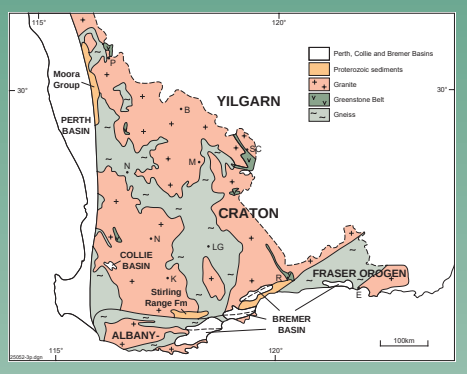
GEOLOGY, PHYSIOGRAPHY AND SOILS OF WHEATBELT VALLEYS

Geological evolution

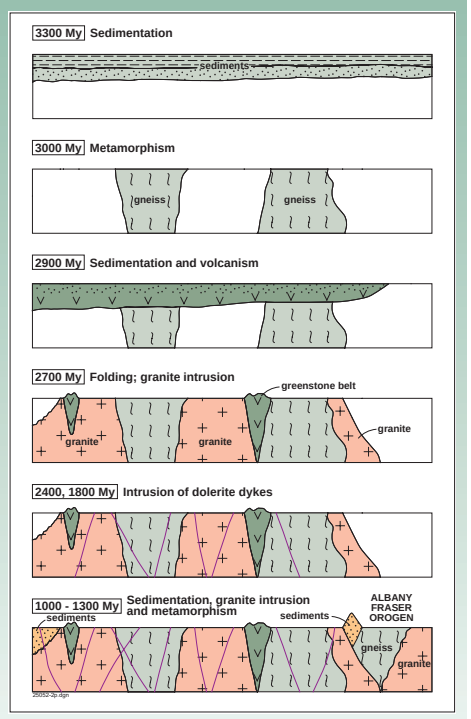
Simplified geological map of the Wheatbelt

The granite, gneiss and greenstone rocks underlying the wheatbelt are some of the world's oldest rocks.



Formation of the crystalline basement rocks

	Million years ago (My)
1 Earliest sediments were formed	3300
2 Folding and metamorphism by heat and pressure to form some of the gneiss areas	3000
3 Extrusion of volcanic lavas and formation of sediments	2900
4 Folding into the gold and nickel bearing greenstone belts, accompanied by granitic intrusions and further gneiss formation,	2700-2500
5 Intrusion of several phases of dolerite dykes	2400,1800
6 Sedimentary rocks were deposited on the western and southern margin of the Yilgarn Craton. Further metamorphism and granite intrusion along the south coast to form the Albany-Fraser Orogen	1300-1000



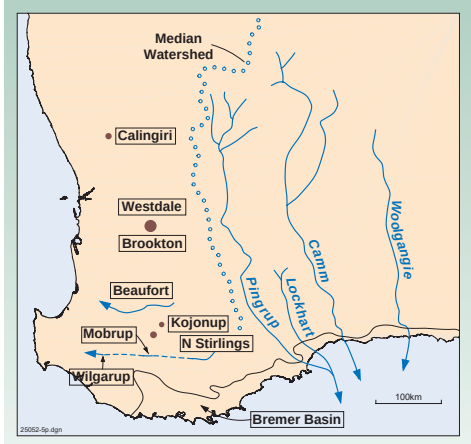
Drainage history

Part of a super continent

150 million years ago, Australia was joined to India and Antarctica in a super continent known as Gondwana.

A different drainage pattern?

When Antarctica separated from Australia between 120 and 50 million years ago, ancient rivers from the wheatbelt, between the median and central watersheds, may have flowed south into the southern ocean.



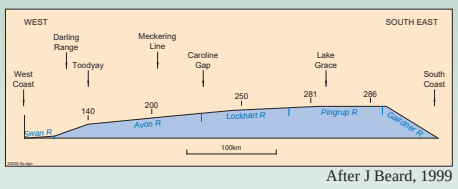
Remnants of old drainage systems

Sediments of Eocene age (45my) can be found in localities west of the median watershed, and occur in deeply buried palaeochannels (old river beds).

Present day drainage

In the Zone of Ancient Drainage, the old valleys are filled with sediments and occupied by discontinuous chains of salt lakes.

Rejuvenated rivers have cut back from the west and south coasts, the Avon River capturing the rivers in the Zone of Ancient Drainage, where it passes through the median watershed.



After J Beard, 1999

Low gradients

Valleys in the Zone of Ancient Drainage have very low gradients, the Pingrup-Lockhart Rivers falling only about 30 metres in 150 kilometres.

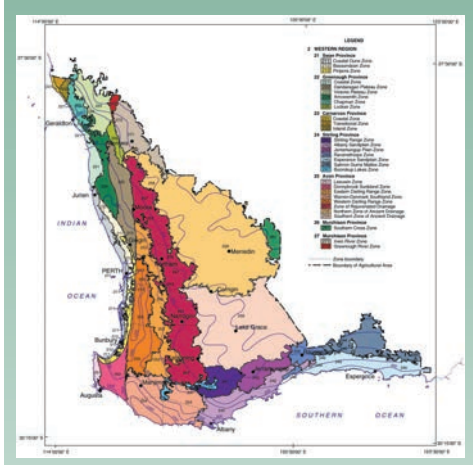
Valley soils

Soil-Landscape Zones

Most of the Wheatbelt is within either the Northern Zone (around Merredin) or the Southern Zone (Lake Grace) in the Zone of Ancient Drainage.

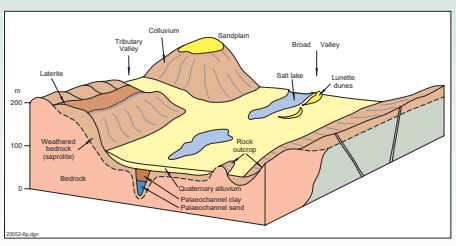
The Northern Zone is characterised by red calcareous clay or loams in the valleys contrasting with the Southern Zone where sandy duplexes are more common.

A Zone of Rejuvenated Drainage extends from Katanning to Moora in the western Wheatbelt.



Broad valleys

The broad valleys of the Wheatbelt are formed largely over sediments (up to 20 metres thick) and weathered basement rock (saprolite). Palaeochannels (dark blue) with deeper sediments (down to 70 metres) occupy only a small proportion of the broad valley floors.

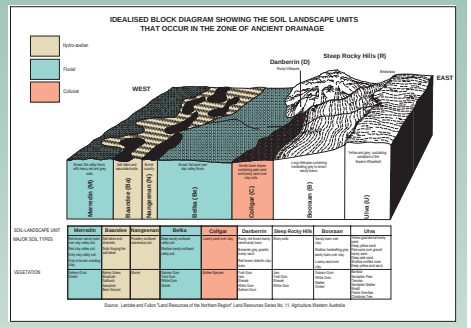


Soils

The salt lake landscape in the valley bottoms (beige) has been formed by the action of both wind and water, and consists of relict lunette dunes, composed of either sand or clays, and flat to undulating plains of clay with finer sediments blown out greater distances forming discontinuous areas of 'morrel' soils.

The fluvial landscapes (green), derived from water-borne sediments, are heavy textured, calcareous, with red or grey calcareous clays or loamy duplexes, often with crabholes (gilgai) in the north. Sandy duplexes which are calcareous and alkaline at depth are more common in the south.

Colluvial landscapes (brown) on the edge of the broad valleys are dominated by sandy surfaced duplex 'mallee soils', with the depth of sand increasing downslope.

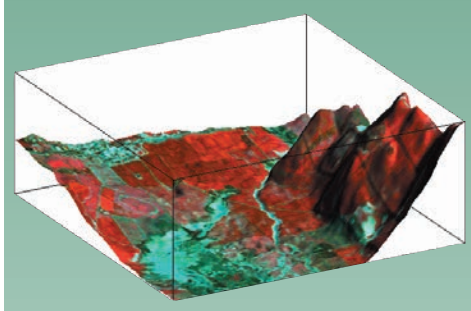


Source: Lantzke and Fulton 'Land Resources of the Northern Region' Land Resources Series No. 11, Agriculture Western Australia

Land Monitor

New ways of looking at the landscape

New insights into the landscape can be obtained by using computers to combine remotely sensed data from satellite and aerial surveys with a digital elevation model (DEM).

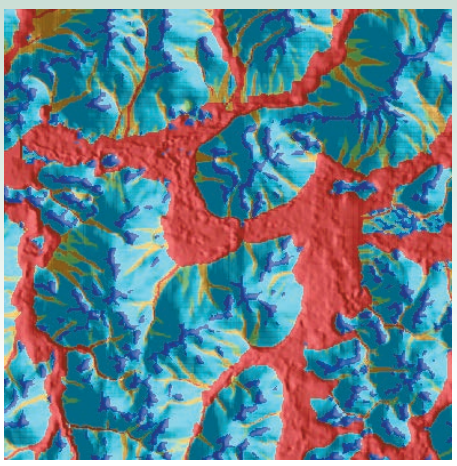


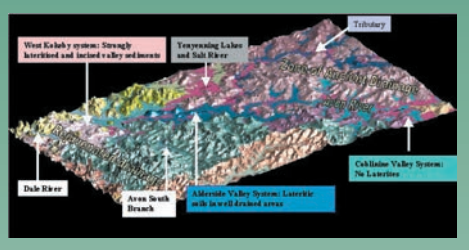
Looking at crops

Visible and infra red data from Landsat TM draped over a digital elevation model (DEM) distinguishes vigorous crop and pasture growth (red) from saline areas (blue-green).

Landform Partitioning

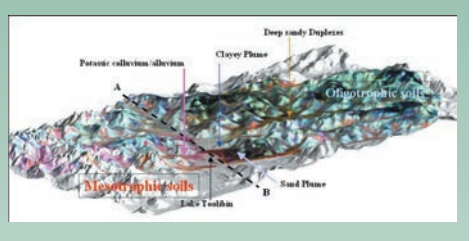
Landforms can be automatically classified with the digital elevation model according to slope and curvature, distinguishing the extent of broad valleys (red) and lower or tributary valleys (yellow). Hilltops are shown in dark blue and upper slopes in light blue.





Soils system mapping

Looking north across the Avon River - soils systems mapping 'draped' over the DEM shows the relation of soils with landscape position. Salinity in the valleys, for instance at Yenyenning Lakes, is mapped in red.



Geological controls on soils

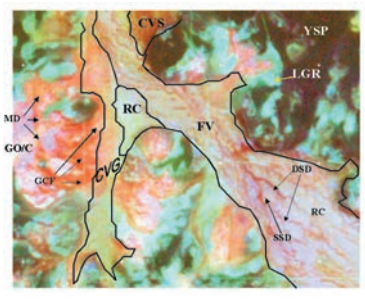
Combining radiometric data from airborne gamma–ray spectrometry with a sun-shaded DEM shows the topographic and geological controls on soil formation.

Rocky hills with weakly developed soils shown by higher concentrations of potassium (red and pink) are distinguished from areas of deeper weathered regolith, with residual or colluvial soils shown by uranium (blue) and thorium (green).

Radiometric data

Detailed radiometric data measuring potassium (red), uranium (blue) and thorium (green) from Elashgin Catchment NE of Corrigin allows mapping of soils on a paddock scale.

The flat trunk valley (FV) shows 'rivers' of deep sandy duplexes (DSD) and sandy and loamy duplexes on interfluves (SSD) with bright white areas of loamy duplexes (RC) away from areas of active flow.



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