7.5YR 5/8 moist) cemented coarse sand and fine gravel particles; distinct irregular boundary

Site 3 contd

Ck	82 on	mainly black, gravelly, stony, and bouldery vitric, vesicular basalt spatter with white coatings of $CaCO_3$ under clasts; some friable brownish Bw material fills interstices of upper few cm of basalt.

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* See footnotes p. 5

† Soil Survey Staff (1990)

§ Alternative possibility is new subgroup (provisional) ?Paralithic Vitrixerand (takes shallowness of profile into account). If fails Andisols, then likely to be Andic Xerochrept or Vitrandic Xerochrept.

Pedon 4

Soil Pedon Site 4 (Potters Point)

Location:	Section on S side of Hay Drive c. 50 m downhill from loop (turning circle) road around reservoir at crest of Potters Point hill overlooking Valley Lake (Mt. Gambier)
Grid reference:	54HVD790123 (Gambier SA *7022-2 & Part 7021-1* 1: 50 000 Zone 54H)
Lat.-Long.	37° 50' S, 140° 46' E (approx.)
Parent material:	(1) 0—65 cm on fine basaltic lava spatter erupted from Brownes Lake volcano; (2) 65—205 cm on basaltic airfall tephra probably derived from Valley Lake volcano; includes accretionary lapilli (chalazoidites), limestone, and lherzolite etc. accessory lithics
Landform:	Approx. 10 m below rim of Valley Lake maar
Vegetation:	Roadside scrub and large trees
Elevation:	120 m a.s.l.
Slope/Aspect:	3° facing N
Rainfall (1*):	Mean annual rainfall (mm): 747 Monthly min.-max. (mm): 12 (Feb), 109 (July) Mean annual raindays: 192
Temp. (2*):	Mean annual temp. (°C): 13.3 Mean daily min.-max for year (°C): 7.7, 19.0
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	Vitric Haploxerand§ Calcic Haploxerand (Soil Taxonomy 1999)

Horizon	Depth (cm)	Description
Ap1	0-20	Black to very dark brown (10YR 2/1 to 2/2) moist, very dark greyish brown (10YR 3/2) dry, silt loam; very friable and soft; non-sticky and non-plastic; well developed fine granular and crumb structure, crushing easily to fine crumbs; profuse fine roots; distinct boundary
Ap2	20-45	very dark brown (10YR 2/2) moist, very dark grey (10YR 3/1) dry, fine gritty silt loam; very friable to loose (moist), very soft; non-sticky and non-plastic; well developed fine crumb structure with some slightly firm fine granules crushing readily to fine crumb; many fine roots; distinct wavy boundary
Ap3 (?AB)	45-65	very dark brown (10YR 2/2 with a slightly more reddish hue than Ap2) moist, very dark greyish brown (10YR 3/2) dry, gravelly and stony sandy loam (near loamy sand); very friable; moderately developed medium crumb structure crushing readily to fine crumb; some coarse (1-2 cm) porous subangular blocky peds; knobbly and angular pieces of weakly weathered vesicular basalt (yellowish brown 10YR 5/4 exterior, black interior) up to 5-6 cm across, increasing towards base; few medium roots; indistinct irregular boundary
(2)Bk1	65-85	very dark greyish brown to dark brown (10YR 3/2 to 3/3) moist, greyish brown (10YR 5/2) dry, medium loamy sand with gravel; friable, soft; moderately to weakly developed subangular (porous) blocky structure that readily crushes to single grain; very few roots; distinct wavy boundary

Site 4 contd

(2)Bk2	85-100	dark brown (10YR 3/3) moist, grey to greyish brown (10YR 5/1 to 5/2) dry, gravelly sandy loam with gravel increasing towards base (marked by pea-size accretionary lapilli layer plus lherzolite pebble); friable and soft, but firmer in place than horizon above; weakly developed subangular blocky to blocky structure (near massive) crushing to single grain; few red-stained roots; distinct wavy boundary
(2)Bk3	100-125	greyish brown (2.5Y 5/2 moist) coarse loamy sand with gravel; firm in place; massive to weakly developed porous blocky structure crushing to single grains; very fine threads of calcium carbonate throughout; some bryozoan fragments (part of erupted tephra material); a few medium roots; grades into (2)Bk4 subhorizon
(2)Bk4	125-150	as for (2)Bk3 but with more $CaCO_3$ threads increasing towards base; indistinct boundary
(2)Ck1	150-175	greyish brown (2.5Y 5/2 moist) coarse sand with gravel; massive; marked $CaCO_3$ threads (maximum abundance); distinct boundary
(2)Ck2	175-205	near greyish brown (2.5Y 5/2 moist) gravelly sand with stones (coarse lapilli); firm to dig; $CaCO_3$ veins and flecks throughout.

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* See footnotes p. 5

† Soil Survey Staff (1990)

§ Alternative new subgroup proposal (provisional) could be Calcic Vitric Haploxerand.

Pedon 5

Soil Pedon Site 5 (Grant Ave)

Location:	Section on NE side of Grant Ave (West) c. 450 m SE from junction with Benara Road (Mt. Gambier)
Grid reference:	54HVD781116 (Gambier SA *7022-2 & Part 7021-1* 1: 50 000 Zone 54H)
Lat.-Long.	37° 51' S, 140° 45' E (approx.)
Parent material:	Basaltic airfall tephra (coarse lapilli and ash tuff beds) erupted from Brownes Lake volcano (coarse, lapilli-rich upwind deposits); includes some limestone etc. accessory lithics
Landform:	On lower slopes of Brownes Lake volcano; the site is overlooked by the highest point of Brownes Lake volcano at 189 m (Centenary Tower, Mt. Gambier) c. 450 m to the east
Vegetation:	Roadside scrub
Elevation:	60 m a.s.l.
Slope/Aspect:	10° facing SW
Rainfall (1*):	Mean annual rainfall (mm): 747 Monthly min.-max. (mm): 12 (Feb), 109 (July) Mean annual raindays: 192
Temp. (2*):	Mean annual temp. (°C): 13.3 Mean daily min.-max for year (°C): 7.7, 19.0
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	Vitric Haploxerand§ Calcic Haploxerand (Soil Taxonomy 1999).

Horizon	Depth (cm)	Description
Ap1	0-22	Very dark brown (10YR 2/2) moist, dark greyish brown to very dark greyish brown (10YR 4/2 to 3/2) dry, gritty silt loam with gravel; very friable; non-sticky, non-plastic; moderately to well developed fine granular and crumb structure crushing readily to fine crumb; many fine roots; distinct, near-sharp boundary
Ap2	22-40	near very dark brown (10YR 2/2 with slight reddish tinge) moist, dark greyish brown to very dark greyish brown (10YR 4/2 to 3/2) dry, gritty silt loam with gravel; very friable and very soft in hand, slightly firm in place; non-sticky and non-plastic but 'spongy' wet; moderately developed medium and coarse crumb structure crushing very easily to fine crumb; some fine and medium roots; distinct wavy boundary
A/B	40-50	dark brown (7.5YR 3/2 moist) very gravelly sandy loam (near loamy sand) with stones up to 5-6 cm in diameter; very soft and very friable matrix; weakly to moderately developed medium and fine crumb structure; distinct wavy boundary
Bw1	50-70	yellowish brown (10YR 3/4 to 4/4) moist, dark yellowish brown (10YR 4/4) dry, very gravelly loamy sand/sandy loam; friable, softish matrix; non-sticky, non-plastic; weakly developed crumb structure; many clasts of vesicular basalt; distinct sharp boundary
Bw2	70-100	dark brown to dark greyish brown (10YR 4/3 to 4/2 moist) coarse loamy sand with gravel; friable; very weakly developed porous subangular blocky structure crushing to single grain; distinct boundary

Site 5 contd

Bk	100-120	greyish brown to brown (10YR 5/2 to 5/3 moist) slightly gravelly loamy sand; gravel and stones increase from 110 to 120 cm; soft in hand, slightly firm in place; very weakly developed blocky structure otherwise single grained; small white specks of $CaCO_3$ throughout; distinct wavy boundary
BCk1	120-150	greyish brown (10YR 5/2 moist) loamy sand with sparse gravel; soft in hand, slightly firm to dig; massive to weakly developed porous blocky structure, crushing to single grain; distinct boundary
BCk2	150-170	near dark brown (10YR 4/3 moist) coarse sand (near coarse loamy sand) with sparse gravel; softish; some small white specks ($CaCO_3$); single grained; distinct wavy boundary
Ckm (?Cdk)	170-190	near dark greyish brown (10YR 4/2 moist) sandy tuff strongly cemented with $CaCO_3$; very firm, very hard to dig; massive, breaking to blocks that are very hard to crush between thumb and forefinger.

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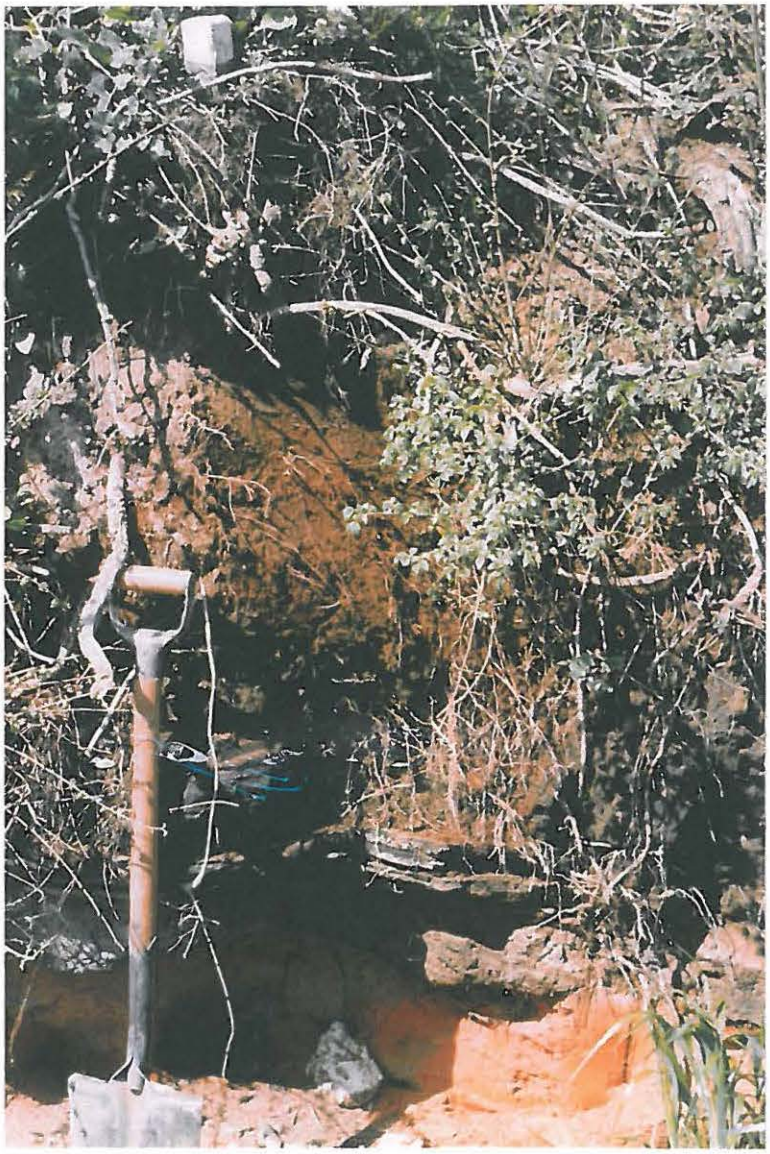
* See footnotes p. 5

† Soil Survey Staff (1990)

§ Alternative new subgroup proposal (provisional) could be Calcic Vitric Haploxerand.



Pedon 6

Soil Pedon Site 6 (Gray St)

Location:	Section exposed at front boundary of undeveloped property (NW corner by boundary peg) on E side of Gray St about 200 m N from junction with Commercial Street West in Mt. Gambier town. Site is about 2 km N of centre of Valley Lake volcano. (Note: Property previously had house, subsequently demolished, on it; main part of site was bulldozed, but profile horizonation appears normal.)
Grid reference:	54HVD805133 (Gambier SA *7022-2 & Part 7021-1* 1: 50 000 Zone 54H)
Lat.-Long.	37° 50' S, 140° 47' E (approx.)
Parent material:	Basaltic airfall tephra (ash and lapilli tuff beds with some limestone etc. accessory lithics) erupted from ?Valley Lake or Blue Lake volcanoes overlying siliceous aeolian sand of the Bridgewater Formation (cf. calcareous sands)
Landform:	Near crest of flat-topped rise on old dune ridge system buried by 1.4 m of basaltic tuff
Vegetation:	Overgrown (*Pelargonium* sp.) garden (previously elms along frontage)
Elevation:	55 m a.s.l.
Slope/Aspect:	Near flat (1-2° W)
Rainfall (3*):	Mean annual rainfall (mm): 775 Monthly min.-max. (mm): 29 (Feb), 107 (July) Mean annual raindays: 162
Temp. (2*):	Mean annual temp. (°C): 13.3 Mean daily min.-max for year (°C): 7.7, 19.0
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	Mollic Vitrixerand§

Humic Vitrixerand (Gail Taylor 1999)

Horizon	Depth (cm)	Description
Ap	0-30	Very dark brown (10YR 2/2) moist, dark greyish brown (10YR 4/2) dry, silt loam; loose to very friable and very soft; very well developed fine granular and crumb structure; profuse roots; indistinct boundary
Bw1	30-45	dark yellowish brown (10YR 3/4) moist, yellowish brown (10YR 5/4) dry, silt loam; very friable, very soft; moderately developed porous subangular blocks and crumb structure; many fine roots; distinct boundary
Bw2	45-80	dark yellowish brown to strong brown (10YR 4/4 to 7.5YR 4/4) moist, yellowish brown (10YR 5/4) dry, fine sandy loam; friable; moderately developed (porous) subangular blocks crushing to crumb structure; some fine roots; distinct boundary
BC	80-95	near very dark greyish brown (2.5Y 3/2 moist) gravelly loamy sand; massive crushing to single grain; distinct boundary
Cr	95-140	dark greyish brown (10YR 4/2 moist) lithified basaltic ash and lapilli tuff beds; sharp boundary
2C	140-170	yellowish red (5YR5/8 moist) coarse sand; loose; single grain (structureless).

* See footnotes p. 5

† Soil Survey Staff (1990)

§ Just makes Vitrixerands (if Haploxerands would be Vitric Haploxerand)

Pedon 7 .

Soil Pedon Site 7 (Louden Hill Quarry)

Location:	Section exposed at S end of a small industrial limestone quarry (now used as rubbish dump) c. 50 m W of Louden Hill Road and c. 200 m S of junction of Port and Louden Hill Roads (between Louden Hill and Bucks Hill to the west of O B Flat). The site is c. 5 km S of the Mt. Gambier volcanic complex, c. 6 km NE of Mt. Schank.
Grid reference:	54HVD783064 (Gambier SA *7022-2 & Part 7021-1* 1: 50 000 Zone 54H)
Lat.-Long.	37° 53' S, 140° 45' E (approx.)
Parent material:	(1) Weathered basaltic airfall tephra (ash and lapilli tuff beds) erupted from either Mt. Gambier or Mt. Schank overlying (2) aeolian sand (Bridgewater Formation); the latter contains large "boulders" of Mt. Gambier Limestone in places
Landform:	On gentle lower slopes of old dune ridge system buried by c. 0.6 m of weathered basaltic tuff
Vegetation:	Pasture grasses
Elevation:	35 m a.s.l.
Slope/Aspect:	About 3° facing N
Rainfall (1*):	Mean annual rainfall (mm): 747 Monthly min.-max. (mm): 12 (Feb), 109 (July) Mean annual raindays: 192
Temp. (2*):	Mean annual temp. (°C): 13.3 Mean daily min.-max for year (°C): 7.7, 19.0
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	Mollic Vitrixerand or Argixerollic Vitrixerand§ → Alfic Humic Vitrixerand (Soil Taxonomy 1999)

Horizon	Depth (cm)	Description
Ap	0-20	Very dark brown (10YR 2/2) moist, dark greyish brown (10YR 4/2) dry, silt loam; friable, becoming slightly firmer towards base; non-sticky, non-plastic; very well developed fine granular structure with some crumb; few charcoal fragments; many roots; distinct slightly wavy boundary
A/B	20-30	mixed very dark brown (10YR 2/2) and dark brown (7.5YR 4/4) moist, mainly dark brown (10YR 4/3) dry, silt loam; friable (more so than Ap) with a few very firm yellowish brown (Bw) "peds" (probably small pieces of weathered ash tuff — hard to crush); non-sticky, non-plastic; well developed medium granular structure breaking to fine granular structure and some yellowish brown medium crumb; bioturbated (worm mixed?); diffuse wavy boundary
Bw1	30-50	between dark yellowish brown (10YR 4/4) and dark brown (7.5YR 4/4) moist, pale brown to pale yellowish brown (10YR 6/3 to 6/4) dry, fine sandy loam; very friable and soft; non-sticky, non-plastic; moderately developed very coarse (porous) subangular blocks crushing readily to fine crumb; some very firm lumps, about 1 cm or more across, of dark greyish brown (2.5Y 4/2 moist) lithified ash tuff material, especially at lower boundary; some charcoal fragments and worm casts; some roots; distinct wavy boundary

Site 7 contd

Bw2	50-60	dark yellowish brown (10YR 4/4 to 3/4 moist) medium-coarse sandy loam with gravel and abundant knobbly lumps of lithified ash (mainly) and fine lapilli tuff up to 6-7 cm across; matrix very soft and friable; lumps of tuff, dark yellowish brown (10YR 3/4 moist) to very dark greyish brown (near 2.5Y 3/2 moist) where less weathered, are very firm (require some force to break apart, or a blow from knife); moderately developed fine (porous) blocky to subangular blocky structure crushing easily to fine blocks; a few roots; distinct wavy boundary
2Ab	60-75	near dark brown (10YR 3/3) moist, greyish brown (2.5Y 5/2) dry (speckled) coarse loamy sand; friable; weakly developed blocky structure to massive, crushing to single grain; some charcoal fragments; few small lumps of (?)tuff mixed from Bw2 horizon above; some charcoal fragments; blotchy diffuse boundary
2Eb	75-95	greyish brown (10YR 5/2 in upper part, 2.5Y 5/2 in lower part) moist, very pale brown (10YR 7/3) dry, sand; very friable to loose; single grained; indistinct irregular boundary
2E/Btb & 2Btb	95-120	pale yellow (2.5Y 7/4) moist, pale yellow (2.5Y 8/4) dry, sand with strong brown (7.5YR 5/6 moist) firm to hard, rounded sandy clasts/nodules with (?)clay bridges ('B-balls') 1-2 cm across; few charcoal fragments; some worm channels [2E/Btb]; grades horizontally to yellowish brown (10YR 5/6 to 5/8 moist) (clayey) sandy loam/sandy clay loam; plastic [2Btb]; grades horizontally (beyond profile slice described) to large clasts (boulder size) of bryozoan-rich Mt. Gambier Limestone; indistinct irregular boundary (at 1.20 to 1.35 m depth)
2C	120-150	yellow (10YR 7/6 to 2.5Y 7/6 moist) weakly bedded sand.

* See footnotes p. 5
† Soil Survey Staff (1990)
§ Argixerollic Vitrixerand if argillic horizon confirmed.

Pedon 8

Soil Pedon Site 8 (Laslett Road)

Location:	Section in shallow cutting on N side of Laslett Road about 800 m E of junction with "Mt. Schank" road [around Mt. Schank] and about 1200 m E of main crater of Mt. Schank volcano
Grid reference:	54HVD779004 (Schank SA *7022-3 & Part 7021-4* 1: 50 000 Zone 54H)
Lat.-Long.	37° 57' S, 140° 45' E (approx.)
Parent material:	(1) Weathered basaltic airfall tephra (ash tuff) erupted from Mt. Schank overlying (2) aeolian sand (Bridgewater Formation) (cf. Site 7)
Landform:	On crest of low ridge of old dune system buried by c. 0.7 m of weathered basaltic ash tuff
Vegetation:	Bracken fern and roadside grasses
Elevation:	20 m a.s.l.
Slope/Aspect:	1-2° S
Rainfall (4*):	Mean annual rainfall (mm): 767 Monthly min.-max. (mm): 20 (Feb), 114 (July) Mean annual raindays: 157
Temp. (2*):	Mean annual temp. (°C): 13.3 Mean daily min.-max for year (°C): 7.7, 19.0
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	Vitric Haploxerand

→ Thaptic Haploxerand (Soil Taxonomy 1999)

Horizon	Depth (cm)	Description
Ap	0-20	Very dark brown to very dark greyish brown (10YR 2/2 to 3/2) moist, dark greyish brown (10YR 4/2) dry, slightly gritty silt loam; very friable, very soft; non-sticky, non-plastic; moderately developed granular and crumb structure (some granules slightly firm); many roots; site may have had small additions of reworked aeolian sand; distinct boundary
AB	20-40	near dark yellowish brown (10YR 3/4) moist, yellowish brown (10YR 5/4) dry, sandy silt loam; very friable and soft; very 'greasy'; moderately developed subangular blocky structure crushing to some crumb and single grain; some roots; distinct boundary
Bw	40-70	dark yellowish brown (10YR 4/4) moist, yellowish brown (10YR 5/4 to 5/6) dry, sandy loam with gravel; very friable and soft in hand but firmer in place; weakly developed (porous) subangular blocky structure breaking to fine subangular blocks and some crumb; layer of firm, ash tuff pieces ('biscuits'), about 4 x 8 x 2 cm in size and with a speckled black and white appearance, in middle and lower parts of horizon; distinct irregular boundary (at 0.7 to 0.75 m depth)
2Ab	70-90	mainly dark brown (10YR 3/3 moist), blotchy fine sandy loam; very friable to loose; single grained; diffuse boundary
2Eb	90-140	white (10YR 7/2 moist, 10YR 7/1 dry) loamy sand to sand; feels sharp and gritty, loose; single grained; distinct irregular boundary

Site 8 contd

2E/Btsb	140 on	very pale brown to yellow (10YR 7/4 to 7/6 moist) sand; loose; has some very firm (hard to break), rounded, marble-sized yellowish red (5R 4/8 moist) sandy clasts/nodules (Fe 'B-balls') with (?)clay bridges.

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* See footnotes p. 5

† Soil Survey Staff (1990)

Pedon 9

Soil Pedon Site 9 (Northern Scoria Cone)

Location:	Shallow stock-scraped section a few metres below crest on SW side of c. 10 m-high rounded "scoria" (ash and lapilli) cone, the most northerly of about six such cones NW of Mt. Schank and approx. 750 m from main crater; site is c. 100 m NE of junction of "Mt. Schank" road [around Mt. Schank] and "Edmead" road (ends at Bellum Bellum).
Grid reference:	54HVD764012 (Schank SA *7022-3 & Part 7021-4* 1: 50 000 Zone 54H)
Lat.-Long.	37° 56' S, 140° 44' E (approx.)
Parent material:	Basaltic airfall tephra (ash and lapilli tuff) derived from NW fissure eruptions in first phase of Mt. Schank eruptions
Landform:	Small convex basaltic "scoria" cone of ash and lapilli tuff adjacent to main cone of Mt. Schank
Vegetation:	Pasture grasses
Elevation:	40 m a.s.l.
Slope/Aspect:	c. 20 ° SW
Rainfall (4*):	Mean annual rainfall (mm): 767 Monthly min.-max. (mm): 20 (Feb), 114 (July) Mean annual raindays: 157
Temp. (2*):	Mean annual temp. (°C): 13.3 Mean daily min.-max for year (°C): 7.7, 19.0
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	Vitric Haploxerand§ Humic Haploxerand (Soil Taxonomy 1999)

Horizon	Depth (cm)	Description
Ap	0-25	Very dark brown (10YR 2/2) moist, greyish brown (between 10YR 5/2 and 2.5Y 5/2) dry, sandy silt loam with fine gravel; friable to very friable in hand but firm to dig (probably compacted by stock); moderately to well developed medium crumb structure breaking to fine granular structure; some roots; indistinct boundary
A/B	25-30	very dark brown (10YR 2/2 moist) and dark brown (10YR 3/3 moist) sandy silt loam with fine gravel; friable; moderately developed porous subangular blocky structure crushing easily to fine subangular blocks and granules; distinct boundary
Bw1	30-50	near dark brown (10YR 3/3) moist, dark greyish brown (10YR 4/2) dry, sandy loam to loamy sand with gravel; friable; weakly developed crumb structure; pieces of biscuit-sized dark greyish brown to very dark greyish brown (2.5Y 3/2 to 4/2 moist) tuff of fine lapilli and coarse ash grade at 50 cm depth; indistinct boundary
Bw2	50-60	near dark yellowish brown (10YR 4/4) moist, yellowish brown to pale olive brown (10YR 5/4 to 2.5Y 5/4) dry, gravelly loamy sand to sandy loam; friable, softer and 'fluffier' in hand than Bw1; weakly developed fine crumb structure; indistinct boundary
BC(?k)	60-95	very dark greyish brown (10YR 3/3 moist) gravelly coarse loamy sand (just coheres); very friable in hand, soft and crumbly; near massive, very weakly developed medium blocky structure crushing to single grain; some rounded, pea-sized basalt gravel pieces; moderate NaF reaction suggests some $CaCO_3$ present; few bracken roots; indistinct boundary

Site 9 contd

Crk	95-110	near dark brown (10YR 3/3 moist) gravelly coarse sand; single grained; some biscuit-size chunks of speckled black and greyish brown (10YR 5/2 moist) ash tuff on very hard, massive lithified tuff (unable to dig). → R horizon

* See footnotes p. 5
† Soil Survey Staff (1990)
§ Alternative new subgroup proposal (provisional) could be Calcic Vitric Haploxerand (but note carbonate not as extensive as at Sites 4 & 5).

Pedon 10A

B. Mt. Burr range

Soil Pedon Site 10A (Lake Leake - poorly drained)

Location:	Pit in paddock of "Yurnga" property about 40 m NE of junction of Lake Leak Road and road to E (Medhurst Road), Lake Leake
Grid reference:	54HVD638373 (Kalangadoo SA *7022-4* 1: 50 000 Zone 54H)
Lat.-Long.	37° 37' S, 140° 35' E (approx.)
Parent material:	Basaltic airfall tephra (ash and lapilli tuff beds) erupted from late Pleistocene (?c. 20 ka) Lake Leake volcano (?youngest of Mt. Burr range volcanoes)
Landform:	On gently sloping shoulder of volcanic rim on NE side of Lake Leake maar; ground rises to 136 m about 600 m SE of site
Vegetation:	Pasture
Elevation:	100 m a.s.l.
Slope/Aspect:	4 ° facing N
Rainfall (5*):	Mean annual rainfall (mm): 836 Monthly min.-max. (mm): 29 (Jan, Feb), 118 (July) Mean annual raindays: 162
Temp. (6*):	Mean annual temp. (°C): 13.7 Mean daily min.-max for year (°C): 8.6, 18.9
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Poorly drained (water table at 0.8 m); ground surface puggy in places
Classification†:	?Aquandic Placaquept or Aquic Xerochrept

Horizon	Depth (cm)	Description
Ap	0-20	Very dark greyish brown (10YR 3/2) moist, dark grey (10YR 4/1) dry, sandy loam (white speckles of sand grains obvious); friable; non-sticky, slightly plastic; weakly developed subangular blocky and granular structure; some roots, some fine ones reddened by oxidation; indistinct boundary
Bw	20-50	near dark brown (10YR 3/3) moist, dark greyish brown (10YR 4/2) dry, coarse sandy loam (near sandy clay loam); a few dark brown (7.5YR 3/2 moist) mottles; slightly sticky, slightly plastic; near massive, breaking to very weak subangular blocky structure; few roots; indistinct boundary
C(g)	50-90	near dark brown (10YR 4/3) moist, greyish brown (10YR 5/2) dry, sandy loam to sandy clay loam with gravel; massive crushing to near single grain; underlain by
Csm	90-95	hard iron pan of cemented tuff; usually 1-2 cm thick, up to 5 cm; mainly dark reddish brown (2.5YR 2/4) moist, dark reddish brown (5YR 3/4 to 2.5YR 3/4) dry; some pieces are reddish on inside, yellowish red (orange) on outside; water seems to be perched on this horizon; cannot be dug.

* See footnotes p. 5

† Soil Survey Staff (1990)

Soil Pedon Site 10B (Lake Leake - well drained)

Location:	Pit in paddock of farm property about 50 m E of Lake Leake Road adjacent to Aquatic (Boat) Club, Lake Leake
Grid reference:	54HVD641370 (Kalangadoo *7022-4* 1: 50 000 Zone 54H)
Lat.-Long.	37° 37' S, 140° 36' E (approx.)
Parent material:	Basaltic airfall tephra (ash and lapilli tuff beds) erupted from late Pleistocene (?c. 20 ka) Lake Leake volcano (?youngest of Mt. Burr range volcanoes)
Landform:	On fairly steep slope below volcanic rim on E side of Lake Leake maar; ground rises to 136 m about 250 m SE of site. Tuffs crop out below site near road
Vegetation:	Pasture
Elevation:	120 m a.s.l.
Slope/Aspect:	c. 15-20° facing W
Rainfall (5*):	Mean annual rainfall (mm): 836 Monthly min.-max. (mm): 29 (Jan, Feb), 118 (July) Mean annual raindays: 162
Temp. (6*):	Mean annual temp. (°C): 13.7 Mean daily min.-max for year (°C): 8.6, 18.9
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	?Lithic Haploxerand or Lithic Vitrixerand§

Horizon	Depth (cm)	Description
Ap	0-18	Very dark greyish brown (10YR 3/2) moist, dark yellowish brown (10YR 3/4) dry, silty clay loam; friable; slightly sticky, moderately plastic; moderately developed subangular blocky structure with some granules; some fine roots
Bw	18-37	dark yellowish brown to dark brown (10YR 3/4 to 7.5YR 3/2) moist, dark brown (10YR 3/3) dry, gritty silty clay loam with gravel; a few yellowish brown (10YR 5/4 moist) mottles, probably weathered tuff remnants; friable to slightly firm; weakly developed fine and medium subangular blocky structure;
C	37-43	greyish gritty clay on strongly cemented tuffs.

* See footnotes p. 5

† Soil Survey Staff (1990)

§ If fails Andisols, may be Lithic Xerochrept.

Pedon 11A

Soil Pedon Site 11A (Mt. McIntyre - poorly drained, on lava)

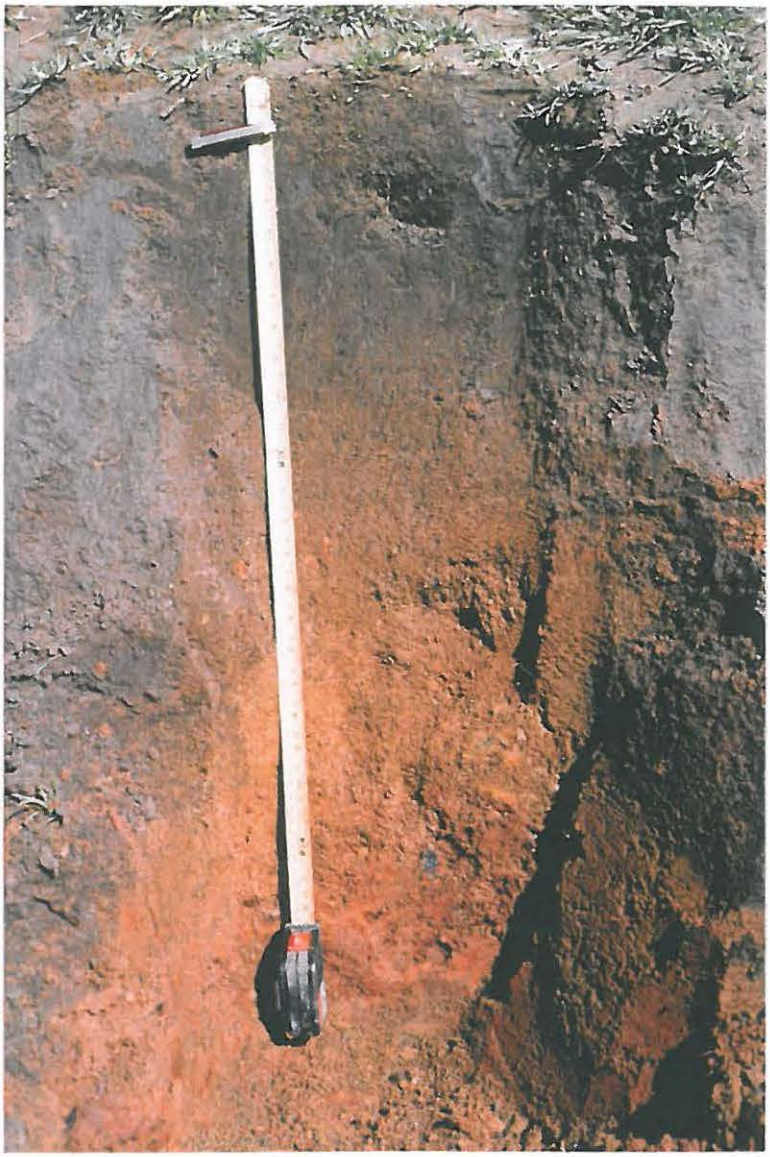
Location:	Pit 15 m from edge of southern arm of quarry on S side of Crushing Road; site is about 250 m SSE of Crushing Plant and about 50 m E of site 11B, Mt. McIntyre
Grid reference:	54HVD597419 (Kalangadoo *7022-4* 1: 50 000 Zone 54H)
Lat.-Long.	37° 34' S, 140° 33' E (approx.)
Parent material:	Basaltic lava (vesicular to massive) erupted from Mid Pleistocene (?c. 0.5 Ma) Mt. McIntyre volcano (site is on dyke visible in quarry walls)
Landform:	On flattish top of lava flows with dyke. Some ?pressure cracks evident on ground surface
Vegetation:	Pasture
Elevation:	175 m a.s.l.
Slope/Aspect:	Near flat
Rainfall (7*):	Mean annual rainfall (mm): 798 Monthly min.-max. (mm): 28 (Jan), 119 (July) Mean annual raindays: 92
Temp. (6*):	Mean annual temp. (°C): 13.7 Mean daily min.-max for year (°C): 8.6, 18.9
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Poorly drained; ground puggy with standing water in patches
Classification†:	?Chromic Pelloxerert§ or ?Vertic Haploxeralf

Horizon	Depth (cm)	Description
Ap	0-20	Very dark greyish brown (10YR 3/2) moist, dark brown (10YR 3/3) dry, gritty clay loam with sparse gravel; slightly speckled appearance; friable with some slightly firm peds; moderately plastic, sticky; moderately developed medium and coarse granular structure; some roots
Bss	20-36	dark greyish brown (10YR 4/2) moist, dark brown (10YR 3/3) dry, slightly gritty clay with sparse gravel; many faint black (10YR 2/1 moist) mottles; friable; plastic, very sticky; weakly to moderately developed subangular blocky structure breaking to fine subangular blocks and blocks; some fine vertic structures (?stress cutans)
Bssg	36-50	yellowish brown to light olive brown (10YR 5/4 to 2.5 Y 5/4) moist, dark brown (10YR 4/3) dry, with many fine yellowish brown (10YR 5/8 moist) mottles and few fine yellowish red (5YR 4/8) mottles with medium dark reddish grey (5YR 4/2 moist) halos of weathered basaltic material, clay; some lumps of very dark grey, subrounded basalt up to 5-6 cm across; plastic, sticky; friable to crumbly when partly dry; weakly developed very fine blocky structure; some vertic structures including fine and medium stress cutans (or clay skins?)
Crg	50-55	dark brown (10YR 4/3 moist) with yellowish red (5YR 4/6 moist) mottles, stony, sightly gritty clay; many lumps of very dark grey (10YR 3/1 moist), subrounded, vesicular basalt usually 5 cm or more across, some with small dark reddish brown (5YR 3/3 moist) mottles; plastic, sticky; massive.

* See footnotes p. 5

† Soil Survey Staff (1990)

§ Proposed new subgroup (ICOMERT) ?Xeric Epiaquert or Aquic Haploxerert.



Pedon 11B

Soil Pedon Site 11B (Mt. McIntyre - well drained, on breccia/scoria)

Location:	Pit 5 m from edge of southern arm of quarry on S side of Crushing Road; site is about 250 m SSW of Crushing Plant and about 50 m W of site 11A, Mt. McIntyre
Grid reference:	54HVD596419 (Kalangadoo *7022-4* 1: 50 000 Zone 54H)
Lat.-Long.	37° 34' S, 140° 33' E (approx.)
Parent material:	Basaltic autobreccia or scoriaceous tephra erupted from Mid Pleistocene (?c. 0.5 Ma) Mt. McIntyre volcano
Landform:	On flattish top of autobreccia/scoriaceous deposits associated with lava flows
Vegetation:	Pasture
Elevation:	180 m a.s.l.
Slope/Aspect:	Near flat
Rainfall (7*):	Mean annual rainfall (mm): 798 Monthly min.-max. (mm): 28 (Jan), 119 (July) Mean annual raindays: 92
Temp. (6*):	Mean annual temp. (°C): 13.7 Mean daily min.-max for year (°C): 8.6, 18.9
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	?Mollic Haploxeralf

Horizon	Depth (cm)	Description
Ap	0-30	Very dark brown to black (10YR 2/2 to 2/1) moist, near dark greyish brown to dark grey (10YR 4/2 to 4/1) dry, silt loam to silty clay loam; slightly speckled appearance; friable; moderately plastic, slightly sticky; moderately to well developed medium and coarse granular structure with a few subangular blocks; bioturbation (worm mixing) at base
A/B	30-35	transitional between Ap and Bt (bioturbated)
Bt	35-60	dark brown (10YR 4/3) moist, dark yellowish brown (10YR 4/4) dry, with a few faint very dark grey (10YR 3/1 moist) and brown (7.5YR 5/4 moist) mottles, clay loam or clay; some pieces of dark, subrounded, vesicular basalt with few reddish brown (5YR 5/4 moist) mottles; very firm to dig but peds separate easily and are friable in hand; very plastic, very sticky; moderately developed medium and fine subangular blocky structure with some ?stress cutans (cf. clay skins); some roots
BC	60-75	reddish brown (5YR 4/4 to 2.5YR 4/4) moist, dark brown (7.5YR 4/4) dry, with a few faint yellowish red (5YR 5/8 moist) mottles, slightly gritty stony clay; many pieces of black (N2/- moist) vesicular basalt, typically 2-5 cm across, with some pale olive brown (2.5Y 5/4 moist) mottles; plastic, moderately sticky; very weak subangular blocky structure
Cr or R	75 on	dark vesicular basalt (very hard to dig).

* See footnotes p. 5

† Soil Survey Staff (1990)

Pedon 12.

Soil Pedon Site 12 (Mt. Muirhead - lower slopes)

Location:	Pit on lower slopes of Mt. Muirhead about 50 m W of main quarry; site is downslope and about 100 m E of site 13 and c. 1 k m NE of junction of Mt. Burr-Millicent Highway and Mt. Muirhead Range Road, Mt. Muirhead
Grid reference:	54HVD474429 (Millicent SA *6922-1* 1: 50 000 Zone 54H)
Lat.-Long.	37° 34' S, 140° 24' E (approx.)
Parent material:	Basaltic tephra (ash and lapilli tuff) erupted from Early Pleistocene Mt. Muirhead volcano (?c. 2 Ma; ?oldest of Mt. Burr range volcanoes)
Landform:	On concave lower slopes of Mt. Muirhead volcano; ground surface marked with distinct puffs and hollows (gilgai) and many cracks several centimetres wide
Vegetation:	Pasture
Elevation:	110 m a.s.l.
Slope/Aspect:	5-10° facing N
Rainfall (8*):	Mean annual rainfall (mm): 791 Monthly min.-max. (mm): 29 (Jan), 112 (July) Mean annual raindays: 178
Temp. (6*):	Mean annual temp. (°C): 13.7 Mean daily min.-max for year (°C): 8.6, 18.9
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	?Chromic or Typic Pelloxerert§

Horizon	Depth (cm)	Description
Ap	0-22	very dark greyish brown (10YR 3/2) moist, very dark grey (10YR 3/1) dry, clay; very plastic, very sticky; many distinct vertic structures (parallelpipeds, stress cutans etc.); indistinct boundary
Bss	22-55	very dark grey to black (10YR 3/1-2/1 to 5Y 2/2) moist, near very dark grey (10YR 3/1) dry, clay; very plastic, very sticky; well developed and prominent vertic structures (parallelpipeds, slickensides, stress cutans); few roots; indistinct boundary
BCss	55-60	very dark grey to black (5Y 3/1 to 2/2) moist, very dark grey (between 10YR 3/1 and 5Y 3/1) dry, clay; very plastic, very sticky; well developed and prominent vertic structures as above; abundant pieces of 'speckled' yellowish brown to pale yellowish brown (10YR 5/4 to 6/4 moist) tuff (mainly ash and fine lapilli); very few roots.

* See footnotes p. 5
† Soil Survey Staff (1990)
§ Proposed new subgroup (ICOMERT) ?Leptic Haploxerert.

Pedon B

Soil Pedon Site 13 (Mt. Muirhead - crest)

Location:	Pit (in sheep scrape) about 5 m altitude below crest of Mt. Muirhead marked by trig point c. 20 m to SW; site is upslope and about 100 m W of site 12 and c. 1 km NE of junction of Mt. Burr-Millicent Highway and Mt. Muirhead Range Road, Mt. Muirhead
Grid reference:	54HVD473429 (Millicent SA *6922-1* 1: 50 000 Zone 54H)
Lat.-Long.	37° 34' S, 140° 24' E (approx.)
Parent material:	Basaltic tephra (ash and lapilli tuff) erupted from Early Pleistocene Mt. Muirhead volcano (?c. 2 Ma; ?oldest of Mt. Burr range volcanoes)
Landform:	Near summit of steep conical rampart of Mt. Muirhead; some cracks in ground surface evident immediately below pit
Vegetation:	Pasture
Elevation:	140 m a.s.l.
Slope/Aspect:	10-15° facing NE
Rainfall (8*):	Mean annual rainfall (mm): 791 Monthly min.-max. (mm): 29 (Jan), 112 (July) Mean annual raindays: 178
Temp. (6*):	Mean annual temp. (°C): 13.7 Mean daily min.-max for year (°C): 8.6, 18.9
Soil moisture, temp. regime†:	Xeric, Mesic
Profile drainage:	Well drained
Classification†:	Vitric Haploxerand§

Horizon	Depth (cm)	Description
Ap	0-25	Very dark brown (10YR 2/2) moist, dark grey (10YR 4/1) dry, silty clay loam; peds firm in place (hard when dry) but separate readily (friable in hand); very well developed medium and fine granular to subangular blocky structure, breaking to fine granules and subangular blocks; few roots; diffuse boundary
Bw1	25-60	very dark greyish brown (10YR 3/2) moist and dry, gritty silty clay loam; a few faint fine orange mottles and some black worm casts; friable; moderately plastic, moderately to slightly sticky; moderately developed porous coarse-medium subangular blocks crushing to fine-medium crumb and subangular blocks; indistinct boundary
Bw2	60-75	dark brown to dark yellowish brown (10YR 3/3 to 3/4 moist), dark brown to very dark greyish brown (10YR 3/3 to 2.5Y 3/2) dry, slightly gritty (silty) clay loam; a few fine orange mottles; very friable in hand; moderately plastic, slightly sticky with 'spongy' feel wet; weakly developed fine subangular blocky structure, crushing readily to crumb; sharp boundary
Ck	75-85	greyish brown (10YR 5/2 moist) sandy clay loam (close to sandy loam) with sparse gravel (ash and lapilli tuff); some firm, brittle, weakly cemented aggregates that crush to single grain; upper 3 mm of horizon comprises hard, white cemented layer of $CaCO_3$.

* See footnotes p. 5

† Soil Survey Staff (1990)

§ If fails Andisols, then likely to be Andic Xerochrept; alternative is new subgroup proposal (provisional) Andic Calcic Xerochrept.

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