

### **3 GEOLOGY AND GEOMORPHOLOGY**

#### ***Geology***

The geology of the Avoca catchment is complex, with a history going back to early Palaeozoic times, involving deposition of considerable thickness of sediments, tectonic and igneous activity and erosion.

During the early Ordovician or Cambrian, deposition of sediments commenced, reaching a thickness of more than 3000 m. The sediments were folded and intruded by granitic rocks in Ordovician and Devonian times, causing contact metamorphism. Then followed a long period of erosion. In Tertiary times fluvial sediments were deposited and remnants of these are common. Volcanic activity during the late Tertiary produced small basaltic lava plains in the south-east. Since then, further dissection and deposition of alluvium on the flood plains have occurred. Further details can be found in Lawrence et al (1976).

The Geological Survey of Victoria has published maps at a scale of 1:250 000 for the whole area St Arnaud SJ 54-4 and Ballarat SJ 54-8.

#### ***Geomorphology***

Elevation differs by only 660 m from the highest to the lowest point in the catchment, and most of the area is of low relief. However, several geomorphic units, as shown in Figure 8, affect the slope gradients, soils, productivity and land deterioration hazards. The Pyrenees Range and Great Dividing Range constitute the steepest country with fast-flowing streams in rocky drainage lines. Intermediate zones, from steep hills to gently undulating plains, differ greatly in productivity and hazards. The flat alluvial plains are productive, with deep soils and a low erosion hazard. The geomorphic zones recognised are discussed below.

#### ***Mountains***

The Pyrenees Range extends from Mount Lonarch on the Great Dividing Range in the south northwards to St Arnaud, the highest point being Mount Avoca at an elevation of 760 m - some 500 m above the adjacent plains. Differential earth movements were responsible for the broad outlines of the Great Dividing Range and the Pyrenees Range. At the close of the Tertiary period, deep weathering and erosion reduced the uplifted section to its present elevation and rugged topography (J. J. Jenkin, personal communication).

#### ***Steep hills***

The topography is strongly influenced by differential resistance to weathering and erosion of the complexly folded and metamorphosed bedrock. Many summits of steep hills represent an old plain on Ordovician sandstones and shales dissected by tributaries of the Avoca River.

Many of the granites also remain as steep hills - for example Mount Kooyoora, Yowang Hill (locally known as Yawong Hill) and Mount Buckrabanyule. Associated with the granitic intrusions are the relatively steep metamorphic aureoles that have resisted weathering and erosion more than the adjacent granite mass or the non-metamorphosed Ordovician sediments.

#### ***Gentle hills***

Large areas of gently undulating hills occur on Ordovician sediments and to a lesser extent on granitic rocks, usually the result of planation by the major creeks or the Avoca River. The lower gradients lessen the erosion hazard of this landscape.

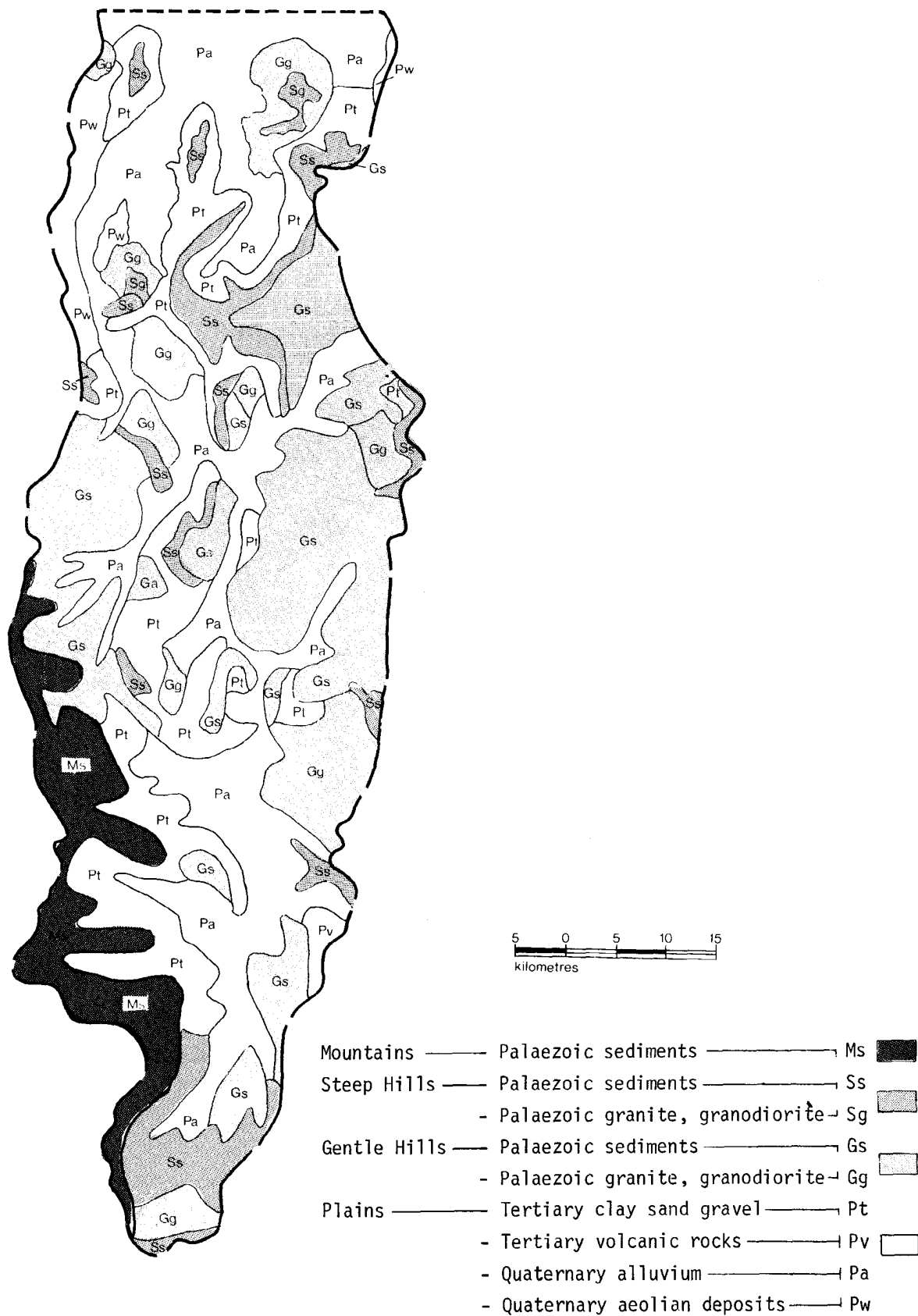
In granitic areas the subdued landscapes characteristically occur adjacent to steep hills with rock outcrop. In the south, metamorphic aureoles have protected the granitic areas from dissection.

#### ***Plains on Tertiary sediments***

During the Tertiary, large rivers dissected the highlands and laid down extensive beds of gravel, sand, clay and silt in broad valleys cut into the basement rocks. Dissection has continued and what were gravel beds in the Tertiary rivers now form the caps of residual hills. These occur regularly between St Arnaud and Amphitheatre.

Associated with parts of the Pyrenees Range, and most of the metamorphic aureoles, are long gentle alluvial aprons deposited as a series of Tertiary and Quaternary fans.

Figure 8 - Geomorphic zones in the Avoca catchment



In the Natta Yallock-Archdale area a large lake formed after the Avoca River was dammed back by a late Tertiary basalt flow. The Avoca found an outlet to the north and has since eroded out most of the lacustrine deposits and redeposited alluvium at least four times. The present course of the river through this area is not well defined, but the deep lead still takes water into the Loddon system.

### *Volcanic plains*

The only area of volcanic rocks in the catchment occurs in the south-east where basalt extruded in the Clunes area during Pliocene times flowed down Bet Bet Creek, cutting off the late Tertiary Avoca River from the Loddon River system (H. E. Wilkinson, personal communication).

### *Alluvial plains*

The broad Riverine Plain has a southerly extension into the Avoca Valley. A series of Quaternary sediments was deposited and eroded by north-flowing streams, producing terraced plains.

### *Plains with aeolian deposits*

Calcareous aeolian dust known as “parna” (Butler 1956) is thought to have blanketed the landscape in the north, including the undulating plains on the marine Parilla Sand. This landscape represents the eastern limit of the extensive Wimmera plains.