DEPARTMENT OF MINES
SOUTH AUSTRALIA

REVISION OF PERMIAN AND DEVONIAN NOMENCLATURE OF FOUR FORMATIONS IN AND BELOW THE ARCKARINGA BASIN

by

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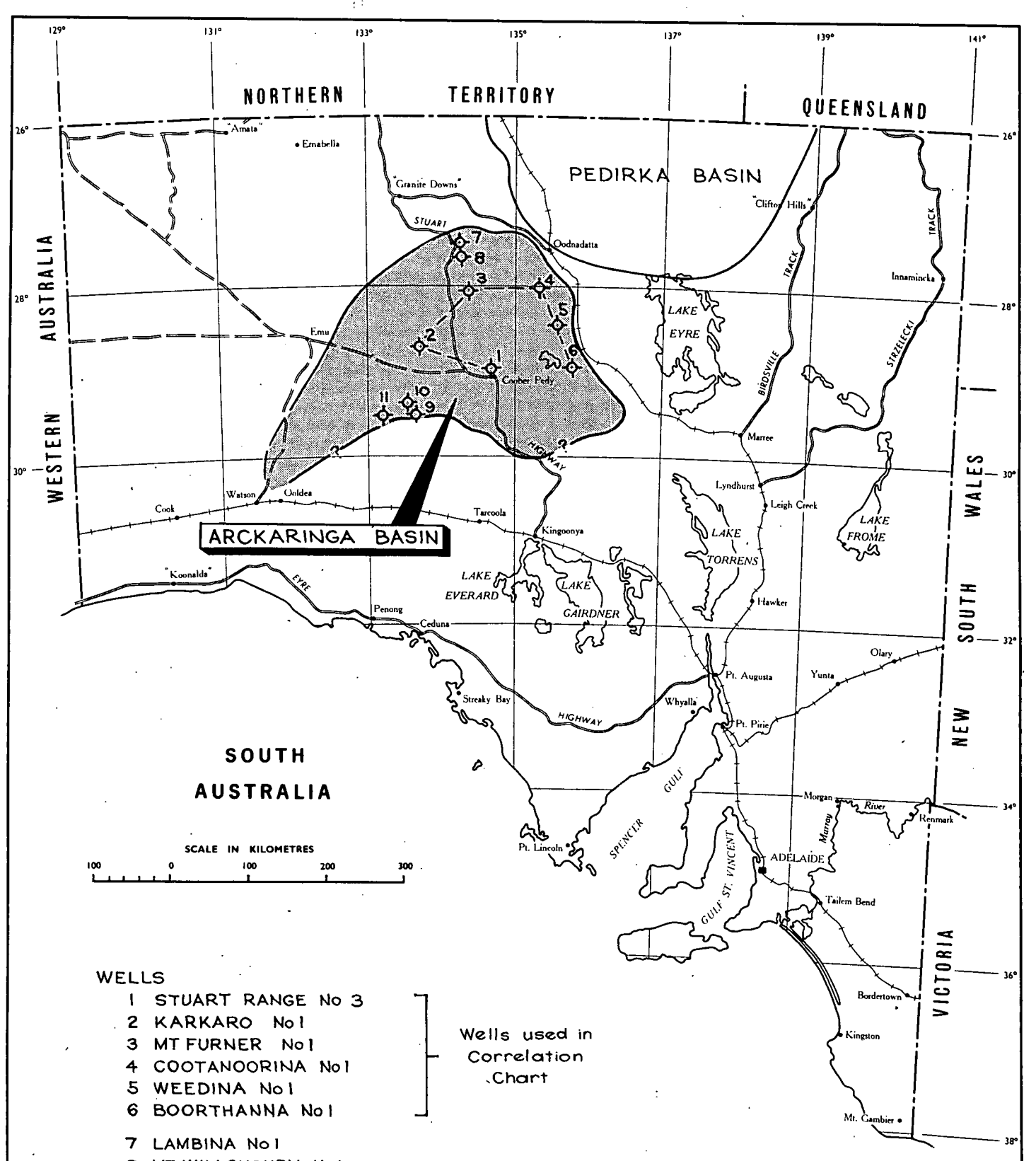

WELLS

1 STUART RANGE No 3
2 KARKARO No 1
3 MT FURNER No 1
4 COOTANOORINA No 1
5 WEEDINA No 1
6 BOORTHANNA No 1

Wells used in Correlation Chart

7 LAMBINA No 1
8 MT WILLOUGHBY No 1
9 WALLIRA No 1
10 WALLIRA No 2
11 WALLIRA WEST No 1

FIG. 1.

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Compiled. I.J.T.	ARCKARINGA BASIN LOCALITY MAP	Date: 5 Feb 1974
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INTRODUCTION

The following is a short summary defining or redefining Permian formations of the Arckaringa Basin and one underlying ?Devonian unit in downward sequence:

1. The Mount Toondina Beds are delimited as the Mount Toondina Formation (Early Permian).
2. The Stuart Range Beds are delimited as the Stuart Range Formation (Early Permian).
3. The Lake Phillipson Beds are redefined and renamed the Boorthanna Formation (Early Permian).
4. Cootanoorina Formation is a new term for the ?Devonian unit below the Arckaringa Basin.

The definitions of all four units have been expanded or revised from subsurface stratigraphic well information using both lithological and petrophysical logs. Only two of the units are known to crop out. All petrophysical logs, cuttings and core samples are retained by the South Australian Department of Mines (S.A.D.M.).

MOUNT TOONDINA FORMATION

The Mount Toondina Beds were first defined by Freytag (1965) at the only known outcrop of carbonaceous sediments in the Arckaringa Basin. The name is derived from a low hill named Mount Toondina which is described by Freytag as a piercement structure (diapir) which brought the carbonaceous sediments to the surface.

Mount Toondina is 45 km south-southwest from Oodnadatta at latitude 27°57'S, longitude 135°22'E on OODNADATTA map area. Neither the upper nor the lower boundary of the Mount Toondina Beds could be described from the type section, the base of which is not exposed and the top is an erosional surface on a raised structure. The exposed carbonaceous shales correlate in part only with the subsurface reference section.

A number of stratigraphic wells have since been drilled by the S.A.D.M. throughout the Arckaringa Basin and more precise limits can be given to the boundaries and the sequence now called the MOUNT TOONDINA FORMATION. The limits of the formation are based on lithology and geophysical logs of the six wells shown in Figure 2. Cootanoorina 1, 8 km south of Mount Toondina, was the first of the main stratigraphic wells to penetrate the Mount Toondina Formation. Cootanoorina 1 (located at latitude 28°00.5' and longitude 135°20') therefore is designated as the subsurface reference section.

The Mount Toondina Formation lies between 187.5 m and 516.6 m as shown by gamma ray and neutron logs of Cootanoorina 1 and is 329.1 m thick. The upper section above 359.7 m consists of grey carbonaceous shales, coals,

and interbedded grey sandstones, siltstones and sandy shales. The lower section below 359.7 m is slightly more sandy and less carbonaceous. Reference should be made to the other wells in the correlation chart (Fig. 2) for distribution and variations in lithology.

Environment of deposition

The Mount Toondina Formation is interpreted as having been deposited in non-marine lagoons and swamps with intermittent deposition of fluvial sands.

STUART RANGE FORMATION

Using Lake Phillipson Bore (1905) as the type section and referring to several bores in the Lake Phillipson and Boorthanna Troughs, Ludbrook (1961, 1967a) formalised and described the Stuart Range and Lake Phillipson Beds, names which were informally applied to parts of the Permian sequence by Balme (1964). The Stuart Range Formation (Unit 1 of Allchurch and Wopfner, 1973) is better represented in Cootanoorina 1 and occurs between 516.6 m and 777.2 m on the gamma ray and neutron logs and is 260.6 m thick. The ill-defined upper boundary in Stuart Range No. 3 (Ludbrook, 1967b) can now be located at 318.5 m (Fig. 2).

The formation is a shale unit, greenish-grey when wet and pale grey when dry. Its wide distribution is shown by its presence in all wells in figure 2.

Karkaro 1 well shows particularly clearly the marked changes in lithology above and below the Stuart Range Formation on both the gamma ray and neutron logs.

Environment of deposition

A restricted marine depositional environment is indicated by the fauna which include foraminifera and gastropods (Ludbrook, 1967b).

BOORTHANNA FORMATION

The name Boorthanna Formation is introduced to replace that of Lake Phillipson Beds because of the prior use of the name Phillipson Beds for friable current-bedded sandstones with a basal polymictic conglomerate cropping out in the Phillipson Range in the northeast Canning Basin (Wells, 1962; Casey and Wells, 1964).

The top of the Boorthanna Formation is difficult to place accurately in Lake Phillipson Bore because of the paucity of samples. The base of the unit was not reached in Stuart Range 3. Therefore the formation is best represented in Boorthanna 1 from which it takes its name, and where it can be defined. The type section is the unit between 739.1 m and 115.8 m (623.3 m thick in Boorthanna 1 well on the gamma ray and neutron logs (Fig. 2)). The unit consists predominantly of sandstones and conglomerates but also includes sandy clays and boulder to pebble clays (diamictites).

Sandstones and conglomerates succeed the diamictites, and in some wells local erosion of basement highs is indicated. The erosion produces basal conglomerates which sit directly on basement structural highs and grade out to pebbly sandstones and homogeneous sandstones which overlie the diamictite in the depressions.

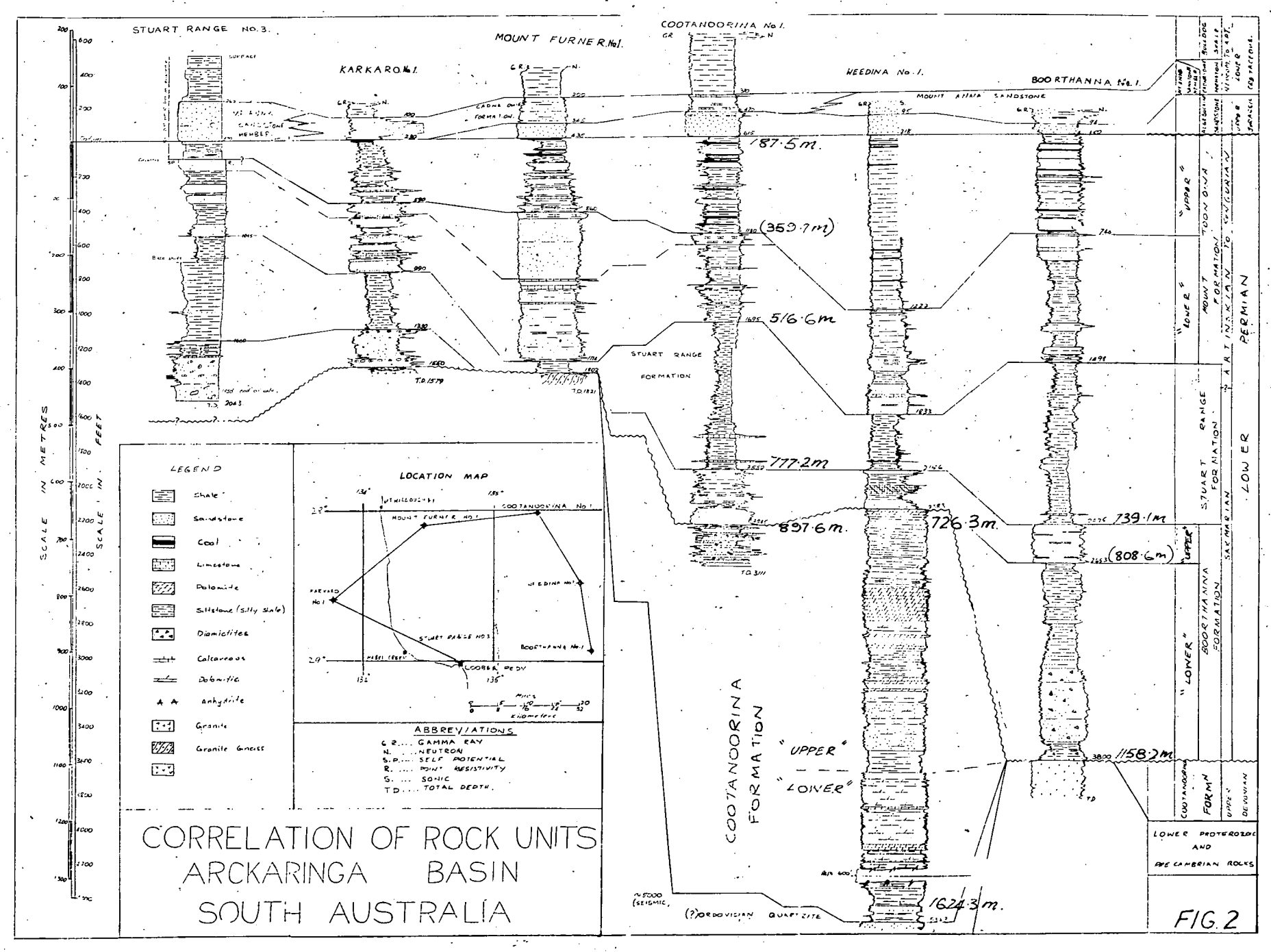
Environment of deposition

Part of the lower Boorthanna Formation may have been deposited during Permian glacial times although transport by rivers, mudflows and turbidity currents are envisaged. The sediments are interpreted as being deposited into grabens under predominantly marine conditions.

Conglomerates adjacent to the Peake and Denison Ranges show abundant striated, faceted and soled pebbles. The lithology has been interpreted as a tillite of Permian age but very little evidence has been found in any of the Arckaringa Basin drillholes, indicating that glacial sediments were reworked throughout most of the basin. Only one soled pebble has been recorded from drilling and this was in Anna Creek Bore (Ludbrook, 1961, P.78).

COOTANOORINA FORMATION

This is a new name replacing the informal term Unit III (Allchurch et al, 1973) and defining the informally used Cootanoorina Beds (Townsend, 1973 unpubl.). The unit was first described in Cootanoorina 1 Well, from which it takes its name. Cootanoorina 1 is 8 km south of Mount Toondina. As it was not completely intersected in Cootanoorina 1, Weedina 1 well has been selected as the type section (see Figure 2). The COOTANOORINA FORMATION is 898 m thick between 726.3 m and 1 624.3 m in Weedina No. 1 Well located at latitude 28°28'31"S and longitude 135°39'20"E.



CORRELATION OF ROCK UNITS ARCKARINGA BASIN SOUTH AUSTRALIA

FIG. 2

The unit consists of dolomite and anhydrite, interbedded with massive dolomitic sandstones, and rests on (?) Ordovician quartzite. It is more sandy in the upper part and is more dolomitic in the lower.

Environment of deposition

The Cootanoorina Formation is interpreted as having been deposited in a shallow terrestrial lake which was intermittently evaporitic and produced dolomite and anhydrite interbedded with sandstones.

AGE OF THE UNITS

All of the Permian formations have been dated palynologically and palaeontologically in various papers by Balme (1964), Ludbrook (1961, 1967, a & b), Harris and McGowran (1973), and results are incorporated in Figure 2.

The (?) Devonian age of the Cootanoorina Formation was determined by Harris (Wopfner & Allchurch, 1967) from microfloral evidence.

The lithologies are discussed in greater detail in a report on the Arckaringa Basin by Townsend (1975 in press) and comparisons between basins can be seen in the Permian correlation chart of Youngs, in Figure ..... of this issue titled "The Early Permian Purni Formation of the Pedirka Basin".

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