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REPORT: Geomorphic Summary of Observed Features within the South East Province of South Australia. 29th January, 1957 (pgs.3-11)

PLAN: Structural Geology Map (36-1)

29th January, 1957.

Memorandum to : Dr. G. R. Heyl

from : Marshall K. Corbett.

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GEOMORPHIC SUMMARY OF OBSERVED FEATURES WITHIN

THE SOUTHEAST PROVINCE OF SOUTH AUSTRALIA.

Geomorphic features observed from aerial photographic coverage of the Southeast Province of South Australia have been summarized as follows. In several instances, a direct association and/or relationship between two or more of these features is obvious. Place names used may be located by reference to four and one mile maps of the Australian Army Series.

Coastline - The coastline which forms the southwest boundary of the Province trends west from the South Australia-Victoria border to Cape Banks, thence northwest to Cape Jaffa and beyond. Generally, this coastline is characteristically typical of an emergent coastline of low relief except that portions of its shoreline aspects have been modified by secondary submergence.

From present appearance, this coastline can be subdivided into three sections, each having different shoreline characteristics. The first section is the straight, low, and uniform shoreline beginning at Cape Jaffa and running northwestward. Only a small portion of this section borders the Southeast Province but that which does portrays only minor irregularities developed through wave action on a smooth evenly graded beach. Inland from the shore is a highly developed strand plain similar to those associated with shallow emergent coastlines of old age.

A second portion of coast includes the shoreline from Cape Jaffa to Cape Banks. Submergent shoreline characteristics are evident throughout. Two large embayments, Rivoli and Guichen Bays, are included, each having smooth, graded, concave beaches. Remaining shoreline is relatively straight but interrupted by several irregularities similar to and including the prominent sea cliffs and associated stacks which comprise the headlands of Cape Jaffa, Cape Thomas, Cape Dombey, Cape Martin, Cape Buffon, and Cape Banks. The overall shoreline aspect of this section of coast is one of initial sea cliff and embayment development associated with the penetration and encroachment of a sea over a submerged land mass.

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The third section of coast lies between Cape Banks and the South Australia-Victoria border. It is characterized by shoreline features generally found along steep emergent coastlines. The shoreline is highly irregular but comprised primarily of narrow beaches interspersed with minor headland projections. Its contact with the adjacent land mass seems abrupt and except for the sands of the narrow beaches extensive marine deposits are noticeably lacking. Similarly, sea cliff development except locally, is also inevident.

Lagoons - Lagoon development between Cape Jaffa and Cape Banks has been extensive. These include large bodies of water which make up Lake Bonney, Lake George, Lake Eliza, Lake Robe, and probably, at one time included what is now Rivoli and Guichen Bays. These water bodies are depositional in appearance and are extremely shallow for their size. Landward shorelines are smooth and flat whereas seaward they become more abrupt and irregular. Deposition has and is taking place along landward shores.

In addition to the obvious lagoons just mentioned, several others, many of which are much smaller and more mature in comparison, were observed inland from the coast between Beachport and Robe. Many of these are now intermittent swampy areas, having become filled with fine materials since development, but all retain their original lagoonal appearance which permits identification. Their inland extent can be traced eastward as far as Naracoorte where mature lagoons remain preserved in a zone trending northwest from Penola.

Beach-dunes - Traversing the Southeast Province are several topographic ridges, some of which attain an altitude of several tens of feet above sea level. All are composed of large deposits of windblown and waterlaid materials and portray the usual characteristics of a complex association between beach ridges, strand lines, dunes, and blow outs - thus the name beach-dunes. Variations between these essentially sub-parallel beach-dunes were observed and include such factors as trend, alignment, topographic expression, and to a lesser extent, composition.

Major trend of all dunal ridges is in a northwest-southeast direction which, incidently, parallels the present coastline. Near Penola this trend departs from the normal and becomes southward, the larger beach-dunes extending as far as Kalangadoo. This leaves the area east of Kalangadoo and north of Mt. Gambier relatively free from beach-dune development.

A coastward diversion and/or widening of beach-dunes occurs locally just north of Furner and again in the vicinity of Lucindale; the

latter is the most obvious for dunal ridges near Lucindale have considerable topographic relief.

Immediately northwest of Kalangadoo these same beach-dunes are noticeably subdued as compared with their elevated extensions to the north. Those north of Furner not only show a similar change in elevation but are also offset horizontally from their extensions in either a north or south direction. This leaves a zone of low elevation dunal ridges extending from Penola west to the highly developed lagoonal region between Beachport and Robe. The westernmost of these are comprised primarily of stranded beach ridges without the usual mixed accumulation with windblown sands. Those to the east retain their original intermixed composition as do all others within the Southeast Province.

A peculiar feature of both the subdued beach-dunes northwest of Kalangadoo and those near Mt. Gambier is the departure their boundaries indicate from the normal sharp irregular landward boundary and smooth straight coastward boundary that characterizes major beach-dunes of the region. These exhibit sub-angular boundaries, irrespective of side, as though they had been disturbed and perhaps shifted slightly by errosive forces subsequent to original deposition.

Interdunal corridors - Separating each major beach-dune series are wide, smooth, and flat corridor-like lowlands whose trends parallel those of the dunal ridges they separate. These lowlands are typical examples of planes of marine erosion and most of them harbor either lagoons or their marsh-like remnants. These, in turn, were observed as being in various stages of development depending upon their distance from the coast or relationship to periods of marine inundation.

The largest interdunal corridor within the complex is the eastern-most within which the town of Penola is situated. Like others its floor slopes gently seaward thus permitting maximum marsh conditions to exist near its coastward boundary. Yet, unlike all but those nearest the coast, this corridor still contains large bodies of open water.

Except for the large corridor just mentioned it was observed that the effects of marine inundation obviously diminished with increased distance from the coast.

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Lunettes - Within several of the interdunal corridors traversing the Southeast Province, and particularly within the large corridor near Naracoorte and Penola, are a number of striking features known as lunettes, a name which adequately reveals their wind-water origin. These features are similar to lagoons but differ in that they are bordered on their leeward (eastward) side by semi-circular deposits of windblown sands. In many cases the forces responsible for their formation remain active whereas others have since become stabilized by the non-prevalence of varying wet-dry conditions.

Drainage - Surface drainage is noticeably absent within the Southeast Province. Notable exceptions include a portion of the Glenelg River southeast of Mt. Gambier which flows into South Australia from Victoria and then recrosses the border before reaching the sea. Two smaller streams, including their tributaries, are visible east of Naracoorte and Struan. These are Naracoorte creek, which flows west through Naracoorte and Mosquito creek which also flows west but passes through Struan. Both creeks cross a large dunal ridge, flow into an interdunal corridor, and finally become lost within the lake and swamp country west of the towns through which they pass. Neither reaches the sea as surface streams.

Other natural surface channels are those limited streams which originate in springs south and west of Mt. Gambier. Except for several artificial canals constructed for the purpose of draining swamplands within interdunal corridors, surface drainage is almost non-existent throughout the remainder of the region.

Underground drainage is strongly developed, as witnessed by major spring and seepage zones, but the high water tables resulting from large volumes of groundwater prevent the Southeast Province from becoming a well drained region. An exception is the area in the vicinity of Mt. Gambier where adequate underground drainage is provided by extensive solution channels within outcropping limestones. Wherever these rocks outcrop sink hole development provides evidence of advanced internal solution.

Elevated portions of the region, such as the dunal-ridges, are reasonably well drained.

Groundwater seepage - Groundwater discharge zones in the form of springs and seeps were observed at several points throughout the region. Maximum discharge, however, is generally confined to three areas. The first is along the coast south of Mt. Gambier where several large springs discharge groundwater from limestone solution channels.

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The second major discharge area involves another spring zone which is situated between Tantanoola and Millicent. Like in the first area, these springs discharge large quantities of groundwater.

The third groundwater discharge area is the most extensive of all. It extends from the coastal lowlands between Beachport and Robe eastward almost as far as Kalangadoo and Penola and is characterized by many well developed springs and by large and extensive seepage zones. This area provides the major outlet for most of the near surface groundwater contained within the Southeast Province, especially that within its central districts.

Volcanic Features - Interrupting the otherwise smooth and relatively low land of the region are several volcanic features which make up a range having the greatest topographic relief of the Province. This range trends northwest from Mt. Gambier and comprises the high peaks of Mt. Bluff, Mt. Burr, Mt. McIntyre, Mt. Muirhead, Mt. Graham, Mt. Lookout, and other minor volcanic plugs or domes.

Unlike the smooth topped but massive features just mentioned, but just as striking in appearance, are the isolated craters of Mt. Gambier, Mt. Schank, Lake Leake, and Lake Edward. Except for Lake Leake, each of these features rise abruptly from the surrounding terrain. All but Mt. Schank contain one or more lakes within their steep walls.

Many of the volcanic features mentioned fall into distinct alignment, thus forming three groups of similar trend. The westernmost group includes Mt. Bluff, Mt. Lookout, and Mt. Muirhead. The easternmost group is made up of Lake Edward, Lake Leake, and Mt. McIntyre. A third group lies between these and comprises Mt. Burr and Mt. Graham.

Most volcanic features were observed as being irregularly light to dark in tone, thus portraying a mottled appearance not shown by surrounding terrain. The Mt. Schank and Mt. Gambier craters, however, are darker and more even toned. In no instance could a definite tonal contact with adjacent terrain be observed; the tones of all volcanic features grade and blend evenly with those adjacent.

Surface Materials - Consolidated and unconsolidated materials are both visible on aerial photographic coverage of the Southeast Province. Of the two, the unconsolidated group is more obvious, partly because of its widespread extent. Nearly all of the region is blanketed by recent deposits which range in texture from coarse sands to fine clays. These are common ingredients of coastal plains.

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Beach-dunes traversing the area are composed primarily of coarse sands. Other areas, particularly the newer interdunal corridors near the coast and the lowlands southeast of Penola and east of Mt. Gambier, are predominately sandy as well. Whereas the sands of the lowlands some distance inland from the coast are, in a sense, redistributed beach-dunes, those of the newer corridors are marine or beach sands as originally deposited.

Remaining lowlands, such as the older interdunal corridors and the Dismal Swamp region, also contain heavy accumulations of sand, but these are interspersed and somewhat mixed with silts and clays in varying amounts. These fine materials are particularly evident in association with swampy conditions and, as in the Dismal swamp and partly filled lagoons east of Robe and west of Struan, are prevalent to the extent of forming large muck deposits.

Overlying the sandy beach-dunes near Mt. Gambier are thin veneer-like deposits of volcanic ash. These are confined to limited areas near and around major volcanic features as would normally be expected.

Surface or near-surface exposures of consolidated rocks within the Southeast Province are not extensive, the largest of these being the easily soluble limestones portrayed by sink-hole development in the vicinity of Mt. Gambier and east of Struan. Exposures near Mt. Gambier extend northwestward from the South Australia-Victoria border to Tantanocla, and from the coast inland almost to the Dismal swamp. Exposures east of Struan extend beyond the border into Victoria and from Comaum north past Kybybolite. Those of this latter area are not as outstanding as those found near Mt. Gambier and in many places are covered by a light veneer of sand. Yet, close inspection revealed the solution features contained within.

Other consolidated rocks observed include the pyroclastics and lavas associated with the many volcanic features already mentioned. These range from the extrusive basalts and intrusive dyke of Mt. Schank to the congealed basalt necks, and extrusive lapilli, and ash of other centers of volcanism.

Another rock type was observed at the surface as a small circular exposure six miles northwest of Mt. Gambier. Other similar to it were located near Malla and in the vicinity of Lake Leake. The medium gray and uniform photo tones of these exposures resemble those generally expressed by medium colored, fine grained rocks.

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Faults - Several faults were observed on photo coverage of the Southeast Province. The largest of these is the Kanawinka fault which crosses the South Australia-Victoria border near Comaum and trends northwest past Struan and Naracoorte. Its most obvious characteristic is a major scarp which is sporadically exposed along its length. Greatest relief displacement afforded by this southwestward facing scarp could be seen between Comaum and Struan where the fault with which it is associated effects a northward swing.

No other fault as large as the Kanawinka in either extent or magnitude of displacement was observed, although many lesser ones were obviously visible throughout the exposed limestone region near Mt. Gambier. These all have a general northwest trend and include the Nelson fault situated near the junction of the South Australia-Victoria border and the coast, the Allendale fault which passes through Mt. Schank, the Knight fault west of Mt. Gambier, and the Tartwaup fault near Compton. All are expressed by slight scarps in conjunction with strong surface lineations and alignment of limestone solution features.

Other minor faults, similarly expressed, were also observed; one near Glencoe West, another south of Tantanoola, one west of the Knight fault, one each south of Mt. Schank and Mt. Salt, and two others near the Nelson fault.

Lineaments - The trends of many of the lesser faults in the vicinity of Mt. Gambier could either be extended or supported by several lineaments portrayed by combinations of soil and rock patterns, topographic irregularities, sink-hole alignment, and spring or seepage zones. A pronounced en echelon pattern results which extends northwest from the Glenelg River to Millicent.

Continued extension of this same zone is provided by other lineaments which parallel the coast from Furner northward past Kingston.

Similar northwest to north trending lineaments are located along the South Australia-Victoria border from the Glenelg River to Comaum. Immediately south of Comaum they are especially noticeable and many tend to en echelon and finally horsetail northward along the coastward or downthrown side of the Kanawinka fault. Others of this complex trend northeastward and thus bisect the Kanawinka fault near Comaum.

Several other lineaments were observed as a group within the area northwest of Penola and in the vicinity of Lucindale. Most of these conform in trend to the dunal ridges of the same area but a few have their

beginning near the western edge of the interdunal corridor near Struan and Naracoorte and trend westward. These latter finally effect a northward swing which brings them parallel to or into alignment with other lineaments.

Strike and dip - Limited and relatively horizontal surface exposures of rock precluded observation of strike and dip throughout major portions of the Southeast Province. Those which were observed are confined entirely to the limestones outcropping near Mt. Gambier and collectively they convey a general but slight regional dip to the northeast, thus permitting strike to conform with the northwest-southeast pattern produced by other lineal features of the area.

Few strike and dip observations were made which were found to be contrary to this regional dip. The more obvious of these occur near previously described fault zones, and within slightly folded localities such as Mt. Salt.

Folds - Folds, either anticlinal or synclinal, were noted as being conspicuously absent from the Southeast Province. The most prominent fold features observed are the Mt. Salt complex, Knights Dome, the Tantanoola Anticline (?), and a small group north of Green Point. All observed folds seem to be associated with either faults or minor fractures for their axes trend northwest parallel to observed faults of the area. None are large in either extent or amplitude.

A noticeable peculiarity in regards to these fold structures is their apparent relationship to volcanism. Mt. Salt, Knight's Dome, and the Tantanoola Anticline (?) are all situated west of and nearly equidistant from the volcanic features of Mt. Schank, Mt. Gambier, and Mt. Bluff respectively.

Anomalous features - Two different anomaly types have been observed from aerial coverage of the Southeast Province. The first is a group of tonal anomalies, three of which are located near Lucindale, two near Penola, and two others near Naracoorte. All are located within interdunal corridors and characterized by circular light toned and mottled surface patterns. Although similar in appearance they vary in size.

The second anomaly type observed is located at Penola. It, too, lies within an interdunal corridor. Its abnormality arises from a peculiar arrangement or pattern resulting from the continuous alignment of several small lagoons and lunettes. As arranged they form a definite U-shaped pattern the apex of which lies south of Penola. Its winglike

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limbs extend northward on either side of the town and partly enclose two of the tonal anomalies previously described. In addition, these tonal anomalies are situated close to and parallel with the resultant axis of this U-shaped pattern.

Marshall K. Corbett

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Photogeologist.

MKC/aw.

36° 51'

Kingston

NARACOORTE — KINGSTON SHALLOWS

Lucindale

NARACOORTE

KANAWINKA FAULT

Struan

APPROXIMATE

Conmurra

Robe

LAKE ROBE (Salt)

LAKE ELIZA (Salt)

LAKE ST. CLAIR (Salt)

LAKE GEORGE

PENOLA — ROBE SYNCLINAL TROUGH

Furner

Beachport

Comaum ?

Penola

APPROXIMATE

SOUTHERN OCEAN

MILLICENT

MOUNT McINTYRE

MOUNT BURR

Kalangadoo

Lake Leake

Lake Edward

TANTANOOLA ANTICLINE (?)

MOUNT BLUFF

TARTWAUP FAULT

LAKE BONNEY

MT. GAMBIER UPWARP

SOUTH AUSTRALIA / VICTORIA

KNIGHT'S DOME

MOUNT GAMBIER

Kongorong

Cape Banks

MT SALT

MOUNT SCHANK

ALLENDALE FAULT

NELSON

Glenelg River

FAULT

Port Mac Donnell

DISCOVERY BAY

LEGEND

- Faults
- Probable Faults
- Possible Faults
- Linears (Fault Controlled ?)
- Strike and Dip
- Structural Anomalies (A)
- Regional Fold
- Regional Folds (Inferred)
- Local Folds
- Major Structural Subdivisions

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STRUCTURAL GEOLOGY OF THE GAMBIER ROBE–NARACOORTE DISTRICT SOUTH AUSTRALIA

(Determined from Aerial Photo Analysis)

FROME REPORT: Photogeology of the Gambier – Robe – Naracoorte District, South Australia. By M. K. CORBETT.

APPROXIMATE SCALE

2 0 2

2 INCHES = 1 MILE

OCTOBER 1956

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