October 2000
Vol. 4, Number 4

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Western Wildlife

LAND FOR WILDLIFE

NEWSLETTER OF THE *LAND FOR WILDLIFE* SCHEME

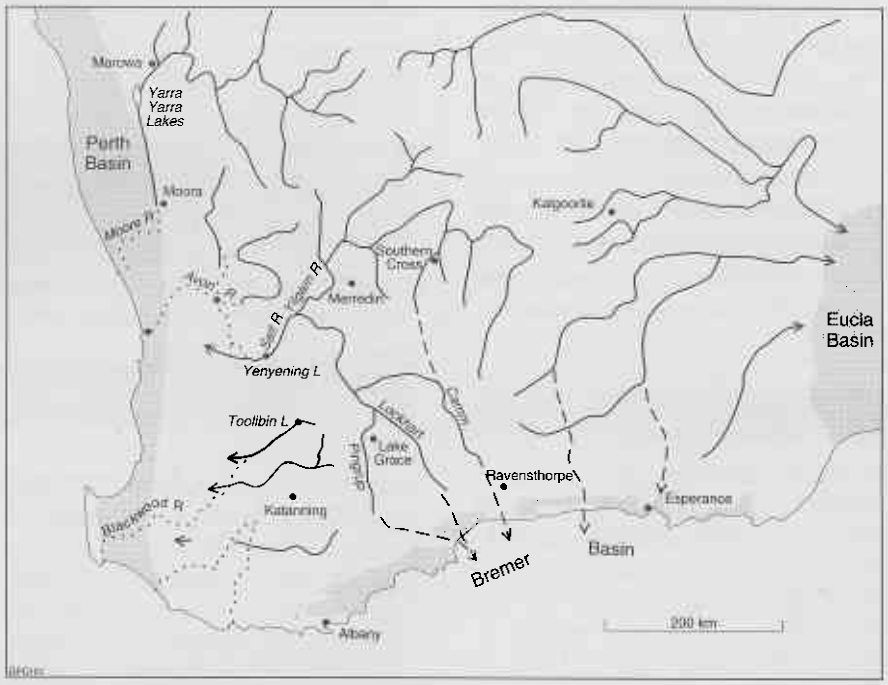
REGISTERED BY AUSTRALIA POST PRINT POST: 606811/00007

ANCIENT RIVERS IN THE WHEATBELT

by Philip Commander

THE flood in the Avon catchment in January this year demonstrated that rivers still flow in the normally internally draining wheatbelt when heavy rain centred on Corrigin and Hyden connected Lake Grace to the sea through the Lockhart River. An event of this magnitude may be only once in a generation, but illustrates the longer timescale of geological and geomorphic processes. In former times the wide flat valleys and salt lakes in the interior of South-West Western Australia were traversed by large rivers which formed the present landscape, but under the current climate exceptional intense rainfall is needed for runoff to occur.

These major valley systems preserved on the Darling Plateau are now filled with as much as 60 m of sediments, and are occupied by discontinuous chains of salt lakes. Not only are we in a comparatively dryer climatic phase, but uplift and tilting of the land has reduced the erosive power and led to increased sedimentation especially in north sloping valleys. The valleys are known as palaeodrainages (palaeo=old), and were first named by John Beard in the 1970s, in the course of vegetation mapping. In the intervening years, more information has come to light on the nature of the sediments and their history, and how they form a relict drainage pattern in the interior of the Australian continent.



Palaeodrainages are shown in solid lines, with possible southward courses dashed: modern rivers are dotted where they depart from the palaeodrainages

The landscape in the south west is ancient – essentially dating back to the Cretaceous Period (as much as 65 million years ago [mya]) when Australia was joined to Antarctica. The last major period of erosion may have been as long ago as the Lower Cretaceous (110mya), judging by the presence of the youngest terrestial sedimentary rocks deposited to the west in the Perth Basin and to the east in the Eucla Basin. Since that time, sediments surrounding the granite-greenstone Yilgarn Craton have mainly been of marine origin. By the Eocene (45mya) when Australia and Antarctica had parted company, many of the rivers ceased to erode downwards and the valleys began to fill with sediments.

The seaway opened up between the two continents is now part filled with sediments in the Bremer Basin – exposed in the Fitzgerald National Park and represented by spongolite and marine erosion benches at Mt Barren. The short south coast drainages have modified the previous systems, cutting off the headwaters of the Camm, Lockhart and Pingrup Rivers. Beard suggests

continued on page 3

October 2000
Vol. 4, Number 4

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Western Wildlife

NEWSLETTER OF THE *LAND FOR WILDLIFE* SCHEME

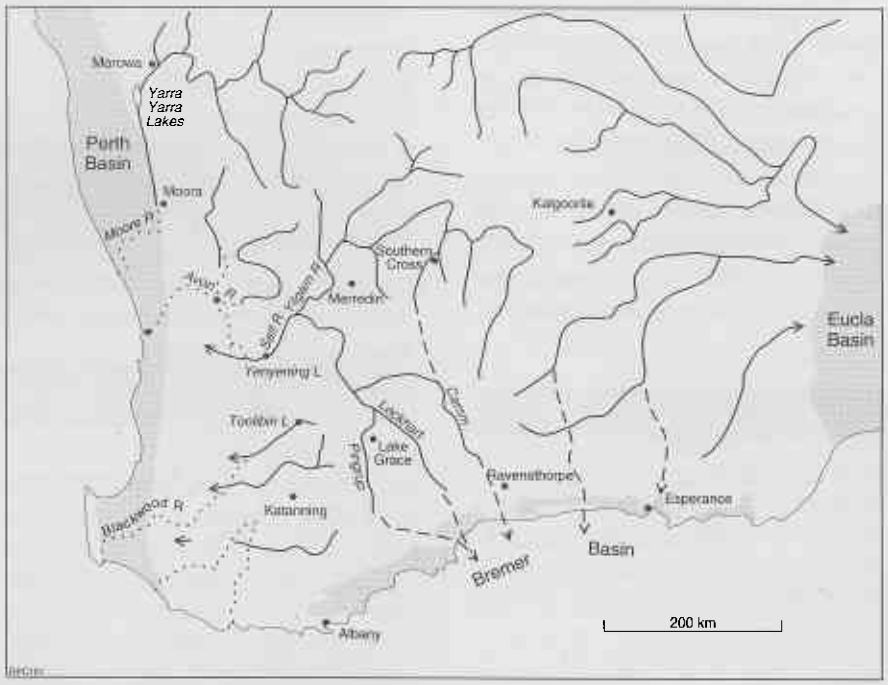
REGISTERED BY AUSTRALIA POST PRINT POST: 606811/00007

ANCIENT RIVERS IN THE WHEATBELT

by Philip Commander

THE flood in the Avon catchment in January this year demonstrated that rivers still flow in the normally internally draining wheatbelt when heavy rain centred on Corrigin and Hyden connected Lake Grace to the sea through the Lockhart River. An event of this magnitude may be only once in a generation, but illustrates the longer timescale of geological and geomorphic processes. In former times the wide flat valleys and salt lakes in the interior of South-West Western Australia were traversed by large rivers which formed the present landscape, but under the current climate exceptional intense rainfall is needed for runoff to occur.

These major valley systems preserved on the Darling Plateau are now filled with as much as 60 m of sediments, and are occupied by discontinuous chains of salt lakes. Not only are we in a comparatively dryer climatic phase, but uplift and tilting of the land has reduced the erosive power and led to increased sedimentation especially in north sloping valleys. The valleys are known as palaeodrainages (palaeo=old), and were first named by John Beard in the 1970s, in the course of vegetation mapping. In the intervening years, more information has come to light on the nature of the sediments and their history, and how they form a relict drainage pattern in the interior of the Australian continent.



Palaeodrainages are shown in solid lines, with possible southward courses dashed: modern rivers are dotted where they depart from the palaeodrainages

The landscape in the south west is ancient – essentially dating back to the Cretaceous Period (as much as 65 million years ago [mya]) when Australia was joined to Antarctica. The last major period of erosion may have been as long ago as the Lower Cretaceous (110mya), judging by the presence of the youngest terrestial sedimentary rocks deposited to the west in the Perth Basin and to the east in the Eucla Basin. Since that time, sediments surrounding the granite-greenstone Yilgarn Craton have mainly been of marine origin. By the Eocene (45mya) when Australia and Antarctica had parted company, many of the rivers ceased to erode downwards and the valleys began to fill with sediments.

The seaway opened up between the two continents is now part filled with sediments in the Bremer Basin – exposed in the Fitzgerald National Park and represented by spongolite and marine erosion benches at Mt Barren. The short south coast drainages have modified the previous systems, cutting off the headwaters of the Camm, Lockhart and Pingrup Rivers. Beard suggests

continued on page 3

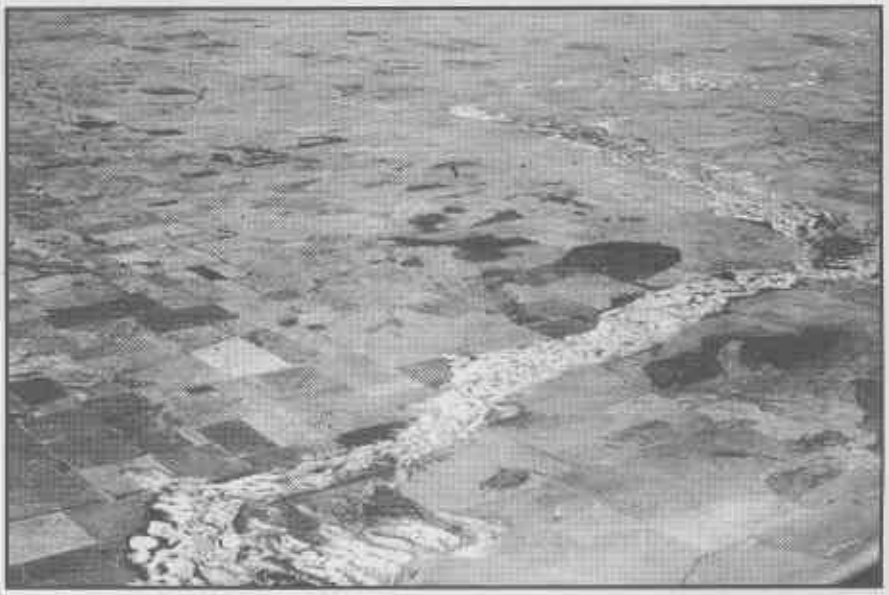
Ancient Rivers continued from page 1

that these once flowed southwards, and have been reversed, with capture at Caroline Gap where the Yilgarn and Lockhart Rivers join. Other west flowing palaeodrainages have been captured by the Blackwood, Avon and Moore Rivers.

The bottoms of these valleys are referred to as palaeochannels, as they contain the sand laid down in former river beds during the Eocene (about 45mya). They are generally less than a kilometre wide, and occupy a small proportion of the broad flat valleys. The palaeochannels are completely concealed, and must be found with geophysical methods using the difference in gravitational electrical properties with the surrounding bedrock. Some of the Wheatbelt valleys, especially the west flowing ones, seem to be much younger. At Yenyening, Toolibin, and Yarra Yarra Lakes, the spores and pollen in the valley sediments indicate a Pliocene age (5mya), and the Eocene sediments have been eroded and are preserved high in the landscape in the Darling Range.

The low gradients and lack of surface outflow result in groundwater discharge within the valleys. The small amounts of salt brought in by rainfall have been concentrated over time, and groundwaters may commonly be six times the salinity of sea water, with salt deposits being formed in some of the salt lakes. Throughout the Quaternary (the last 1.5 mya), the salt lakes are likely to have expanded and contracted to take account of different rainfall and evaporation conditions during ice ages and interglacials. The balance of evaporation to salt lakes has now been upset by large scale clearing in the Wheatbelt. Greatly increased groundwater recharge has led to rising water levels in the valleys and expansion of the salt lake areas to account for increased evaporative discharge of groundwater. A consequence may be significant loss of valley floor vegetation if not reversed.

Pumping at Lake Toolibin is being trialled to see whether the saline water level can be lowered to protect the lake and its vegetation. The problem with pumping to lower the water table is that the sands in the palaeochannels occupy only a small proportion of the valley floors – less than a kilometre wide, and they are overlain by low permeability clay which does not allow water to pass through easily.



The Yilgarn River at the Caroline Gap, Mt Stirling (U-shaped darks blobs) to south, Mt Caroline (oval blob) to north.

The saline water in palaeochannels is important for gold ore processing at Southern Cross, and in the Eastern Goldfields, and may have possibilities elsewhere for saline aquaculture. Although most of the palaeodrainages in the wheatbelt also contain saline water, in the west some of the palaeochannels now abandoned by modern drainage lines, form dry valleys and contain fresh water. The Beaufort, from Boscabel to Towerrinning, and westwards, and the Avon west of Mt Kokeby near Brookton to Darkin Swamp are two of the largest systems found to contain fresh groundwater. The modern rivers such as the Blackwood, Avon and Moore drain saline water from the palaeochannels at a low rate, which contributes to their high salinity.

The palaeodrainages in the wheatbelt preserve a record of the past climate, and the response to changing conditions. It is our challenge to understand the changes resulting from our land use, and to create a landscape which will accept the increased surface and groundwater flow.

Further reading

Beard, J., 1999. Evolution of the river systems of the south-west drainage division, Western Australia. J. Roy. Soc. W.A. 82, 147-164.

Salama, R. B., 1997. Geomorphology, geology and palaeohydrology of the broad alluvial valleys of the Salt River System, Western Australia. Australian Journal of Earth Sciences 44, 751-765.

van de Graaff, W.J.E., Crowe, R.W.A., Bunting, J.A., and Jackson, M.J., 1977. Relict early Cainozoic drainages in arid Western Australia. Zeitschrift für Geomorphologie N.F. 21, 379-400.

Waterhouse, J.D., Commander, D.P., Prangley, C., and Backhouse, J., 1995. Newly recognised Eocene sediments in the Beaufort River Palaeochannel. Western Australia, Geological Survey, Annual Review 1993-94, 82-86.

Philip Commander is a hydrogeologist with the Water and Rivers Commission.
He can be contacted on <philip.commander@wrc.wa.gov.au>