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Office of Minerals and Energy Resources South Australia
EARTH Resources
INFORMATION SHEET

VOLCANOES OF THE MOUNT GAMBIER AREA

INTRODUCTION

Volcanic activity occurred in the Mount Gambier area in recent geological time. The outbursts, which would have been spectacular, took place along the edge of the main zone of activity centred on southern and western Victoria, and southeastern South Australia.

The Blue Lake crater complex at Mount Gambier is only one of the better preserved examples of its type in Australia, and is a well-known scenic attraction. Less well known is the extent of volcanic activity, for at least 20 eruptive sites occur in this part of South Australia (Fig. 1).

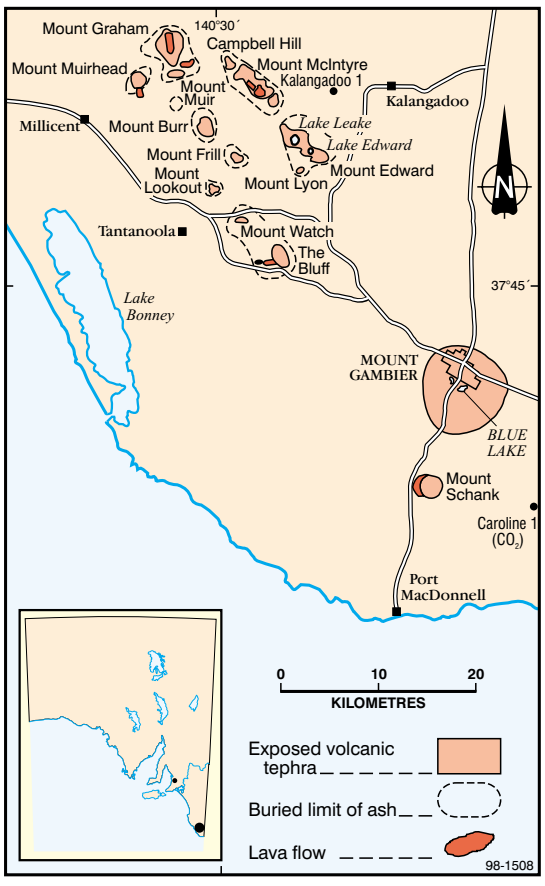

Fig. 1 *Volcanic centres in the Mount Gambier area.*

In most cases, the eruptions were along lines of crustal fissuring, starting with small flows of black basalt lava. The shallow regional water table led to interactions with the hot rock and eventually to the rapid accumulation of steam. Activity changed as the lava flows were followed by explosion craters and blowholes, from which thick deposits of ash and scoria were ejected.

Mount Schank and Mount Gambier represent the final phase of this activity and are the youngest volcanoes in Australia.

PAST ERUPTIONS

Dreamtime legends of the local Booandik Tribe of Aboriginals tell of the giant Craitbul and his family who wandered around the southeastern region looking for a place to settle and live in peace. They camped and made ovens at Mount Muirhead and Mount Schank but were frightened away from both sites by the moaning voice of a bird spirit. Moving to Mount Gambier they managed to escape from the spirit and there they lived for a long time. Again they made an oven, but one day water came up from below and put out their fire. They made others, until they had four, which are now the craters of Mount Gambier.

It is not possible to date this Aboriginal legend, but the story implies that volcanic activity took place comparatively recently in geological terms. A study of relationships between the volcanic rocks and fossil beach deposits has shown that there were two phases of activity (Fig. 2).

Early Phase

Volcanic centres northwest of Mount Gambier are believed to have erupted at the beginning of the Pleistocene period about $1\frac{1}{2}$ million years ago. The deposits have been modified by erosion and partly covered by fossil beach sand drift. At Mount Watch Quarry, fossil beach deposits cover beds of volcanic agglomerate and scoria.

Lakes Leake and Edward are within extinct volcanic craters. Most of the other hills and

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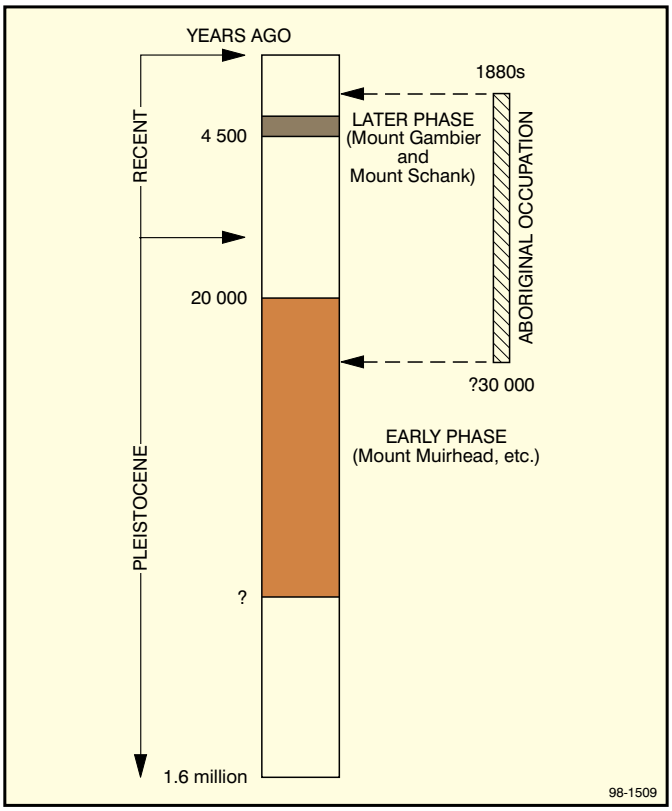


Fig. 2 *Phases of volcanic activity.*

elongated ridges associated with this phase were formed by fissure eruptions.

Later Phase

This eruptive phase consists of the Mount Schank and Mount Gambier volcanoes, whose shapes are still fresh and have been only slightly affected by erosion. Mount Gambier contains several explosion craters, and volcanic activity has exposed the regional water table. Mount Schank has two dry craters with a lava flow; its crater floors are above the regional water table.

MOUNT GAMBIER

In 1862, the Reverend J E Tenison Woods published a journal containing descriptions of the geology of Mount Gambier. He recognised most of the significant geological features, but believed that the craters were calderas formed by collapse of the county rock. It is now known that the craters are explosion structures called *maars*, which consist of a rim made of ejected material, resting directly on Gambier Limestone and drift sand.

The main features of the complex can be seen from the many scenic lookouts (Fig. 3), and the geological section (Fig. 4) shows the relationship of the volcanic deposits to the Gambier Limestone.

Before the volcanic eruptions, the area consisted of a series of low sand dunes trending northwesterly, which were deposited as a series of barrier dunes similar to the present day Coorong due to retreating sea levels during Pleistocene times.

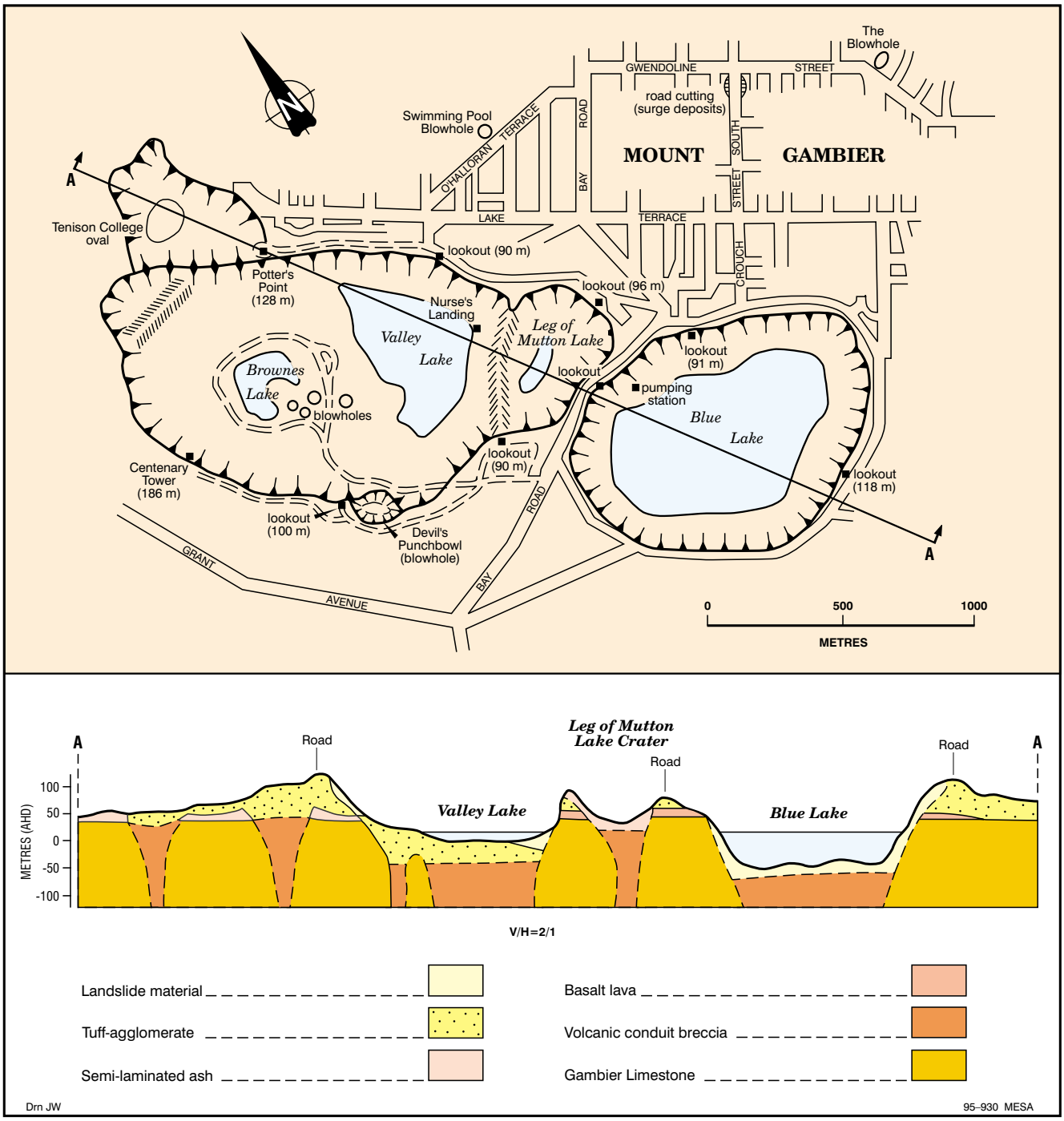
Carbon dating of plant remains from tuff layers has shown that the main period of activity occurred about 4600 years ago, well within the known time of occupation by Aboriginal people.

The first activity saw the formation of small-scale maars, followed by the eruption of black basaltic lava which can be seen on the side of the Blue Lake crater.

Then came a short period of quiescence when groundwater in the country rock percolated down the volcanic conduits. This water was converted to superheated steam when it reached hot subterranean magma. Pressure then built up until new vents blasted their way through the earlier basalt cap, depositing a thick layer of ash and tephra (Fig. 4) to form craters which can be seen today. Large blocks of basalt and limestone were thrown out, some weighing more than 20 tonnes. These volcanic ‘bombs’ lying in ash deposits are exposed in several road cuttings in the area. Small ‘bombs’ containing rock rich in olivine crystals are interesting mineralogical specimens. Close study of the ash deposits has shown evidence of small rainwater channels. Rain often accompanies volcanic eruption due to the large amounts of water vapour released from the vents.

Crudely bedded basalt agglomerate and ballistic bombs, Mount Watch. *(Photo t014287)*

Basalt lava flow overlying tuff at Nurses Landing, Mount Gambier. *(Photo t014281)*



Figs 3 and 4 *Scenic lookouts and blow holes, Mount Gambier and diagrammatic cross section, Mount Gambier craters.*

Blowholes

One interesting feature of the Mount Gambier complex is the presence of blowholes representing points of steam discharge. The best known is the *Devil's Punchbowl*; another, *The Blowhole*, is located within the city some distance from the main volcanic vents (Fig. 3).

Drilling and trench excavations reveal that volcanic ash extends over a radius of about 8 km from the Blue Lake.

MOUNT SCHANK

This volcano rises abruptly from the plain 14 km south of Mount Gambier, and shows evidence of two phases of volcanic activity. A small cone on the southern side of the mount was produced by the early phase, together with a basaltic lava flow to the west (the site of current quarrying operations). The later phase created the main cone, which now slightly overlaps the original smaller ones (Fig. 5). These

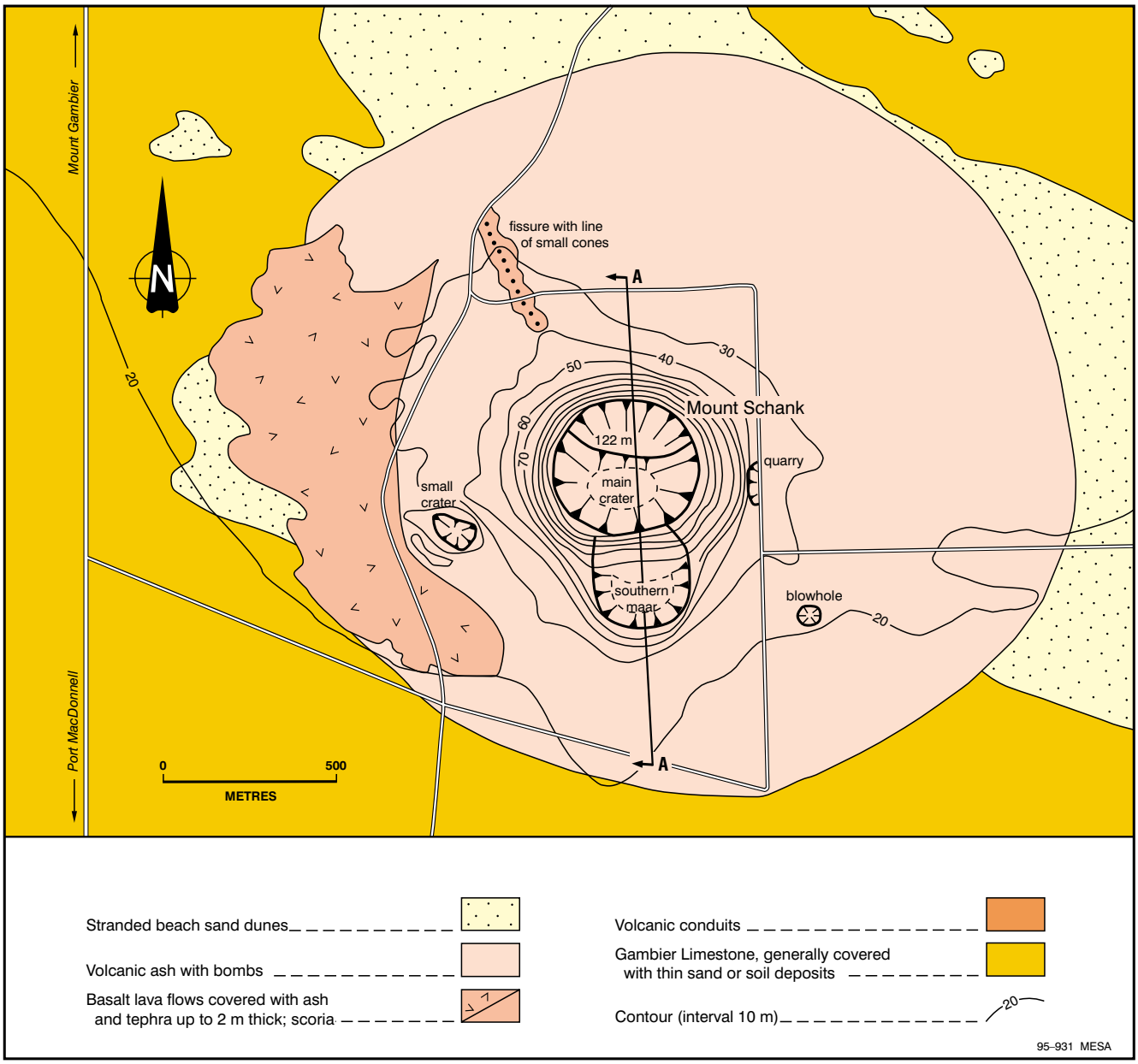


Fig. 5 *Volcanic cones at Mount Schank.*

cones consist of bedded ash, consolidated to form tuff layers, which are visible on the inside walls of the crater and in the quarry on the eastern side of the mount. Work by the University of Adelaide Physics Depart- ment has revealed that Mount Schank erupted about 4500 years ago.

Mount Schank differs from the craters at Mount Gambier in that its floor is dry, being approximately at the level of the surrounding plain.

FUTURE ERUPTIONS AND VOLCANIC GASES

It is impossible to predict whether these volcanoes will erupt again in the future.

Although no eruption has occurred within recorded time, several earthquakes have been recorded in the region. In May 1897, a large earthquake caused water spouts and quicksand volcanoes on the beaches of Kingston, Robe and Beachport; aftershocks continued for several months. In 1948, Robe was again shaken by a large earthquake. Other smaller earthquakes have occurred throughout the South-East since then.

Almost certainly any future volcanic eruption would first be indicated by increasing seismic activity on the recorders operated by PIRSA in the region.

In a study of subsurface temperatures, carried out by the Bureau of Mineral Resources (now AGSO), no evidence of abnormal heat flow was found, suggesting that there is no large source of hot magma near the surface. Recent studies on the rare gases helium, neon and xenon, contained within the Caroline carbon dioxide well near Mount Gambier, have

Westerly view of Mount Schank. *(Photo t014283)*

indicated a volcanic origin for the gas. The gas is trapped at depths up to $2\frac{1}{2}$ km below the surface and has been tapped for commercial use.

GEOLOGICAL CONSERVATION

Both Mount Gambier and Mount Schank have been classified as geological monuments by the Geological Society of Australia and as such are protected from major changes by future development. Monuments of this type can be damaged by the unnecessary collecting of rock specimens or the use of off-road vehicles.

GLOSSARY

Agglomerate. A coarse pyroclastic deposit composed of a large proportion of interlocking scoria and volcanic bombs. Layering within agglomerates is generally poor and on a large scale. Mostly found near scoria cones.

Basalt. A type of iron and magnesium-rich lava that melts at temperatures higher than 1000°C. Basalt lavas are very fluid when molten and hence spread over large areas before setting hard. Basalt is a relatively heavy rock, black to grey in colour when fresh.

Lava. Rock that has been expelled from a volcano or fissure at the earth's surface while in a molten state. Lavas are generally erupted at temperatures 600 to 1200°C.

Magma. Molten rock below the earth's surface, which becomes lava if extruded quietly or ash if explosively discharged above ground.

Pleistocene. The first of the two epochs of the Quaternary Period, ranging from 1.6 million to 10 000 years before present.

Pyroclastic. Fragmental volcanic material or detritus (initially molten) of any size that has been explosively ejected from a volcanic vent to form a deposit.

Scoria. A basalt pumice formed by escaping gases bubbling out of the lava in a way similar to uncorked soda water. When fresh, this rock is black and glassy, but is often changed to a reddish colour by the action of volcanic steam and/or hot waters.

Tephra. A collective term for all pyroclastic deposits, including the deposits of pyroclastic flows, surges and falls.

Tuff. Volcanic ash and cinders that have become compacted or cemented and rock-like.

FURTHER READING

Sheard, M.J., 1978. Geological history of the Mount Gambier volcanic complex. *Royal Society of South Australia. Transactions,* 102:125-139.

Southeasterly aerial view of Mount Gambier. *(Photo t014277)*

Sheard, M.J., 1986. Some volcanological observations at Mount Schank, southeast South Australia. *South Australia. Geological Survey. Quarterly Geological Notes,* 100:14-20.

Sprigg, R.C., 1952. The geology of the South East Province, South Australia with special reference to Quaternary coastline migrations and modern beach developments. *South Australia. Geological Survey. Bulletin,* 29.

Smith, J., 1880. *Booandick tribe of South Australian Aborigines: a sketch of their habits, customs, legends and language.* Government Printer, Adelaide.

RELATED PUBLICATION

Geology of the South East. Brochure published by the South Australian Department of Mines and Energy in 1989.

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