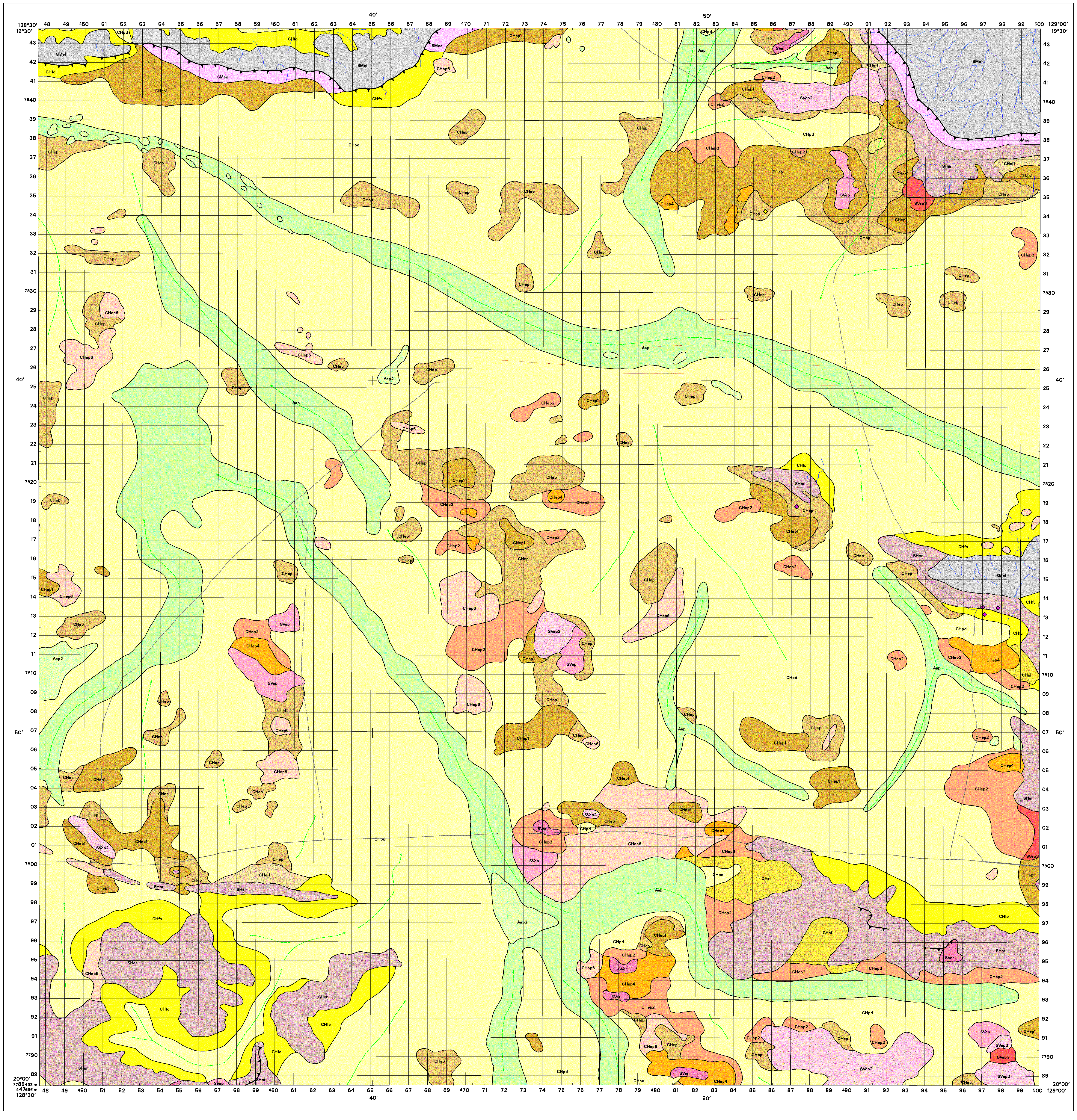
GRANITES TANAMI SERIES
REGOLITH-LANDFORM MAP

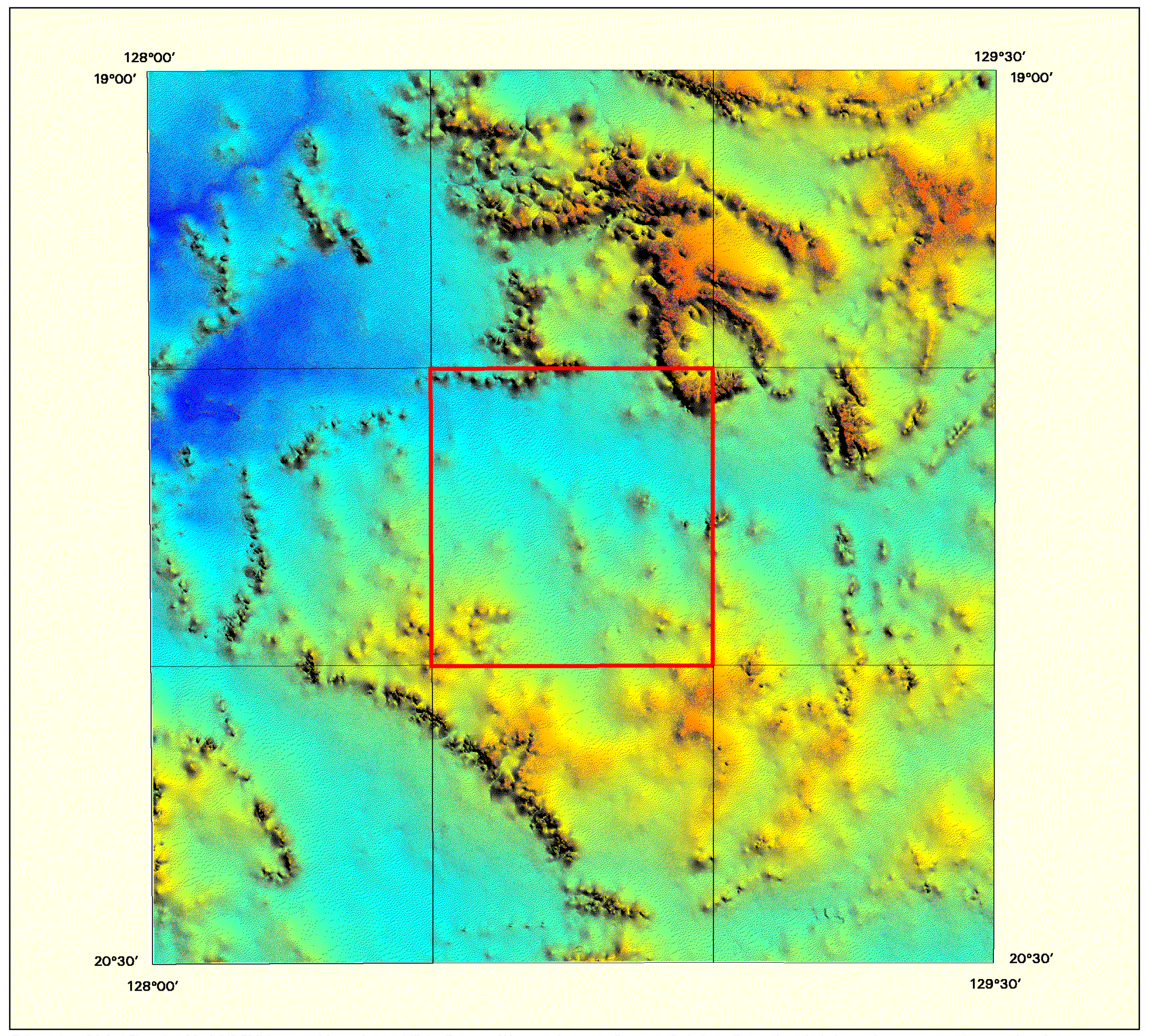
WATTS

SHEET 4658
SCALE 1:100,000



DIGITAL ELEVATION MODEL

SCALE 1:1,000,000



False colour Digital Elevation Model (DEM) image with north-east hillshading over Watts and surrounding area. Relative relief of the whole image is 363 metres. Lowest elevations at 313 metres are shown in blue and highest elevations at 676 metres are shown in red. Sun is north-east at 45° and 70° elevation. The DEM image is derived from AUSLIG/AGSO/CRES 9-second elevation grid.

Transported Regolith

Alluvial sediments

Aap	*Alluvial and colluvial sediments consisting of sand, silt and clay forming extensive low relief depositional plains. Alluvial sediments are mainly covered by sheetflow and aeolian ferruginous fine to medium quartzose sand. Minor gravelly lags (lithic, quartz and Fe nodules). Local lake or swamp sediments consist of mottled clays. Ground water calcrete (local heaving) and surface carbonate nodules common.*
Aap1	*Alluvial and minor colluvial sheetflow sediments of sand, silt and clay. Local lenses of conglomeratic gravel. Lags consist of lithic fragments, Fe nodules and Fe granules. Minor lacustrine/swamp clays and fine sand. Forms narrow floodplains.*
Aap2	*Alluvial and sheetflow deposits consisting of ferruginous fine to coarse quartzose sand and clay. Carbonate nodules and pavements common. In places eroded sheetflow and alluvial sediments form dissected gently incised terrain. Reworked aeolian sand. Scattered quartz and ferruginous gravel lags. In places heaving of calcrete forms hummocky micro relief. Forms extensive low relief depositional plains.*
Aap3	*Alluvial and colluvial sediments consisting of sand, silt and clay forming extensive low relief depositional plains. Alluvial sediments are mainly covered by sheetflow and aeolian ferruginous fine to medium quartzose sand. Fe gravels and granules very common. Minor lithic and quartz gravels. In places ground water calcrete (local heaving) and surface carbonate nodules common.*

Lacustrine sediments

Lpp	*Lacustrine sediments consisting of heavy reddish brown to grey clay, silt and sand forming playa floors. Evaporatic halite and gypsum crusts on floors and rim of lakes.*
Lpp1	*Lacustrine and alluvial sediments consisting of sand and clay. Minor evaporatic salts in playa floors. Ferruginous lag and, in places, calcrete forms indurated pavements and bars. Sheetflow ferruginous sand. Lacustrine and alluvial plain.*

Aeolian sediments

ISul	*Undifferentiated reddish orange fine grained aeolian quartz sand. Forming longitudinal dunes and minor sand spreads. Dunes trend mainly east-west. Sand is well sorted, rounded and stained by iron. Dunes generally less than 4m in height. Local surface accumulations of Fe granules. In places halite and gypsum crusts near to playas.*

Colluvial sediments

CHfc	*Colluvial fan and sheetflow deposits consisting of medium to fine ferruginous quartzose sand, minor ferruginous lithic fragments, quartz and Fe nodules. Minor clay. Forms low angle colluvial fans and pediments.*
CHpd	*Sheetflow and local alluvial channel deposits consisting of ferruginous fine to coarse quartzose sand and minor gravel. In places longitudinal dunes and sand spreads. Aeolian sand reworked by sheetflow processes. In places ferruginous gravel and nodules at approximately 1 metre depth. Local patchy quartz, lithic and Fe nodule/granule lags. Forms extensive low relief sheet flood colluvial plains and minor alluvial or erosional plains.*
CHpd1	*Sheetflow and minor alluvial deposits consisting of ferruginous fine to coarse quartzose sand and minor gravel. Transported clays. In places scattered lithic fragments. Forms very low relief depositional colluvial and alluvial plains*

Insitu Regolith

Saprolite covered by colluvium (typically < 2m thick)

CHei	*Highly ferruginous colluvial gravels, sand and minor clay. Minor ferruginous alluvial gravel and sand. Sediments generally < 2 m thick over saprolite. In places angular colluvial gravel cemented by Fe to form ferruginous ferricrete. Lags consist of lithic fragments, Fe gravels, Fe granules and quartz. Forms pediments, footslopes and minor erosional plains.*
CHei1	*Colluvial fan and sheetflow deposits consisting of medium to fine ferruginous quartzose sand, lithic fragments, quartz and minor Fe nodules. Micaeous and feldspathic sand and gravel locally common. Sediments generally < 2 metres thick over saprolite. Forms low angle colluvial fans and pediments.*
CHei2	*Colluvial sheet flow sediments and minor alluvium consisting of ferruginous sand, Fe and lithic gravels over mottled saprolite. Fe nodules and ferruginous lithic gravel lags are common. Forms pediments and colluvial footslopes down slope from highly ferruginous erosional scarps.*
CHep	*Sheetflow deposits consisting of medium to fine ferruginous quartzose sand, in places scattered ferruginous nodules and lithic fragments. In places micaeous sand and medium textured clays. Reworked aeolian sand and local residual sand and clay. In places alluvial sediments covered by colluvial sand. Forms extensive sheetwash colluvial plains and erosional plains.*
CHep1	*Sheetflow and minor alluvial deposits consisting of ferruginous fine to coarse quartzose sand and sandy clays. Aeolian sand reworked by sheetflow processes. Quartz, lithic, ferruginous gravel/granular lags. Residual quartzose sand. Miceous sands locally common. Subcrop, saprolite typically within 2 metres of surface. Forms extensive low relief colluvial covered erosional plains and minor depositional plains.*
CHep2	*Sheetflow deposits consisting of Fe nodules and granules over medium to fine ferruginous quartzose sand. Reworked aeolian sand and local alluvial sediments. Residual sand and clay. Highly weathered ferruginous saprolite or Fe duricrust likely to be within 2m of the surface. Lags sonsist of Fe nodules and granules and minor quartz. Forms sheetwash colluvial sediments on erosional and depositional plains.*
CHep3	*Sheetflow ferruginous sands, reworked aeolian sands and lags consisting of Fe granules and minor Fe gravels. Ferruginous sands are generally < 2 metres thick over gravelly soils, highly ferruginous collapsed saprolite and Fe duricrust. Saprolite at depth is typically highly ferruginous and mottled. Forms erosional plains and rises.*
CHep4	*Thin cover (generally < 1 metre) of sheet flow ferruginous sand, Fe nodules and gravels over Fe duricrust or saprolite. Saprolite typically highly ferruginous and mottled at depth. In places ferruginous lithic fragments and Fe nodules are cemented by Fe to form ferruginous duricrust. Ferruginous lithic and Fe nodular lags common. Minor quartz lag. Forms erosional plains and lag covered colluvial plains.*
CHep5	*Highly ferruginous sheetflow colluvial sands (typically less than .5 metre) and gravels over Fe duricrust, ferruginous and mottled saprolite. Minor pockets of alluvial clay and sand. Fe gravel and granule lags common, minor quartz lag. In places exposed Fe duricrust forming indurated pavements. Forms rises and erosional plains.*
CHep6	*Residual and sheetflow colluvial quartzose sand over highly weathered saprolite. In places ferruginous and lithic gravel lags. Aeolian sand reworked by sheetflow processes. Residual sand overlie highly weathered mottled saprolite. Saprolite typically within 1-2m of surface. Forms low relief erosional plain.*

Saprolite

SVee	*Escarpment exposing highly weathered ferruginous saprolite. Fe duricrust forms indurated breakaways. Fe duricrust consist of collapsed highly ferruginous saprolite (commonly weakly horizontally layered) with local Fe segregation developing within the upper part of the mottled zone. Down slope from scarps saprolite largely covered by ferruginous lags and colluvium. Forms escarpments, pediments and minor rises.*
SVep	*Saprolite largely covered by a veneer of lithic fragments, gravel lags and ferruginous sand. Minor alluvial sediments. Lags consist of lithic fragments, Fe gravels and quartz. In places mottled and bleached saprolite exposed at surface. Forms erosional plains and rises.*
SVep1	*Bleached and ferruginous saprolite partly covered by ferruginous sand and Fe gravelly lags. Residual clay soils common. Forms dissected rises (9-30m relief).*
SVep2	*Thin cover (typically < 0 .4 metre) of sheetflow sediments consisting of ferruginous sand and clay over mottled saprolite. Lags consist of quartz, lithic fragments and Fe gravels/granules. Residual clay soils common .In places exposed iron stained saprolite. Forms erosional plains and rises.*
SVep3	*Veneer of highly ferruginous lithosols, sand and lags over ferruginous saprolite. In places exposed saprolite forming stony pavements. Lags consist of ferruginous lithic fragments, Fe granules and quartz. Pockets of collapsed saprolite cemented by iron. Saprolite is typically highly weathered and mottled. Forms lag and sand covered erosional plains and rises.*
SVep4	*Highly ferruginous saprolite with patches of Fe duricrust cementing collapsed saprolite. Saprolite partly covered by lithosols. Forms flat topped hills and rises. Likely to reflect old palaeo-landsurface.*
SVer	*Highly ferruginous saprolite partly covered by ferruginous lags consisting of lithic fragments, Fe gravel and Fe granules. Stony lithosols and ferruginous sand. Pockets of ferricrete and Fe duricrust cementing the top of the saprolite. Saprolite is typically highly weathered and mottled. Forms rises and highly ferruginous plateaux.*
SHer	*Ferruginous saprolite, partly covered by lags, stony lithosols and sheetflow sand. Local patches of Fe duricrust cementing the top of a collapsed residual profile. Ferruginous lithic and quartz lags. Forms rises (9-30m relief).*
SMee	*Moderately weathered bedrock partly covered by lithic lags and colluvial sand. Feldspathic and micaeous sands and gravels common. Forms actively eroding escarpment, pediments and minor rises.*
SMel	*Ferruginous saprolite and moderately weathered bedrock partly covered by lithosols and Fe lags. Colluvial footslope deposits of gravel and sand adjacent to and down slope from hills. Saprolite retains original structure. Local patches of highly ferruginous collapsed saprolite. Forms low hills (30-90m relief) and hills.*

REGOLITH CODES

A	*Alluvial deposits*
L	*Lacustrine sediments*
IS	*Aeolian sediments*
CH	*Sheet flow deposits*
SV	*Very highly weathered bedrock*
SH	*Highly weathered bedrock*
SM	*Moderately weathered bedrock*

MINERAL OCCURRENCES

◇	*Au*
◆	*Cu*
◆	*U*
△	*Au, Cu*
◆	*Fe*

LANDFORM CODES

ap	*Alluvial plain*
ee	*Escarpment*
eh	*Hills*
ei	*Pediment*
el	*Low hills*
ep	*Erosional plain*
er	*Rises*
fc	*Colluvial fan*
pd	*Depositional plain*
pp	*Playa plain*
ul	*Dune field*

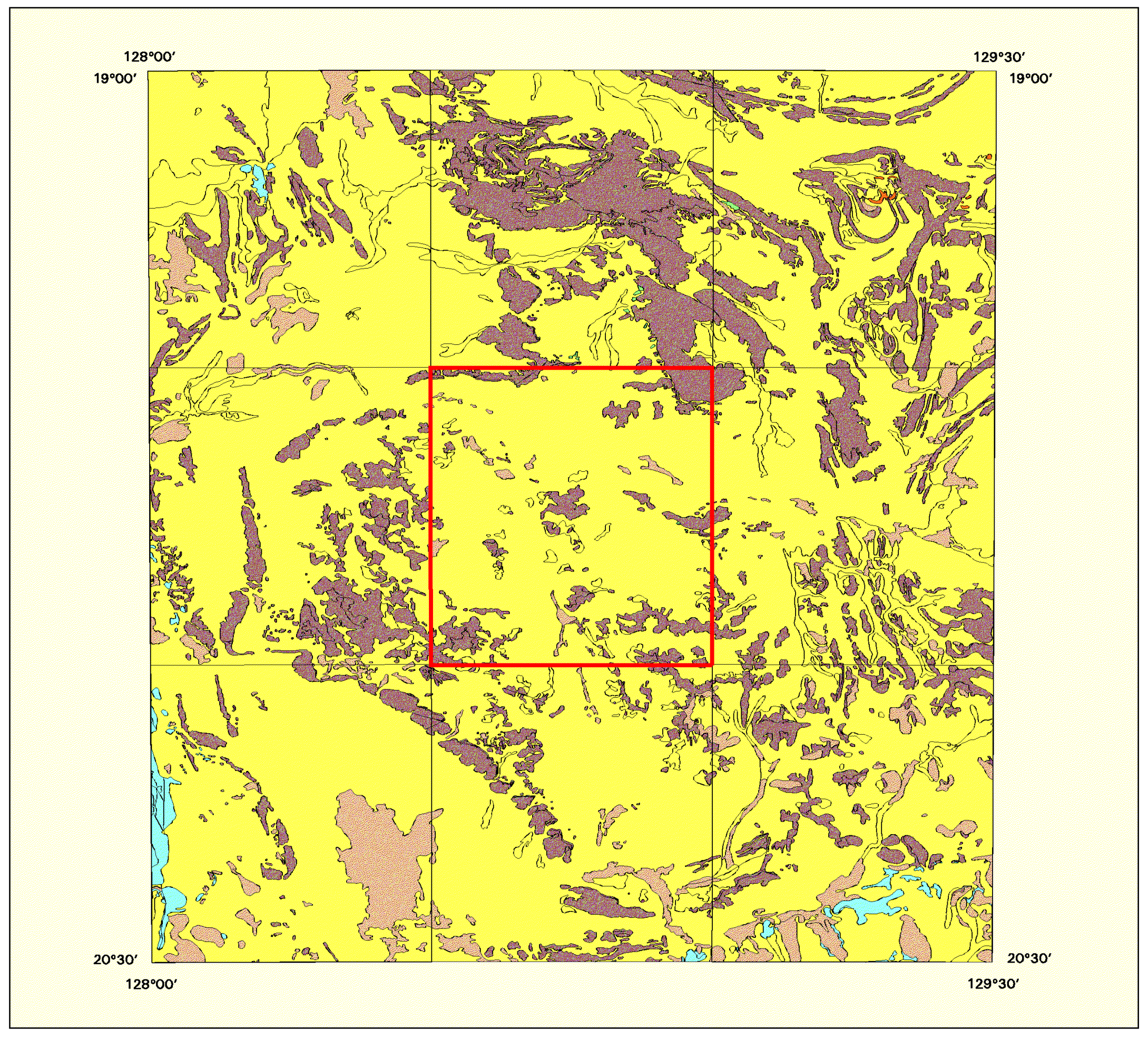
───	*Regolith-landform unit boundary*
─▲─▲─	*Erosional scarp*
- - - -	*Palaeodrainage (approximate)*
───	*Longitudinal sand dune*
━━━	*Secondary road*
───	*Minor road*
- - - -	*Vehicle track*
───	*Drainage*

Gold (Au) geochemistry from 1972 stratigraphic drilling by AGSO. Bottom hole sample analysed.

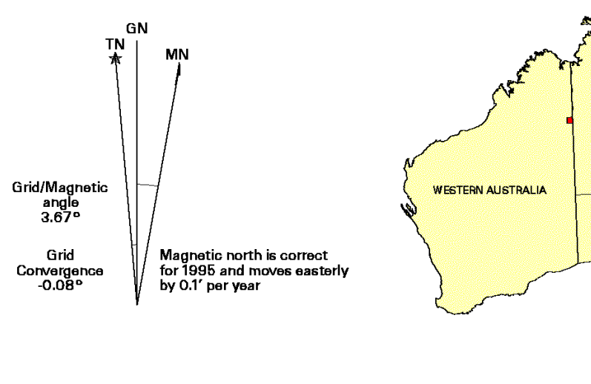
●	*> 15 ppb Au*
●	*9 - 15 ppb*
●	*5 - 9 ppb*
●	*< 5 ppb*

REGIONAL GEOLOGY

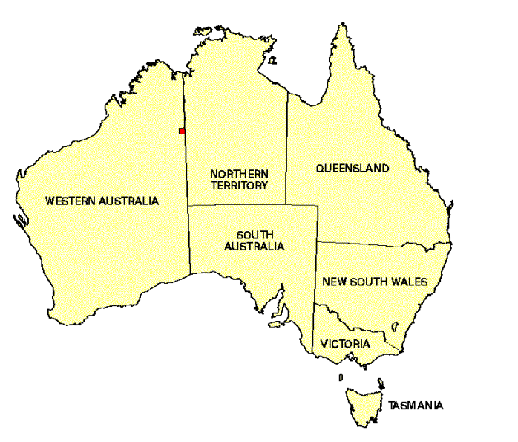
SCALE 1:1,000,000



🟨	*QUATERNARY - Colluvium, alluvial, lacustrine and aeolian sediments.*
▨	*TERTIARY - Highly weathered bedrock, ferricrete, silcrete, and calcrete.*
🟩	*MESOZOIC - Sandstone, siltstone, conglomerate, and laterite.*
▨	*PALAEOZOIC - Sandstone, siltstone, mudstone, limestone, and dolomite.*
▨	*MIDDLE CAMBRIAN - Dolomite, siltstone, sandstone and claystone.*
🟧	*LOWER CAMBRIAN - Tholeiitic basalt, tuffaceous sands, and lithic arenite.*
▨	*PROTEROZOIC - Arenite, conglomerate, siltstone, limestone, schist, amphibolite, adamellite, granodiorite and pegmatite.*


GN
TN
MN
Grid/Magnetic angle 3.67°
Grid Convergence -0.08°
Magnetic north is correct for 1995 and moves easterly by 0.1' per year

MAP LOCALITY



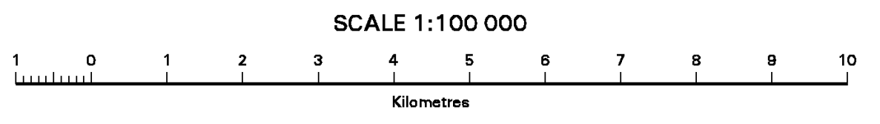
INDEX TO 1:100 000 MAPS
1:250 000 maps shown in blue

127°30' 19°00' — 130°30' 19°00'

WOLF CREEK 4459	STURT CREEK 4559	SLATEY CREEK 4659	MALLEE 4759	BREADEN 4859	WILSON CREEK 4959
	BILLILUNA SE52-14			TANAMI SE52-15	
MUELLER 4458	BALWINA 4558	WATTS 4658	PARGEE 4758	TANAMI 4858	BUCK 4958
BALGO 4457	KEARNEY 4557	LEWIS 4657	MC FARLANE 4757	FRANKENIA 4857	PTILOTUS 4957
	LUCAS SF52-02			THE GRANITES SF52-03	
STRETCH 4456	THOMAS 4556	LUCAS 4656	PEDESTAL HILLS 4756	INNINGARRA 4856	GRANITES 4956

21°00' 127°30' — 21°00' 130°30'

SCALE 1:100 000



UNIVERSAL TRANSVERSE MERCATOR PROJECTION
Horizontal Datum: WGS84 AMG Zone 52

Compiled by J.R.Wilford (CRC LEME/AGSO), 1999
Cartography by D.Butrovski (CRC LEME/AGSO), M.Ratajkoski (AGSO) and T.Brennan (CRC LEME/AGSO), 1999
GIS by D.Butrovski and T.Brennan (CRC LEME/AGSO), 1999
Image Processing by J.R.Wilford and D.Butrovski (CRC LEME/AGSO), 1999

It is recommended that this map be referred to as: Wilford, J.R. and and Butrovski, D., Tanami Granites Regolith-Landforms Map Series; (1:100,000 map scale).

Published by CRC LEME, Canberra, Australia

© CRC LEME 1999
This work is copyright. Apart from any fair dealings for the purpose of study, research, criticism or review, as permitted under the Copyright Act, no part may be reproduced by any process without written permission. Copyright is the responsibility of the Director, CRC LEME.

Enquiries relating to this map should be directed to:

The Publication Officer
CRC LEME
c/- CSIRO Division of Exploration and Mining
Private Mail Bag
Post Office, WEMBLEY W.A. 6014
Tel:(08) 9333 6272, Fax: (08) 9333 6146

Digital Elevation Model (DEM) information shown on this map has been derived from GEODATA DEM-9S © Commonwealth of Australia 1996 by permission of the Australian Land Information Group (AUSLIG), Department of Industry, Science and Resources, Canberra.

Restricted Circulation

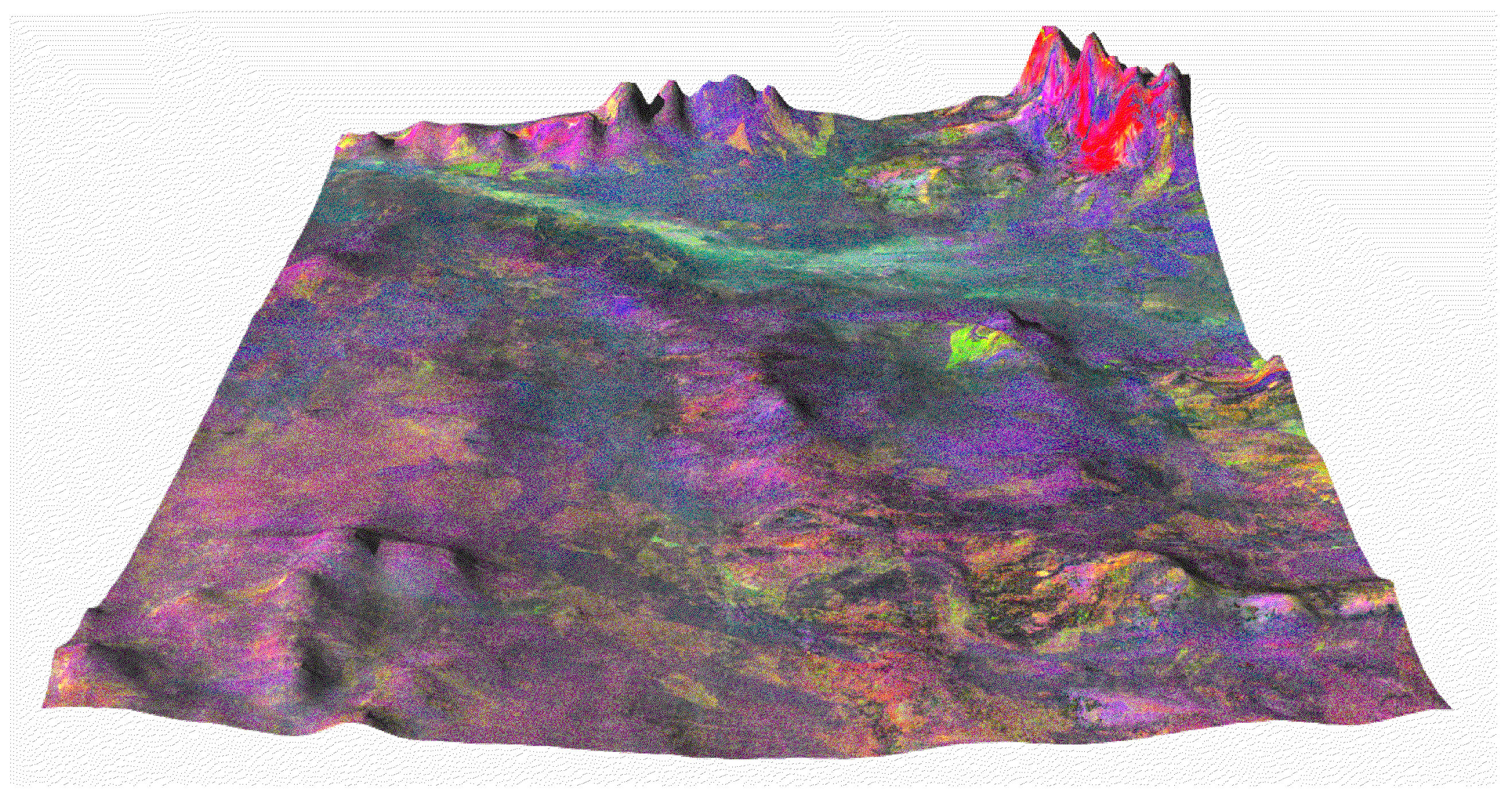
This map is not to be given additional distribution or be cited in other documents without the consent of the Director of the Cooperative Research Centre for Landscape Evolution and Mineral Exploration (CRC LEME)

The Director
CRC LEME
c/- CSIRO Division of Exploration and Mining
Private Mail Bag
Post Office, WEMBLEY W.A. 6014
Tel:(08) 9333 6272, Fax: (08) 9333 6146

CRC LEME has tried to make the information in this product as accurate as possible. However, it does not guarantee that the information is totally accurate or complete. Therefore, you should not rely solely on this information when making a commercial decision.

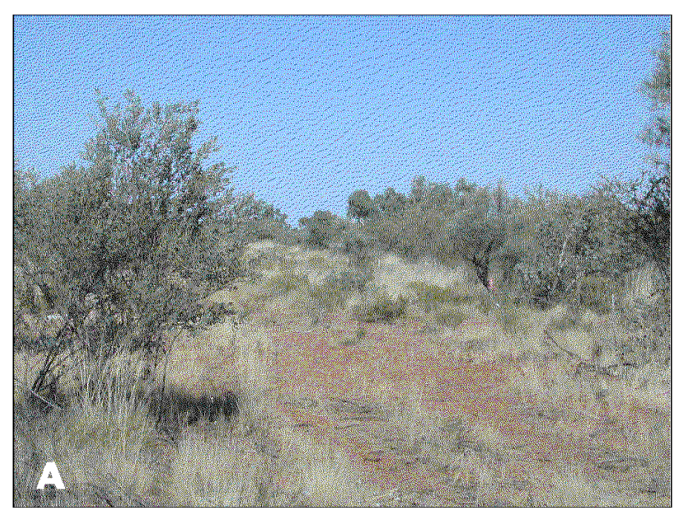
CRC LEME is an unincorporated joint venture between the Australian National University, University of Canberra, Australian Geological Survey Organisation and CSIRO Exploration and Mining, established and supported under the Australian Government's Cooperative Research Centres' Programme.

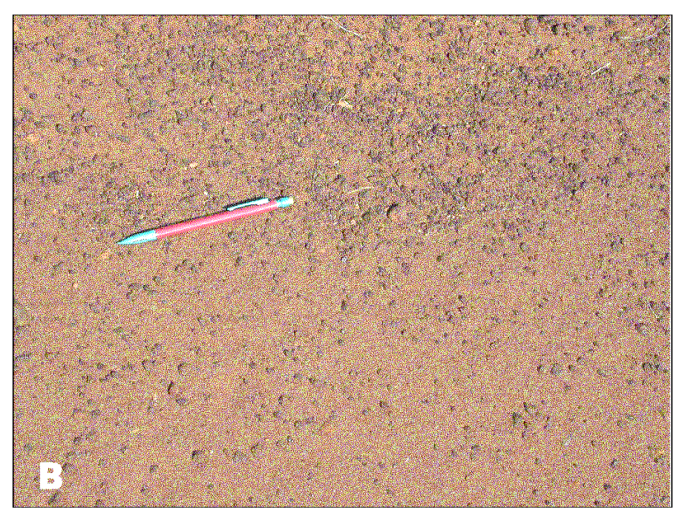
3-D LANDSCAPE PERSPECTIVE

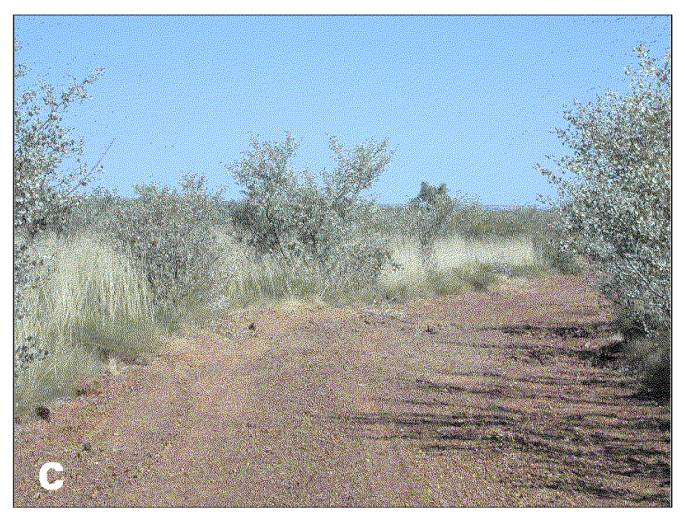


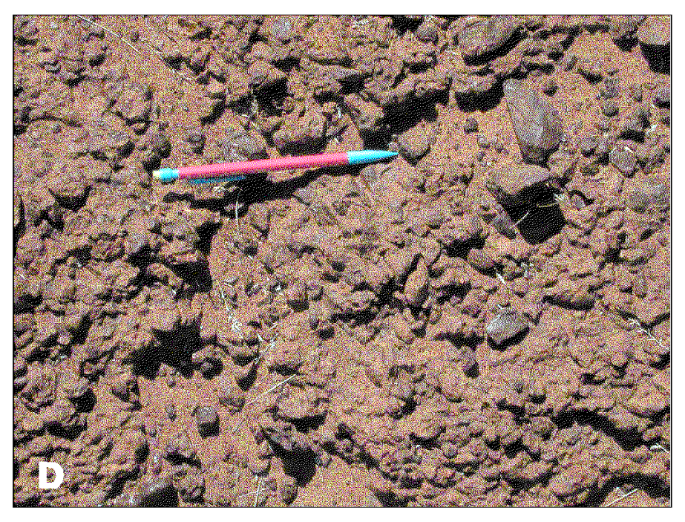
Landsat TM Directed Principal Components / Band Ratio draped over a Digital Elevation Model (40x vertical exaggeration)

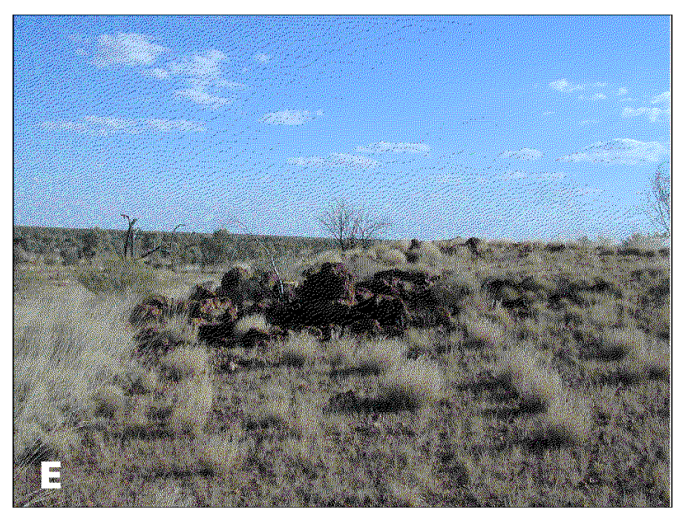
Note: A Directed Principal Component Analysis (DCPA) technique is used to enhance Landsat TM imagery.
The DCPA is used to separate clays in the imagery by deriving principal components from ratios of bands 4/3 and 5/7.
Ratio 4/3 enhances green vegetation and ratio 5/7 enhances a mixed response of vegetation and clay.
The DCPA operating on these band ratios is able to separate the vegetation from the clay response.
The 'clay' band (derived from the second principal component) was then combined with a ratio of bands 5/4 and 1+7 in a colour composite image. Ratio 5/4 highlights ferruginous materials and bands 1+7 highlight silica-rich materials. The final image was displayed as a three band composite image with clay in red, iron oxides in green and silica in blue.

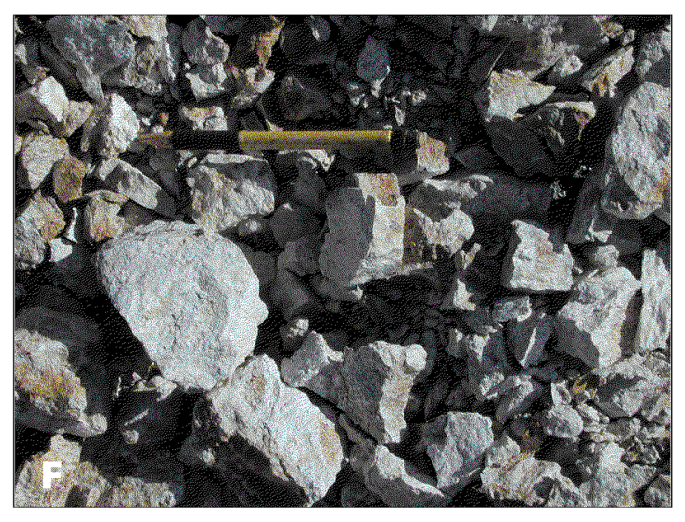

A


B


C


D


E


F

Subtle variation in the composition and thickness of colluvial sediments over saprolite are separated using airphotos and eTh concentration. Fine Fe granular lags over ferruginous colluvial quartzose sand (A - landscape and B - lags) are delineated by moderate eTh concentrations over sheetflood sand plains. Thin Fe lags and ferruginous sand over

Fe duricrust (C - landscape and D - Fe duricrust) are delineated by high eTh concentrations on erosional plains. Highly weathered ferruginous and silicified saprolite (E) forming local erosional scarps. Bleached and silicified saprolite (F) with diffuse iron staining below palaeochannel alluvium.

CRCLEME
Cooperative Research Centre for
Landscape Evolution & Mineral Exploration

WATTS
REGOLITH-LANDFORM MAP SERIES
FOR ACACIA RESOURCES, NORMANDY NFM
AND OTTER GOLD NL
FIRST EDITION FEBRUARY 2000
http://leme.anu.edu.au/

Restricted Circulation
CONFIDENTIAL