THE EVOLUTION OF THE YARRA RIVER
Report on excursion on Sun 23 April led by Lex Ferguson

This excursion covered the geological history of the Yarra River between Eaglemont and Yarra Glen. Though parts of the Yarra date back into the Mesozoic, the stretch we were looking at has all formed since about 21 million years ago, as our leader, Lex Ferguson, demonstrated during the day. In theory a river develops an "ideal" longitudinal profile with a rapidly-flowing youthful upper course in a V-shaped valley, a broad sideways-meandering mature middle course, and "old age" as it approaches the sea, when it has lost all erosive power and is depositing sediment on a broad flood plain. In reality, because of relative changes in sea level, faulting and uplift and volcanic activity, many rivers including the Yarra can exhibit these features "out of sequence" in their course and over time go through these stages repeatedly. Lex showed us how the Yarra had developed in this way over the last 21 million years and why the river changed its route to the sea from a more northerly course at that point in time.

There were 22 participants on the trip and we stopped at a number of sites. The Melway references are given for readers who may wish to visit these spots themselves.

Stop 1 The Boulevard, Eaglemont, Melway 32B7 Here the Yarra is in a broad mature-stage flood plain, only eroding laterally, if at all. Downward erosion is prevented by the knick point downstream at Dights Falls. The alluvium (or river sediment) is not very deep at about 10 m so this part of the valley was probably not ponded as a lake when lava blocked the river lower down. Lex has worked out the time sequence for the abandoned meanders in the immediate area; the Bolin Bolin Billabong was cut off about 1100AD as determined by Monash investigators. The river still floods and deposits the mud it is carrying which consists largely of silt-sized quartz (5-10 microns) and clay. Coarser sand is carried along the riverbed by saltation* but there is insufficient energy for this to be lifted over the banks at times of flood. The presence of coarser sand in bores etc is a good indicator of river channels. *Saltation comes from the Latin for *jump*; the sand grains are bounced along the riverbed.

Lex gave us a profile across the river valley at Heidelberg. At the highest level, around 80 m above sea level here, is the Nillumbik Peneplain (also called the Nillumbik Terrain or Palaeosurface). This represents a base level to which erosion had worn down the landscape by the end of the Cretaceous; the Silurian bedrock beneath this plain was deeply weathered during Palaeocene times about 65 million years ago. At Eaglemont the pallid zone of deeply weathered Silurian rocks was overlain by gravel, sands and white clay probably in the early Cainozoic. Obviously the Nillumbik Peneplain has been uplifted since then but this has happened unevenly, being about 20 m at Melbourne rising to 200 m at the foot of the Kinglake Plateau. It has been dissected by erosion but can be traced by the concordance of summit heights.

Two terraces are evident at Stop 1. At 60 m a.s.l. is a terrace cut into brown semi-weathered Silurian dating from about 23 million years ago and another at about 30 m (1-2 m.y.a.). These mark periods when the river was at former "mature" stages (see above) but

when something such as uplift triggered further down-cutting, these remnants of flood plain were left high above river level.

Stop 2 Finns Reserve, Templestowe, 33B3 After crossing the suspension bridge we climbed the opposite slope to see some terrace gravels dating from the Pliocene about 3 m.y.a. The gravel is granitic and poorly rounded so has come directly from a source such as Mount Donna Buang. Rainfall was higher during the Pliocene and the river consequently had more energy and carrying capacity.

Stop 3 Westerfolds Park, Templestowe, 33F2 Here we were able to stand at the top of a long gently falling slip-off slope with the river and undercut slope of the meander in the distance. This feature happens when uplift causes the river to down-cut in its meanders but the river continues to erode both sideways and downwards giving rise to an asymmetrical valley cross-section.

Lunch Stop, Warrandyte. A kayaking competition caused parking problems here so we went directly to Stop 4. We intended to see how the Yarra has cut a gorge and so is exhibiting youthful traits. Lex says that the best place to observe this is the part of Warrandyte State Park accessed from Jumping Creek Road, Melway 24A11.

Stop 4 Memorial Tower, Kangaroo Ground, 271G10 The tower stands on the site of a volcano dated at 21 m.y.a. It is lava from this volcano that flowed down part of the postulated former course of the Yarra stretching east-west from south of Yarra Glen to Campbellfield. The lava has preserved the river gravels beneath it in patches as far as Bundoora. At Campbellfield our leader has measured a gravel-filled riverbed 150 m wide by 20 m deep that only a river the size of the Yarra could have produced. The proto-Yarra would have turned south towards the sea along the low-lying Melbourne Warp after Campbellfield. The lava followed the prior course of the Yarra after it had been abandoned.

Stop 5 Kangaroo Ground Cemetery, 271K8 A road cutting reveals river gravels preserved beneath the basalt from the volcano above.

Stop 6 Skyline Road, Christmas Hills, 274B3 At this final stop we stood at the top of the imposing fault scarp of the Yarra Fault looking out over the mature-stage flood plains of Yarra Glen. It was the movement of this fault lifting the Nillumbik Terrain that blocked the Yarra's prior course and forced the river to find another route. It seems that the southern termination of the Yarra Fault in the vicinity of the northern end of the Brushy Creek Fault may have presented a weak point or point of reduced movement where the river could carve a new course through the uplifted block at Yering Gorge. Lex suggested that the fault displacement of at least 150 m would have happened in stages and the river was able to cut down at the same rate.

We are grateful to Lex Ferguson for elucidating the story of the Yarra River for us in such a clear and interesting way.

Rob Hamson