DEPARTMENT OF MINES

SOUTH AUSTRALIA

Geological and Hydrological Observations along the Strzelecki Creek, portion of Cooper Creek and on adjacent parts of the Great Australian Artesian Basin.

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ABSTRACT

A reconnaissance trip up the Strzelecki Creek to Cordillo Downs, down the Cooper and across to Mirra Mitta bore on the Birdsville track is described. A review of borehole and field evidence along the margin of the Great Australian Artesian Basin abutting the Flinders Range indicates inconsistencies in current stratigraphy. Evidence from the surface and from boreholes shows that the suspended subartesian basin or area of subartesian aquifers on Cordillo Downs extends 100 miles south of the Cooper and 50 to 60 west of the South Australian/Queensland North-South border. Drilling to test for usable stock water to a depth of 1500 feet along the Cooper and the Strzelecki downstream of Innamincka is recommended.

INTRODUCTION

Early in 1957 the Chairman of the Pastoral Board requested the assistance of the Mines Department in providing a radio transceiver for a proposed tour of inspection of remote areas in the north-east corner of the state. In subsequent discussions it transpired that one purpose of the tour was to examine the country in the vicinity of the Strzelecki Creek to determine whether it should be re-opened for pastoral occupation and also whether the old stock route down the Strzelecki should be re-opened. As this involved an assessment of existing and potential water supplies, including underground water, in the area it was suggested that it would be advantageous for a geologist experienced in hydrology to accompany the expedition.

Accordingly the writer was instructed to join the expedition to investigate and report generally on the geology, and particularly on the possibilities of obtaining useful supplies of groundwater in the areas traversed. At the same time the

expedition afforded the Mines Department the opportunity of having one of its officers traverse some areas which had not been examined by a Departmental geologist for 30 years and some areas which had not previously been examined at all.

The party consisted of four members - Messrs. C. H. Melville, W.S. Reid and G.A. Buchanan of the Pastoral Board, and the writer. Two Landrovers were used, one of which was a 106 inch wheel base vehicle belonging to the Mines Department. The other vehilce was the 86 inch wheel base type and was equipped with a Traeger transceiver. Experience on the expedition indicates that the 106 inch wheel base Landrover can carry a heavy load over most of the terrain through which it is possible to drive a wheeled motor vehicle.

The route taken was the travelling stock route from Farina to Innamincka. Commencing from Trinity Well on the MacDonnell River where it si crossed by the vermin proof fence enclosing Mt. Lyndhurst Station, the party travelled up Petermorra Creek to Deans Lookout Bore. From here the stock route passes Petermorra Bore, Mt. Hopeless, Welland Bore, and Lake Crossing Bore which is immediately south of the channel between Lakes Blanche and Callabonna. The party crossed this channel and the notorious "Cobbler" sandhills on the other side without trouble and struck the Strzelecki west of Montecollina bore. The Strzelecki was followed up to Innamincka, the going being slow and difficult. One pool of usable water, Pidlawurnie, was found on this part of the journey. The other waterholes were either dry or salt. No track was visible from Lake Crossing to Innamincka.

After diversions on Innamincka to inspect the property and some of its boreholes, the party moved on to Cordillo Downs where the writer spent a day examining the dome structure in Tertiary ? sediments centred about Needle Hill.

Beaten tracks were left on the next stage of the journey which lay down to the Cooper via the northern end of the Coongie Lakes, Christmas Creek, and Lake Moolianburrina and Moonlight Flat.

From Moonlight Flat the party followed the Cooper to Coorumunchena Waterhole then travelled west and north-west, transversely across the sandridges, to Kalladeina Bore. The waterholes and most of the Lakes in the Cooper overflow system were full although the Cooper had stopped flowing below Innamincka.

Kalladeina Bore is on the eastern side of the tract of stony tableland of irregular width extending slightly east of north from Marree to the Queensland border. From Kalladeina the party travelled west to Mirra Mitta Bore then north as far as Goyder's lagoon bore. This was the most northerly point reached on the Birdsville Track. The party then travelled south down the Track to Marree with a diversion westwards to Kalamurina Station from Mirra Mitta Bore. At Marree the party split up, the writer returning independently to Adelaide and arriving there on Monday 17th June, 5 weeks after the date of departure.

A distance of approximately 2500 miles was traversed during the journey, a good part of which was over trackless sandhills or rough and sandy river flats. The majority of the travelling time was occupied in this part of the journey.

PREVIOUS WORK

The Great Australian Artesian Basin has been described in general and particularly by a number of authors. The most important publications are listed below. Due principally to lack of boring and the lack of economic incentive, the South Australian portion of the Basin has not received the detailed attention accorded to the Queensland and New South Wales portions.

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WHITEHOUSE, F.W. 1925 On Rolling Downs Fossils collected by Prof. J. Gregory. Trans. Roy. Soc. S. Aust. Vol. XLIX pp 27-36

1954 The Geology of the Queensland Portion of the Great Australian Artesian Basin Report of the Artesian Water Investigations. Committee, Queensland Appendix G pp 1-20

ACKNOWLEDGEMENTS

The opportunity for the reconnaissance described herein was provided by the Pastoral Board, Department of Lands, and the assistance of the Chairman, Mr. C. E. Melville; Member, Mr. W.S. Reid, and the Board's Inspector, Mr. G. A. Buchanan, is gratefully acknowledged. Messrs Reid and Buchanan were responsible for the successful organisation of the expedition.

The help and hospitality of various pastoralists is also acknowledged particularly Mr. Bert Napier of Murnpeowie Station, Mr. Jim Vicary of Innamincka Station and Mr. Roger Beckwith of Cordillo Downs.

Palaeontological assistance from the Departmental Palaeontologist, Dr. Ludbrook is acknowledged.

TOPOGRAPHY

The physiography, topography, and geomorphology of the Great Artesian Basin have been described in general and in detail, for particular parts, by Madigan (1938, 1945, 1946), Jack (1925, 1930), Browne & David (1954) and King (1955) and the reader is referred to these publications for detailed information.

The party traversed a route lying across four distinct types of topographic units which have widespread expression in the South Australian part of the Great Australian Artesian Basin. Firstly there is the saltlake sunklands of the Lake Eyre to Lake From strip; secondly the sandridge desert so well described by Madigan; thirdly the high level new plateau with mesa and butte remnants of the older plateau and fourthly the fresh and salt-water overflow lakes of the inland river systems.

The geomorphology of the areas traversed is not discussed here but some observed facts not adequately explained by current theories of geomorphological evolution of the Basin are recorded. The aerial photographic mosaics compiled on a scale of 4m. to 1 inch by the National Mapping council show a fan shaped pattern of sandridges diverging from the vicinity of Lakes Frome and Callabonna. This pattern causes some speculation as to the possibility of the Flinders Ranges in the Mt. Painter area forming a source for much of the sand in the ridges.

Also requiring further explanation is the well defined straight and comparatively deep channel of the Strzelecki maintained through 100 miles of sandridges and cutting across their trends at a comparatively wide angle. The Strzelecki apparently only receives an overflow from the Cooper at widely spaced intervals.

The geomorphology of the Basin could very well form the subject of more detailed study than that yet given it.

This would have a direct economic interest in that it would aid the study of the shallow groundwater occurrence.

GEOLOGY

The subsurface and surface geology of the Great Australian Artesian Basin has been described both in general and in some detail, by the authors listed above. The present account briefly reviews the geology of one part of the margin in the South Australian portion of the Basin in the light of the rather meagre new facts garnered during the recent reconnaissance and by boring, chiefly along the margins, in the last 10 to 15 years, and in the light of the comprehensive account of the Queensland portion of the Basin by F. W. Whitehouse.

Only one new outcrop of undoubted Mesozoic rocks was observed during the trip. It is situated in Petermorra Creek approximately 19 miles south of Lake Blanche and consists of greenish-buff felspathic sandstones interbedded with grey. siltstone and thin bands of sedimentary limonite. The rocks are fossiliferous and their age has been tentatively determined by Dr. Ludbrook as Lower Cretaceous, the palaeontological evidence being too meagre to place them in their exact position in the Mesozoic succession. Whitehouse (1954) has shown that both the Roma (marine formation) and the Blythesdale (containing fossiliferous marine beds) are of lower Cretaceous age and the Petermorra Creek beds may thus belong in either. Their lithology points to them being part of the Blythesdale but confirmatory evidence is lacking.

In the nearest bores, Dean's Lookout and Petermorra, a sandstone aquifer occurs at depths of 916 feet and 1205 feet respectively. Parts of this aquifer appear, from the available descriptions, to be lithologically similar to the Petermorra Creek sandstone and the two might be correlated on lithologic

grounds though this is notoriously unreliable. The structural evidence is not directly opposed to this correlation. At the surface the Petermorra Creek beds dip 2° to 7° to the north. The depths of the aquifer in the two bores fall within the range to be expected by extrapolating the outcropping beds underground within the measured range of their dips. However structural evidence cannot be considered reliable as the Cretaceous sediments are known to be folded elsewhere along the margin of the Basin adjacent to the Flinders Range.

Other evidence to be taken into consideration is the permeability of the aquifer. Both Dean's Lookout and Petermorra Bores yield copious flows of artesian water under considerable pressure. The sandstone outcropping in Petermorra Creek does not appear very permeable and in fact salt pools were retained on hollows in its surface in the creek bed at the time of inspection. Furthermore the outcrops are at a level equal to or slightly below the bore heads and if the outcropping sandstone were identical with the aquifers artesian water might be expected to find its way to the surface along it. Therefore the two are either distinct beds or some structural barrier prevents the artesian water ascending.

Lockhart Jack in Bulletin 14 places the aquifer 800 feet above the base of the Rolling Downs Group and correlates it by inference with an upper aquifer occurring at comparable depths in Lake Crossing, Montecollina and Woolatchi Bores (Sections HH and DD). The aquifers pierced in Meteor and Yerila Bores are also placed well above the base of the Rolling Downs Group. In Montecollina and Woolatchi bores the upper aquifer is underlain by 621 feet and 619 feet of shale and a lower sandstone aquifer was penetrated at depths of 2418 feet and 1816 feet respectively. Jack apparently considered the lower shale to be part of the Roma and the lower aquifer to be the Blythesdale (of Jurassic age as it was then thought to be).

This explanation of the stratigraphy is open to doubt on some points. If correct it means that the sedimentation of the South Australian Margin is quite different from that of the Queensland margin. Firstly no good aquifers are known in the Roma in Queensland. Secondly, the Bundamba in Queensland yields the copious flows, not the Blythesdale. Thirdly shales are known in the Blythesdale, and finally there is no direct palaeontological evidence to show that the lower shales in Montecollina, Lake Crossing, and Woolatchi bores are in the Roma and not in the Blythesdale. Admittedly this is mostly negative evidence but it is considered sufficient to warrant a more detailed examination of the stratigraphy of the South Australian margin of the Basin, particularly that part abutting the Flinders Ranges.

All other outcrops observed during the reconnaissance are believed to be Tertiary or later.

Near old Tinga Tingana homestead a small patch of dark brown limonitic duricrust or coarse grained sandstone cemented by silica and limonite outcrops in the bed of the Strzelecki. It covers approximately one acre and no bedding planes were observable in it.

A similar material, slightly darker in colour outcrops adjacent to Murta Murta Well some 15 miles north. The dump of the well contains an argillaceous structureless sandstone or sandy clay stone mottled pink, white and reddish brown and similar to the bleached horizon of a lateritic profile. The ferruginous material would thus appear to be of lateritic nature. Murta Murta Well is 46 feet deep with a water level 30 feet from the surface. The water probably occurs in a sandstone underlying the bleached horizon of the laterite profile. In the dump of an old well nearby, now fallen in, lumps of a grey sandstone occur, consisting of equigranular, subangular quartz grains loosely cemented by kaolinite or other clayey material. It is quite porous and was probably the aquifer of the disused well. By

inference a similar sandstone is the aquifer in Murta Murta Well. The same sandstone outcrops in the bed of the Strzelecki 1½ miles south of Murta Murta. Here it is less evengrained, has a higher clay content. It also possesses obscure bedding planes which appear to be dipping to the south.

These were the only outcrops sighted in the Strzelecki. Daralingie and Nappacoongee Wells both penetrated the bleached lateritic sandy claystone and it is possible that the sand between Innamincka and Tinga Tingana is underlain by laterite or the bleached horizon below the laterite.

In the absence of contrary evidence the grey sandstone is presumed to be of Tertiary age. Further north a great depth of strata belonging to the Rolling Downs Group was penetrated in the Patchawarra bore and the published log shows at 450 feet a greyish sandstone which may be the same as that cut in Murta Murta old well. Jack shows this as being in the upper part of the Cretaceous Winton Formation but recent evidence from bores further south indicates that it may be Tertiary in age.

On Cordillo Downs Station a series of distinctive rocks outcrop in what appears to be a dissected dome structure. These have been described by Lockhart Jack in Bull. 11 (Jack 1925) and are referred by him to the Desert Sandstone (now known as Eyrian) of Upper Cretaceous age. As exposed at Needle Hill, near the centre of the supposed dome, they consist (beneath the capping of siliceous duricrust, approximately 20 feet thick) of white kaolinitic argillite and buff mudstone or siltstone with pipe structures overlying interbedded grey yellow and purplish coarse argillaceous sandstone and shale. This overlies in turn a yellow mudstone or shale weathering into cuboidal angular fragments and forming the base of the exposed section.

The greatest thickness of the Eyrian as determined by Jack was 360 feet and it is shown in his sections of the Cordillo Downs area lying unconformably on the Winton. Both formations

are shown as being folded, the dips in the Winton being slightly steeper. The reality of the unconformable relation between the two is open to doubt as it is based apparently mainly on a correlation of beds cut in various boreholes by their lithology. Drillers' descriptionsof the strata were used and these are notoriously unreliable. Supporting evidence for the correlations. is provided by the similarity in chemical composition of water from the various aquifers. This is also considered to be unreliable. A further element of doubt is introduced by the fact that the levels of the bore collars were determined by aneroid. In the absence of more definite evidence the present writer would prefer to regard the unconformity as not demonstrated beyond all doubt.

However, there appears to be no doubt thatthe Eyrian, as occurring on Cordillo Downs, constitutes an easily recognisable formation or group as defined in the Code of Stratigraphic Nomenclature. The yellow and purple mudstone, siltstone or shale in particular is a distinctive unit which can be recognised over a wide area on the surface, in boreholes, and shallow excavations.

The mapping of the Cordillo Downs area by geologists from GeoSurveys Ltd., may bring further evidence to light.

As mentioned earlier the strata to a depth of 450 feet and possibly to 710 feet, in Patchawarra Bore may be Tertiary. A similar succession was penetrated in Leap Year Bore (also on Innamincka Station) to a depth of 466 feet. The supposition that these strata may be Tertiary is based on the determination of at least 560 feet of Tertiary Sediments, lithologically similar to the Patchawarra strata, in the Cootabarlow Bore in the From Embayment of the Great Artesian Basin. The age was determined from fossil pollen content and can be taken as definite. The

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Note: Work by GeoSurveys shows that Tertiary (Eyrian has been discarded) is confirmed to 10 to 30 feet of silicified sandstone forming mesa and bulte tops. W. Johnson 6.3.58

logs of both bores have a general similarity down to 710 and 667 feet depth respectively and the change in environment of deposition from Cretaceous conditions may occur at these depths. A similar change occurs in Bull's Hole Bore on Cordillo Downs at a depth of 562 feet and it is apparent that what is called Eyrian for the want of a better name occurs to that depth in the Cordillo Area.

Beds similar to the white, yellow, purple and buff grey sequence occurring on Cordillo can be recognised in three bores south of the Cooper on Innamincka Station as well as in Cootabarla Bore and other bores in the southern part of the Basin. However owing to the inadequate descriptions of the strata the depths cannot be ascertained in the Innamincka Bores.

The Eyrian purple and yellow mudstone or shale was observed in outcrops on mesa and butte slopes between Kalladeina and Mirra Mitta bores, between Mirra Mitta bore and Cowarie Homestead and near Mt. Gason Bore.

According to recent verbal information from Dr. Brunschweiler of GeoSurveys Ltd., the yellow, white, and purple mudstones and sandstones of the Needle Hill area are regarded as the uppermost part of the Winton and of Cretaceous age but as far as could be ascertained this opinion was not based on fossil evidence.

The only other geological occurrence of interest noted on the journey was a sand bed containing lime nodules and crowded with the remains of Corbiculina desolata (Tate), Centrapala Lirata (Tate) and Plotiopsis centralia (Cotton), encountered 15 feet below the present base of the sand dunes at new Kalamurina Homestead near the Warburton River. The bed may represent a former lagoon belonging to an earlier and wetter phase of the present geomorphological cycle. The top only of the bed was seen. It appears to be a little below the level of the present bed of the Warburton and is overlain by dune sand. According to Dr. Ludbrook the fossils found indicate a Recent to Pleistocene age for the bed.

HYDROLOGY

The hydrology of the South Australian portion of the Great Australian Artesian basin has been discussed at some length by Ward (1946, 1950-51) Jack (1951, 1923, 1925, 1930) and others. Of necessity these discussions have been of mostly a general nature owing to the fact that boreholes are sparse and widely scattered throughout the South Australian portion of the Basin.

Very little additional boring has been done in recent years but field work along the margins of the Basin has indicated that previous explanations of the hydrology may be over-simplified and inadequate.

Geologists of the Mines Department Regional Mapping Section have mapped Blythesdale and other younger Cretaceous sediments outcropping along the western and southwestern margin of the Basin abutting the Flinders Ranges in the vicinity of Mt. Babbage and Woolawatana Head Station. The sediments overlap on the Precambrian and folded and fault structures of significant amplitude have been mapped on them.

Several large creeks debouching from the Flinders Range cross the Cretaceous outcrops and any aquifers should thus receive a considerable accession from this source. The Blythesdale has previously been assumed to be the main artesian aquifer in South Australia and water from bores penetrating it near the Flinders Range should show the influence of the accession of water from the Range. It does not show this influence, in fact according to Jack those bores which are shown on the sections in Bulletin 14 as penetrating the main aquifer closest to the Range yield water having the unmodified chemical characteristics of the water of Queensland origin. That there is no direct connection between the Blythesdale outcrops and the main artesian aquifer is further indicated by the fact that springs do not occur along the outcrops. Meagre data show that the isopotential of the water in the aquifer are equivalent to a level well above the level of the outcrops of Blythesdale adjacent to the Flinders Range.

It therefore seems probable either that structural deformation of the Cretaceous along the margin has prevented the direct access of Flinders Range water to the main aquifer or that the main aquifer is not Blythesdale but a bed lower in the Mesozoic succession.

Present available evidence points to deformation being the cause of the hydrologic anomalies along the margin. However it should be notices that several bores such as Montecollina, Yerila, and Lake Crossing, obtain water of sulphate character from aquifers shown by Jack in Bulletin 14 as occurring in the Roma or Tambo. No direct fossil evidence is given to prove that the shales below the aquifers are of Roma age and the possibility that these upper aquifers are Blythesdale should be kept in mind.

Whatever the explanation of these stratigraphical and hydrological inconsistencies the main aquifer of the Great Australian Artesian Basin is not a practicable source of stock water under present day conditions along the Strzelecki or the Cooper for a long distance downstream of Innamincka owing to its depth below the surface.

Prospects of finding a practicable water supply along these two drainage channels are confined to shallow aquifers or to an extension of the perched sub-artesian basin or basins discovered by boring on Cordillo Downs and Innamincka Stations.

Usable stock water has been previously obtained in small supplies in a number of shallow wells down the Strzelecki Creek. These are of two types. The shallowest wells obtained their water in sand in the channel of the creek, examples being Accalana Well and the native well at the abandoned Carraweena Homestead. Though of good quality the water was in limited supply. Similar type wells were established in interdune flats. Both types could be re-established without much trouble but would not be capable of watering a travelling herd of cattle.

The other type of well dependent on unconfined groundwater obtains its water from a consolidated sandstone occurring beneath a mottled sandy clay stone or siltstone resembling the bleached horizon of a laterite profile. Examples are Murta Murta, Nappacoongee, and Daralingie Wells. Of these Murta Murta and Daralingie are in relatively good order. Both yield good quality stock water, Murta Murta water being potable. The supply available is not known. The sandstone bed, in which the water was struck, outcrops in the bed of the Strzelecki near Murta Murta Well and possibly occurs beneath the alluvium at other places along the Strzelecki and the Cooper downstream of Innamincka. At Innamincka Township a bore 81 feet depth gave water with an approximate total salts content of 146 grains per gallon.

The unconfined aquifer is believed to be fed by water infiltrating after the periodic flow of the rivers supplemented by occasional local rain showers of sufficient magnitude to yield an excess of available water over that lost by evaporation and transpiration. Supplies would thus be limited but would be greater than those available from the shallower soakage wells. Testing for shallow groundwater within 150 feet of the surface is considered worthwhile down the Strzelecki as far as Carraweena Homestead and along the Cooper downstream of Innamincka. As no existing wells are known down the Cooper boring would be more exploratory in nature than down the Strzelecki.

The other possible source of stockwater is an extension of the area of occurrence of relatively shallow sub-artesian aquifers discovered by drilling on Cordillo Downs and described by Lockhart Jack in Bull. 11. On Cordillo several aquifers were penetrated in the Upper Cretaceous varying in depth from 70 to 1628 feet. The yields varied from as little as 1000 gallons per day up to 1000 gallons per hour. Quality was equally variable but most of the aquifers yielded usable stock water.

The source of water in the shallower aquifers was thought by Jack to be local runoff on Cordillo Downs.

What is probably an extension of this area to the south was penetrated in New Patchawarra, Boomerang, and New Leap Year bores on Innamincka Station north of the Cooper, and in Nos. 1, 2 and 3 bores on the Bore Track south of the Cooper. New Patchawarra was drilled 75 yards away from the original Patchawarra and obtained 500 gallons per hour from 457 feet. The succession of strata is generally similar to that in the deeper bores on Cordillo Downs. New Leap Year penetrated 4 aquifers at 86, 187, 410 and 485 feet depths. The quantity of water obtained in a 12 hour test was 1400 gallons per hour. A driller's log of this bore is available and indicates a general similarity with strata cut in Patchawarra and the Cordillo Downs bores. Few details are available for Boomerang bore except that it is 526 feet deep and yields water with an approximate total salt content of 183 grains per gallon.

The three bores on Innamincka south of the Cooper all yield usable stock water. No. 1. which is approximately 90 miles south of Innamincka Head Station is 1010 feet deep and gives 1000 gallons per hour of water with a total solids content of 370 grains per gallon. Water was struck at 272 feet, 375 feet, 920 feet, and 950 feet depth. The other two bores obtained their water at shallower depth.

The source of the water in the various aquifers in the subartesian basin on Cordillo Downs and Innamincka Stations is open to discussion. Undoubtedly on Cordillo some of the shallow aquifers must obtain their water from local run off where creeks such as Needle and Nilpie Nilpie cross the outcrops in the Needle Hill Dome area. However on Innamincka the bores are a long distance from Needle Hill and the water is considered to be of too good a quality to have travelled a considerable distance through an aquifer or aquifers of relatively low permeability such as these evidently are.

For the aquifers cut in New Patchawarra, New Leap Year, and Boomerang bores a local intake in the elevated area between the bores and the Cooper is possible. An elongated dome-like structure occurs in this area and the strata dip to the north and northwest. South of the Cooper the structure is not known and further domes and basins may occur hidden beneath the widespread sand cover. However the Cooper and the Strzelecki are the only defined watercoarses in the area and it is logical to postulate that the shallow aquifers penetrated in Nos. 1, 2 and 3 bores obtain their water from an intake in the Cooper channel. The Cooper flows almost every year and in comparatively large volume and would thus feed any permeable beds which it crosses. On Innamincka the rocks in the Cooper channel are obscured by sand and alluvium but north and south of the stream Eyrian sandstones outcrop in bluffs facing the stream and it would be unusual if some permeable beds did not occur beneath the sand and alluvium in the channel.

Another source for the water in the deeper aquifer cut at 920 feet in Bore No 1 on the Bore Track is possible. Jurassic and Cretaceous sediments outcrop around the Milparinka bedrock high in New South Wa es and any permeable beds in them no doubt receive accessions of groundwater from local runoff. If the structure is suitable this water could travel westwards and provide the subartesian supply encountered at 950 feet in Bore No. 1. However Milparinka is in an arid region and it is possible that insufficient run off is available to yield an excess for a groundwater increment. The possibility that this deeper aquifer in Bore No. 1 is also fed from an intake in the Cooper channel should therefore also be considered.

On the present evidence the exact nature and extent of the subartesian water occurrence in the north-east of South Australian must remain largely a matter of conjecture. It may be that there are a number of sub-artesian basins, some fed by local intakes such as the Needle Hill drainage area andsome fed

by the Cooper. What is certain is that there is an area extending from latitude 26°0'S to latitude 29°10'S and for a distance west of the South Australian eastern border varying between 10 and 20 miles, in which shallow sub-artesian supplies of usable stock water can be obtained.

The exact limits of this area cannot be defined with existing borehole information but it is reasonable to suppose that it extends some distance south and west of Innamincka, assuming as seems likely, that the aquifers have an intake along the Cooper channel in the vicinity of Innamincka.

It is considered that reasonable grounds exist for testing for subartesian water, if required, down to a depth of 1500 feet for some distance along both the Cooper and the Strzelecki downstream of Innamincka.

The exact limit of the area in which testing would be justified is difficult to ascertain. South of Innamincka down the Strzelecki the first bore to penetrateany depth is Montecollina. This bore obtained saline sub-artesian water at 256 feet and usable artesian stock water at 1665 feet. Montecollina is approximately 50 to 60 miles west-south-west from Bore No. 1 on the Bore Track and 140 miles south of Innamincka.

Montecollina sets a southern limit to the area of shallow sub-artesian supplies of usable stock water and probably also for the moderately deep aquifers in the Winton, if Jack's stratigraphy, as shown on Section DD, Bulletin 14, is correct.

From a practical point of view it would seem advisable to test the northern end of the Strzelecki first and to extend the tests down the Strzelecki only contingent on the success of the preceding test. Testing south of Tinga Tingana Homestead is not recommended for subartesian supplies.

Along the Cooper downstream of Innamincka even less information is available to fix the limit of the shallow and moderate depth sub-artesian area and testing should be done commencing from Innamincka in a similar manner to the testing down the Strzelecki.

CONCLUSIONS AND RECOMMENDATIONS

From a re-survey of the available information it is apparent that the geology of the margin of the Great Artesian Basin abutting the Flinders Ranges needs revision. This revision may result in a new appreciation of artesian water possibilities along the margin but will not affect the position in the deeper parts of the basin. Along the Strzelecki between Innamincka and Montecollina bore the main artesian aquifer is at a depth varying between 2500 feet at Montecollina to something over 5500 feet at Innamincka. Along the Cooper the depth decreases downstream to aminimum of between 3000 and 3700 feet near Cooramunchena Waterhole. These depth would require a very expensive borehole to reach the main aquifer.

As an alternative the possibility of the occurrence of usable unconfined groundwater and shallower sub-artesian aquifers is considered good. Wells in the sand deposits in the channel of the Strzelecki have been developed in the past as far south as Accalana 150 miles below Innamincka. They could be redeveloped and similar wells could be dug in the bed of the Cooper. Small supplies only are available from this source. A second source of shallow groundwater is the grey sandstone outcropping near Murta Murta well. Water varying in quality from potable to good stock water has been obtained in this or similar aquifer down the Strzelecki as far south as Chidlee. Though the attitude of the aquifer is not known, boring to a depth of 100 to 150 feet for at least 30 miles south of Chidlee is considered to have a reasonable chance of success. Similarly boring along the Cooper downstream of Innamincka would be justified. The shallow aquifers would yeild larger quanitities than the sand soakage wells but probably insufficient for watering large mobs of travelling cattle.

The third possible source of stock supplies of groundwater is an extension west and south of the area of shallow to moderately deep sub-artesian supplies originally discovered on Cordillo Downs and described by Jack in Bulletin 11. The evidence indicates that the area extends south of the Cooper and by inference it also extends west of Innamincka. As the existing boreholes do not precisely define the limit to the south and west testing would best proceed along both the Cooper and the Strzelecki downstream of Innamincka, a borehole 1500 feet deep being required to thoroughly test the different aquifers.

It is recommended that if permanent stock water is ever required on either the Cooper or the Strzelecki downstream of Innamincka a borehole be drilled to a depth of 1500 feet on either stream at the point nearest to Innamincka convenient from from the point of view of stock usage.

W. Johnson
SENIOR GEOLOGIST

URANIUM AND FUEL SECTION

WJ:AGK
19/9/57

79ft = 100 links

Table No. 1

S.A. DEPARTMENT OF MINES

SUMMARY OF BORE RECORDS

Ground Water Survey

Hundred OUT OF PASTORAL SHEETS XXXXX 11, 15 & 16.

County

BORE	SECTION	DEPTH *in feet below surface*			SUPPLY	SALINITY		HEIGHT *above sea level*	*Strata passed through*	*Remarks*
		Total	Water cut	Static level	*Gallons per hour*	*Grains per gallon*	*Analysis No.*			
√1	PL1232 P.S.11N	46	?	30	-	27	FW226/57		Mottled claystone	Murta Murta Well
√2	PL.1473 BLK 512 P.S.11N	1010	267 375 920	267 300 220	- 40 250	- ¾oz. 300.1 DC 13.4.39			0-4 sand 4-14 red clay 14-48 sandy clay. 48-124 pure clay 124-267 dry drift with bars of sandstone 267-272 coarse gravel 272-375 shale 375-402 sandy shale 402-920 shale 920-940 sandstone 940-950 blue shale 958-? sandstone ? -1010 blue shale	Grid L 3 No. 1 Bore on Bore track Innamincka Lat. 28° 48'S Long. 140° 54'E
√3	PL.1707 BLK 756 P.S. 15S	765	-	60	-	222	FW228/57		Mottled claystone	Daralingie Well
√4	PL.1714	81	-	51		146	FW230/57			Innamincka Policee Stn. Bore
√5	PL.1714	58	-	57	-	128	FW231/57			Innamincka Hotel Well
√6	PL.1714	412		232	2000	-			0-25 dry sand 25-75 black clay 75-250 sand 250-412 red sandstone	Grid L 3 No. 3 bore on bore track Innamincka Stn. Lat. 28° 1ϕ'S Long. 140° 54'E
√7	PL.1707 BLK.756 PS.15S	615	243	-	450	544.5 1385.5			0-46 dry sand and sandstone 46-100 sandstone with bars of dry sand 100-243 sandstone 243-263 sand and bars of sandstone 263-376 sticky blue clay 376 - 615 blue clay	Grid L 3 Old No.2 Bore on bore track Innamingka Stn. Lat. 28° 29'S Long. 140° 55'E
√7A	ditto	306			1200	292.9 DC 479 23.3.39 (tank sample)			0-6 clay 6-55 dry drift 55-95 dry drift with bands of clay and bands of sandstone 95-115 pure dry drift 115-135 hard sandstone 135-241 bands of drift clay and sandstone 241-306 pure drift containing water.	New No 2 Bore along-side old bore
8 √	PL.1714 PS.15S	88	-	82	-	198 ATS	FW 227/57			Patchawarra Well
9 √	PL.1714 PS.15S	479	457	100	533 (DD30')potable				1-115 red and yellow sandstone and gravel 115-167 white and pink clay 167-187 drift sand 187-197 black shale 197-225 pink clay 225-245 black shale 245-285 grey shale 285-286 drift sand. 286-455 grey shale with drift sand at 324-328, 330-345 & 360-365/ 455-466 2' blue shale 9' water sand 466-479 grey shale.	New Patchawarra 75 yards from old Patchawara Bore
√10	PL.1714 PS.15N	539	86 187 410 485	- - - 110	800 1400	292.5 DC (mixture?)			0-3 raw sand 3-32 red sandstone 32-36 hard white sandstone. 36-41 boulders 41-86 white sandstone 86-116 drift sand 116-148 white sandstone 148-154 yellow sandstone 154-187 brown shale 187-190 water sand 190-410 grey shale sandy from 208-330/ 410-420 grey sandstone 420-485 sandy grey shale 485-495 water sand 495-497 light grey shale 497-500 brown coal 500-506 green sandstone 506-512 light grey shale 512-539 green shale	New Leap year Lat. 27° 5'S Long 140° 58'E
11	PL.1714 PS.15N	526	505			0.42 183 ATS	FW234/57			Boomerang Bore 12 m west of Leap Year.

S.A. DEPARTMENT OF MINES

Table No.....

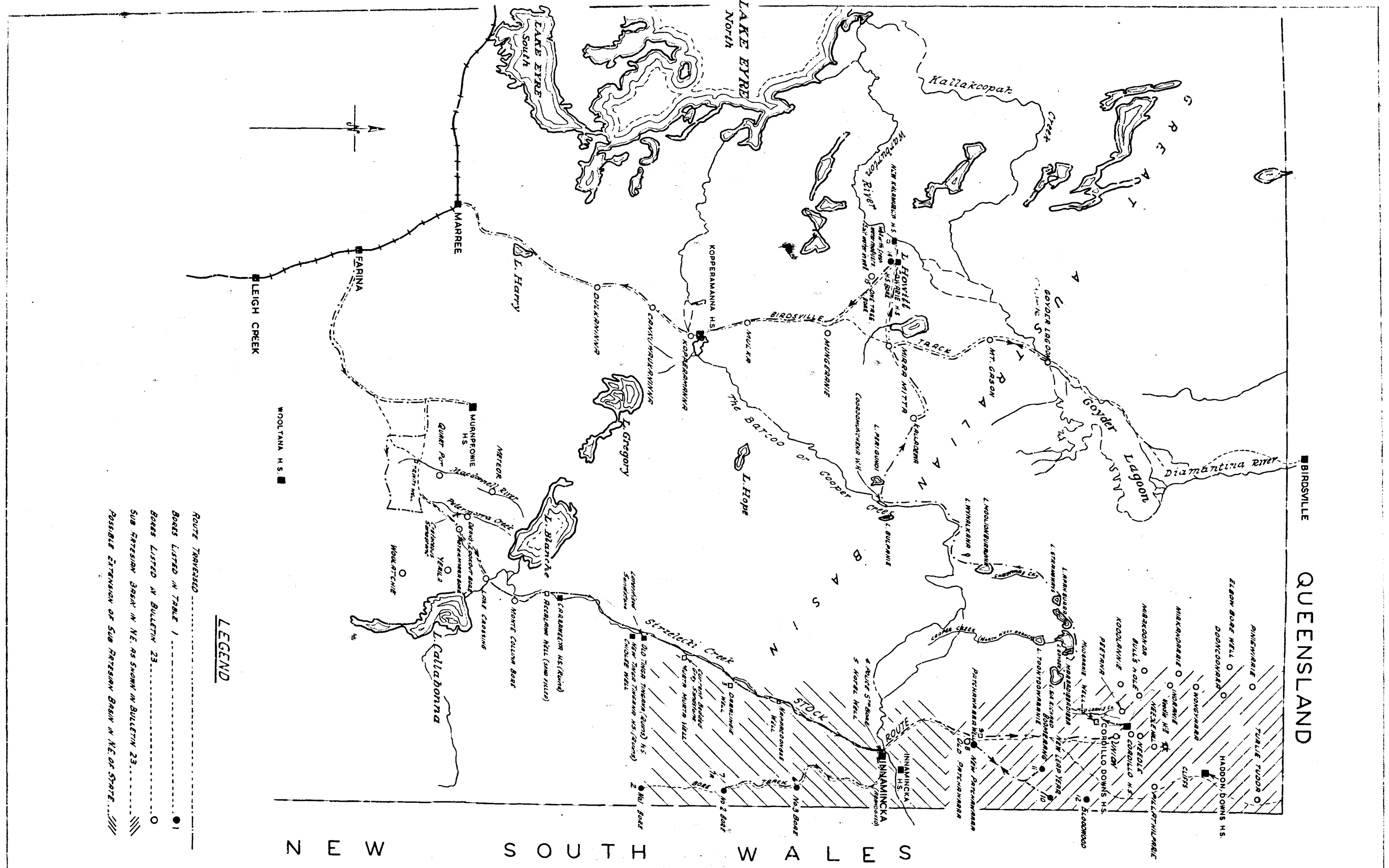
SUMMARY OF BORE RECORDS

Hundred OUT OF

Ground Water Survey PASTORAL SHEETS

County 11, 15 & 16

BORE	SECTION	DEPTH *in feet below surface*			SUPPLY	SALINITY		HEIGHT *above sea level*	*Strata passed through*	*Remarks*
		Total	Water cut	Static level	*Gallons per hour*	*Grains per gallon*	*Analysis No.*			
										Grid L1.
12	PL909 PS15N	550	28	25	400	good			0-2 soil 2-8 biscuit rock 8-97 hard boulders 97-103 drift sand 103-104 hard red sandstone 104-132 hard white sandstone 132-134 pipe clay 134-168 hard white sandstone 168-170 slippery back 170-199 hard white sandstone 199-226 puggy sandstone. 226-234 slippery back 234-248 black shale 248-253 blue sandy shale 253-256 black shale 256-263 sandy shale 263-288 green shale 288-290 stone 290-335 grey shale 335-336 stone 336-354 grey shale 354-356 stone 356-419 sticky shale 419-425 sandy shale 425-435 blue sandstone 435-456 sandy shale 456-458 stone 458-538 green shale 538-547 sandstone 547-550 grey shale	Bloodwood Bore Cordillo Downs Lat 26° 53'S Long.140° 58'E
			97	25	300	"				✓
			425	25	300	"				
			538	70	1000	"				
13	PL 909 PS.15N	35	-	29	-	339				✓ Mudcarnie Well (Grid L1)
14	PL1194 PS16S	70		30	300-500	162.07	W406/51			Cowarie Hstd. Bore
						252	FW253/57			
15	PL	80			200?	642	FW252/57			One Tree Bore.



LEGEND

Route Traversed .....

Bores Listed in Table I .....● 1

Bores Listed in Bulletin 23 .....○

Sub Artesian Basin in N.E. as shown in Bulletin 23 .....

Possible Extension of Sub Artesian Basin in N.E. of State .....

To accompany report by W Johnson

S.A. DEPARTMENT OF MINES

Associated Drawing	No.	No.	Amendment	Exd.	Date

Req No.
D.M.
Compiled from

RECONNAISSANCE OF THE STRZELECKI CREEK AND PORTION OF COOPER CREEK (GREAT AUSTRALIAN ARTESIAN BASIN) LOCALITY PLAN OF AREA TRAVERSED SHOWING BOREHOLE POSITIONS

Approved	Passed		Scale : 16 MILES TO 1 INCH
		Drn.	57-304 Cad
		Tcd. A O W	
		Ckd. K.M.	
Director of Mines		Exd.	Date 1-10-57