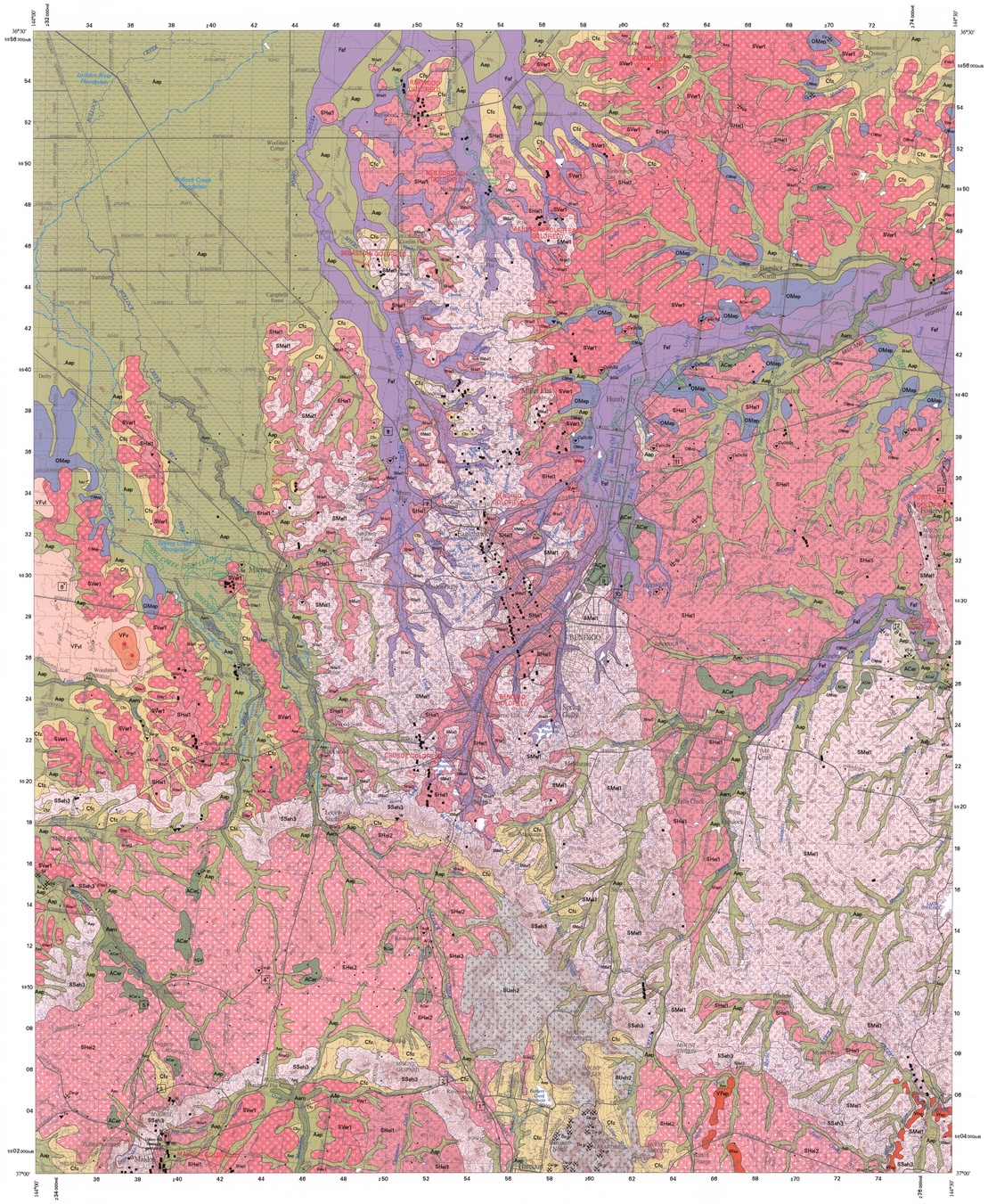


Transported units

	Main regolith type	Landform	Description
Alluvial			
Aam	Alluvial sediments	Meander plain	*Slightly weathered; poorly sorted angular to sub-rounded lithic and mineral fragments in a sandy to clayey matrix; incised meander plains, anabranching, dendritic, moderate density drainage; uniform grey to grey-brown sand and clay soils; low radioelement; alluvial sediments in modern drainage*
Aap	Alluvial sediments	Alluvial plain	*Moderately weathered; variably ferruginised clay, sand and gravel, angular clasts of sedimentary bedrock and reef quartz; red-brown gradational or duplex soils; mostly inactive floodplains with dendritic and anabranching drainage; low radioelement; sediments of the Shepparton Formation and equivalents*
			Loddon River Floodplain: characterised by northeast trending stream channels; derived from both metasedimentary and granitic rocks
			Spring Creek Floodplain: characterised by sediment containing granitic quartz, clay and mica; moderate total radioelement, low K, high Th and U; sediment sourced mainly from granitic rocks of the Harcourt Batholith
			Bullock Creek Floodplain: characterised by sediment containing granitic quartz, clay and mica; very high total radioelement in south, decreases in intensity to the north; high K and Th, variable high U; sediment sourced mainly from granitic rocks of the Harcourt Batholith
Aep	Alluvial sediments	Erosional plain	*Pelitic, very highly weathered quartz pebble and cobble gravel with a kaolinitic clay and quartz sand matrix overlain by clay and silty clay, over mottled, bleached and occasionally iron indurated sedimentary bedrock; auriferous; gradational grey-brown clay soils; no distinctive radiometric response; limited outcrop confined to margins of present drainage; mostly subsurface; Calivil Formation and equivalents*
ACer	Alluvial sediments	Erosional rises	*Very highly weathered sandy coarse pebble and cobble quartz conglomerate up to 10 m thick over mottled, bleached and occasionally ferricrete bedrock; cemented with ferricrete and silcrete in places; duricrust on upper surface consisting of silcrete and argillans +/- ferricrete;no soil preserved; low radioelement; developed over White Hills Gravel and equivalents; auriferous in part*
Colluvial			
Cfc	Colluvium	Colluvial fan	*Slightly weathered, ferruginised, poorly sorted angular to sub-rounded lithic and mineral fragments in sandy to clayey matrix on low hills and flanks; clast composition dependent on source rocks; uniform coarse and fine textured non-cracking soils; low radioelement*
Aeolian			
Iau	Aeolian sediments	Lunette	*Sandy clay forming a narrow lunette on the eastern side of Priors Swamp; no distinctive radiometric response*
Marine			
OMep	Marine sediments	Erosional plain	*Moderately to highly weathered quartz sands on low relief hills or flanks of low hills; distinctive ferruginous pisolitic duricrust overlying mottled clayey B horizon, grading to mottled red-brown and grey clayey fine sands; bleached at depth; pisolitic red-brown duplex soil; lowdensity, widely spaced drainage channels; low radioelement; developed on Parilla Sand*
Human activity			
Faf	Fill	Flood plain	*Fine silty clay with interbedded lenses of quartz and ferruginised bedrock pebbles and cobbles; variable, moderate radioelement; 'sludge' from historical gold mining forming a veneer up to 3 m thick on pre-existing alluvial plains; derived from mining of the Bendigo goldfield*

Volcanic units

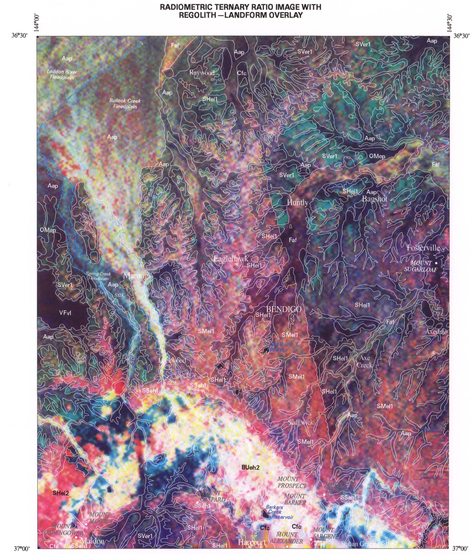
	Main regolith type	Landform	Description
VFv	Lava	Volcano	*Basaltic lavas and minor scoria with red-brown gradational soil, sometimes with pisolitic ferricrete in the upper parts of the profile; spheroidal weathering common throughout soil profile; low radioelement; developed on rocks of the Newer Volcanic Group on and around Bald Hill*
VFvl	Lava	Lava plain	*Stony rise basalt with red-brown gradational soil, sometimes with pisolitic ferricrete in the upper parts of the profile; spheroidal weathering common throughout soil profile; low radioelement; developed on rocks of the Newer Volcanic Group*
VFep	Lava	Erosional plain	*Stony rise basalts on erosional plains; thin discontinuous layer of red-brown clay over blocky subangular to rounded vesicular basalt boulders; uncommon spheroidal weathering only seen near springs; low radioelement, generally remanently magnetised; developed on rocks of the Newer Volcanic Group, on hills flanking the Colliban River and Myrtle Creek*

In situ units

	Main regolith type	Landform	Description
SSeh3	Slightly weathered bedrock (metamorphic)	Erosional hills	*Red-brown to pale brown slightly to moderately weathered contact metamorphosed sedimentary bedrock; hard, iron staining and cementing common; iron indurated along joints; poorly developed, immature red-brown duplex soils, lithic silty clay over clayey subsoil; radial, high density perennial drainage; high total radioelement and K; forms arcuate ridges in Castlemaine Group around the Harcourt and Baringhup granodiorites*
SMel1	Moderately weathered bedrock (metasedimentary)	Erosional low hills	*Yellow-brown and red-brown moderately weathered metasedimentary bedrock; highly to very highly weathered saprolite present adjacent to primary gold mineralisation due to oxidation of accessory sulphide minerals; minor lithic soils; moderate total radioelement, high K, moderate to low Th and U; banding in radiometric imagery coincident with strike ridges in bedrock; developed on the Castlemaine Group*
SHel1	Highly weathered bedrock (metasedimentary)	Erosional low hills	*Weakly mottled, red-brown and yellow brown kaolinitic highly weathered metasedimentary bedrock on low hills and the lower slopes of bedrock ridges; minor ferricrete; thin lithic soils over psammitic units, thick clayey gradational or duplex soils over pelitic units; moderate total radioelement and K, variable Th and U; developed on the Castlemaine Group*
SVer1	Very highly weathered bedrock (metasedimentary)	Erosional rises	*Mottled red-brown and yellow-brown metasedimentary bedrock, partly iron indurated; mostly soft kaolinitic clay with poorly preserved original textures; restricted to the lower slopes of bedrock ridges and low hills; clayey gradational or duplex soils; moderate total radioelement, low K and U, moderate to high Th; developed on the Castlemaine Group*
BUeh2	Unweathered bedrock (granitic)	Erosional hills	*Fresh granite outcrop with little regolith cover; prominent tors on ridge slopes and crests; thin, poorly preserved uniform grey-brown and red-brown clayey transported soils; shallow, widely spaced drainage channels; high total radioelement, K, Th and U; developed on Harcourt Granodiorite*
SHel2	Highly weathered bedrock (granitic)	Erosional hills	*Highly weathered granitic saprolite of quartz, feldspar and clay; original granitic textures generally preserved; rises and ridge slopes with granitic tors and fresh granite mantled by a thin layer of granitic quartz sand and clay; red-brown to grey-brown uniform soils of angular granitic quartz, feldspars and clay; minor ferruginous mottling and pisolites in southwestern corner of map area; very chaotic radiometric response that does not seem to correlate with differences in regolith materials; developed on Harcourt and Baringhup granodiorites*

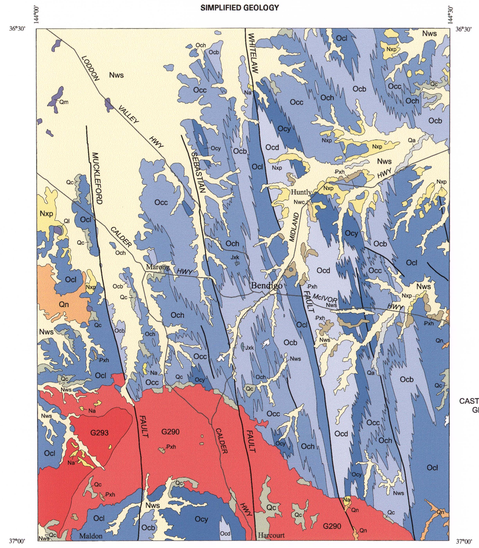
The unit codes on this map follow the RTMAP system devised by Geoscience Australia (see Pain *et al.*, 2001: RTMAP regolith database field book and users guide; CRCLEME Report 138). The landform descriptions follow the classification system set out in the *Australian Soil and Land Survey Field Handbook* (McDonald et al., 1990; CSIRO Publishing). See report accompanying this map for further information.

RADIOMETRIC TERNARY RATIO IMAGE WITH REGOLITH – LANDFORM OVERLAY



SCALE 1:250 000

SIMPLIFIED GEOLOGY

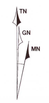


SCALE 1:250 000

MAP SCALE 1:100 000

Transverse Mercator Projection: Australian Map Grid - Zone 55
Grid interval: 2000 metres

Vertical datum: Australian Height Datum (1971)
Horizontal datum: Australian Geodetic Datum (1966)



Magnetic North is 10 ° 53' 31" east of Grid North at the centre of this map. Magnetic North is correct for 2003 and increases annually at a rate of approximately 00 ° 00' 50" east of Grid North.

Grid convergence is 01 ° 38' 46" at the centre of this map.

WARNING! Incorrect description or usage of datums can cause errors. This affects the use of maps, map coordinates and spatial data. What you should do:

Always check carefully and specify explicitly the datums of all data, maps and map references that you use, supply and/or receive.

Wrong use of GDA94 and AGD66 datums can in Victoria displace positions by about 200 m to the NE or SW.

If you are unsure or unaware about datums then immediately seek and use expert assistance.

Further information at http://www.ga.gov.au

DIGITAL TERRAIN IMAGE WITH LANDFORM AND REGOLITH – LANDFORM OVERLAY

SCALE 1:250 000

LANDFORM TYPE

Depositional landforms
- Alluvial plain
- Flood plain
- Meander plain
- Colluvial fan
- Lava plain

Erosional landforms
- Erosional plain
- Rises
- Low hills
- Hills

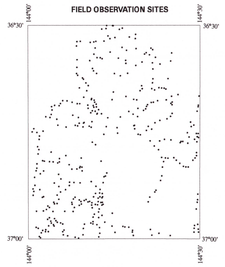
Regolith – landform unit boundary
Landform boundary
Floodplain boundary

LEGEND

- Qm — *Swamp and lake deposits*
- Qa — Coonambidgal Formation
- Qc — *Colluvium and gully alluvium*
- Ql — *Lunette deposits*
- Nws — Shepparton Formation
- Qn — Newer Volcanic Group
- Nxp — Parilla Sand
- Nwc — Calivil Formation
- Na — *Undifferentiated alluvial and colluvial deposits*
- Pxh — White Hills Gravel
- Jxk — Kangaroo Gully Volcanic Breccia
- G293 — Baringhup Granodiorite
- G290 — Harcourt Granodiorite
- Ocd — Dariwillian
- Ocy — Yapeenian
- Occ — Castlemainian
- Och — Chewtonian
- Ocb — Bendigonian
- Ocl — Lancefieldian

CASTLEMAINE GROUP

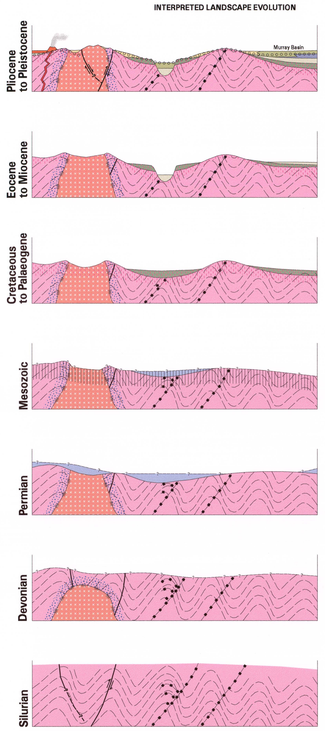
FIELD OBSERVATION SITES



LEGEND

- *Colluvium and alluvium: bedrock derived*
- *Lavas and volcanics (Newer Volcanic Flows)*
- *Weathering profile (Karoonda Regolith)*
- *Fluvio-lacustrine deposits (Shepparton Formation)*
- *Shallow marine sands (Loxton-Parilla Sands)*
- *Fluvial gravels (Calivil Formation deep leads)*
- *Weathering profile (Morval Regolith)*
- *Fluvial gravels (White Hills Gravel)*
- *Weathering profile (Mesozoic palaeosurface)*
- *Glacial deposits*
- *Contact metamorphosed aureole*
- *Granite (Harcourt Batholith)*
- *Quartz reef*
- *Palaeozoic metasedimentary rocks*
- *Geological boundary, accurate*
- *Geological boundary, inferred*
- *Fault, strike-slip*
- *Fault inferred*
- *Intrusive contact*
- *Bedding form surface*

INTERPRETED LANDSCAPE EVOLUTION



Marine transgression in the Pliocene (Parilla Sand) and backfilling of valleys with fluviolacustrine sediments (Shepparton Formation). Extrusion of lavas. Colluvium deposited on flanks of bedrock rises. Weathering in the Pliocene-early Pleistocene (Karoonda Surface). Reactivation of existing faults.

Renewed dissection with narrow, steep-sided valleys incised into the broad shallow valleys. Deposition of fluvial gravels in new, narrower valleys (Loddon River Group and equivalents).

Dissection of the Mesozoic palaeosurface as a consequence of Gondwana break-up. Significant erosion eventually formed a new landscape. Broad shallow valleys filled with fluvial gravels (White Hills Gravel) sourced from the Mesozoic land surface and freshly eroded bedrock. Deep weathering of landscape consisting of ferricrete and silcrete.

Development of a deeply weathered, low relief landscape. Continued erosion and unroofing of granite pluton. A tag of chemically resistant material, such as vein quartz, and possibly gold may have formed at this time.

Permian glaciation modifies the landscape, blanketing it with a range of glacial deposits.

Erosion and intrusion of granite (Harcourt Batholith). Contact metamorphism of rocks around batholith.

Folding and faulting of Ordovician sedimentary rocks (Castlemaine Group) with quartz reef emplacement.

BENDIGO

1:100 000 Regolith – landform map

Geological Survey of Victoria
MINERALS AND PETROLEUM DIVISION

Department of Primary Industries

REGOLITH EXCURSION SITES

No.	AMG	Location
1	254700-5904900	Truck stop north of Harcourt, Calder Highway: highly weathered granite on low hills (SHel2)
2	253300-5905900	Fogartys Gap: slightly weathered contact metamorphosed sedimentary rocks on hills (SSeh3)
3	238800-5905300	Nuggetty Road: colluvial fan sediments overlying in situ granitic regolith (Cfc)
4	244200-5910700	Newry Meadows: highly weathered granite on low hills (SHel2)
5	238200-5908400	Bradford Creek: channel sediments overlying highly weathered granite (ACer)
6	233600-5929600	All Stone quarry: lava flows of the Bald Hill Volcanic Complex
7	251200-5934000	Laugoons quarry, Myers Flat: alluvial sediments (Aep)
8	248800-5937600	Myers Creek: mining residue (Faf)
9	259800-5930700	Council quarry, White Hills: channel sediments on erosional rises (ACer)
10	260300-5930400	Very highly weathered metasedimentary bedrock, White Hills (SVer1)
11	263000-5936700	Marine sands on erosional plains, disused quarry, Epsom (OMep)
12	274200-5928400	Alluvial sediments on erosional plains, McKenzies pit (Aep)

SYMBOL LEGEND

- *Regolith – landform unit boundary*
- *Floodplain boundary*
- *Shallow alluvial workings*
- *Deep lead* — BUNTING LEAD; SPRING CREEK LEAD
- *Eruption point*
- *Field observation site*
- *Commodity: bismuth/clay/dimension stone-granite/feldspar* — Bi, Cu, De-gr, Fe
- *gravel/kaolin/magnesium/sand/tungsten/wollastonite* — Gv, K, Mg, Sd, W, Wo
- *Orogenic gold mine/mullock heap; with additional commodity*
- *Mineral occurrence with commodity*
- *Extractive industry interest area/open cut/quarry; with commodity*
- *Main road; other road*
- *Track*
- *Railway track; operating/disused*
- *Watercourse*
- *Channel; drain*
- *Contours (10 metre interval)*

ADJOINING 1:100 000 SHEETS

WEDDERBURN 7625	MITIAMO 7725	ECHUCA 7825
DUNOLLY 7624	BENDIGO 7724	HEATHCOTE 7824
CRESWICK 7623	CASTLEMAINE 7723	WOODEND 7823

LOCATION DIAGRAM

RESPONSIBILITIES AND ACKNOWLEDGEMENTS

Regolith mapping: A. Krotsnis
Map compilation: A. Krotsnis and L.M. Bibby
Acknowledgements:
Published mapping: Cherry and Wilkinson (1994); Pereira et al. (compilers)(2001); Slater (2002)

Manager, Geological mapping: P. J. O'Shea
Manager, Geological Survey: P. S. Roberts

Cartography: T. M. Beer and J. J. Dunleavy
GIS data compilation and cartographic publishing process

This map incorporates topographic and radiometric data from Geoscience Australia.

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Topographical information correct to 1988.

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Geological Survey of Victoria

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Victorian Initiative for Minerals and Petroleum Report 77.

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1:100 000 Regolith – landform map

2003 Edition 1

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