9559.4
5526

HPW.

SOUTH AUSTRALIA.

R E P O R T

OF

GOVERNMENT GEOLOGIST;

WITH PLANS.

August 1st, 1883.

ADELAIDE:

BY AUTHORITY: E. SPILLER, GOVERNMENT PRINTER, NORTH-TERRACE.

1883.

MUSEUM OF VICTORIA

39609

SOUTH AUSTRALIA.

REPORT OF GOVERNMENT GEOLOGIST.

Ordered by the House of Assembly to be printed, and plans lithographed, August 14th, 1883.

[Estimated cost of printing (720), £9 7s. 0d. Lithographing (5 plans), £23 17s. 6d.]

In accordance with the instructions conveyed in Crown Lands docket No. 201/83, I left Adelaide on March 21st and proceeded to Beltana, which place I left on the 24th. with two men and five camels, arriving at Waukaringa on April 4th, and remained until the 9th, during which time I made an examination of the strata with relation to the probability of obtaining artesian water at the Government bore.

Arriving at Thackaringa, in New South Wales, I crossed over to the Moolenlooloo Hills, and proceeded northward to the Yandama Creek, which I followed to Milparinka, arriving there on May 2nd. Bad weather and rain detained me at the latter place a few days, and it was not until the 7th that I left, *via* the Reefs and Granite diggings, for Innamineka, arriving on the 19th. On the 22nd I travelled northward to the North-east corner peg, thence along the Queensland boundary to Pandie-Pandie station, on the Diamantina river; then, turning southward, down the Diamantina Swamp to Clifton Hills, and thence up Cooper's Creek to Innamineka, arriving there on June 16th. My return journey began on the 18th, following down the Strzelecki Creek to Mulligan Springs; thence on to Blanchewater, Mount Lyndhurst, and Beltana, arriving at the latter place on July 7th, and Adelaide on the 10th.

The chief objects of this journey were to ascertain the extension from New South Wales into South Australia of the gold-bearing rocks of Mount Brown, and the Cretaceous formation in which artesian and other water has been found. The gold-bearing rocks were not found to extend across the border into South Australia, as far as could be ascertained. The Flinders Range is the nearest point in this colony where rocks likely to prove auriferous outcrop, the intervening country being covered over with Cretaceous and Tertiary formations. There may, however, be some low outcrops occurring amongst the sandhills, but this is not very likely, and they cannot exist to any great extent. The extension of the Cretaceous and Tertiary area into this colony from New South Wales and Queensland was proved along a distance of 225 miles of boundary of the former, and 300 miles of that of the latter colony.

The accompanying sketch map and sections (*vide* 1558/83) are intended to show approximately the boundaries, thickness, and stratigraphical positions of the older mineral-bearing and the secondary and tertiary rocks. The latter are provisionally classed as of Cretaceous age, pending the obtaining of further information from fossils and the discovery of older underlying beds over any portions of the area. The ages assigned to the older rocks are in accordance with their similarity in composition and position to certain rocks in New South Wales.

August 1st, 1883.

HENRY Y. L. BROWN, Government Geologist.

REPORT ON JOURNEY TO THE NORTH-EAST.

BELTANA TO THACKARINGA.

From Beltana to Wirrielpa the road taken passes over mountainous country, attaining to an elevation of over 2,000 feet. The formation consists of quartzose sandstones and purple shales, with quartzose bands resting on limestone, siliceous limestone, and limestone conglomerate, shales, and flagstones. Greenstone dykes are intruded, and come to the surface at several points on the eastern flank of the range and elsewhere, and have uptilted and twisted the overlying rocks, throwing them into numerous curves and undulations, accompanied by faults and dislocations. Beds of limestone conglomerate of recent age overlie the older slaty rocks in many places; they appear to be due to the cementation of gravel by lime contained in water from springs. Travelling from Wirrielpa to Tooth's Knob, stony plains of loam, with scattered quartzose sandstone, limestone and ironstone pebbles are passed over. Bluish limestone frequently outcrops, and nodular limestone shows on the surface, together with quartz gravel. The Tooth's Knob Range is composed chiefly of the purple shale and sandstones, and quartzose sandstones. Going southward from this range quartzose sandstone underlying limestone is crossed dipping west, followed by stony plains showing nodular limestone, purple and greenish shale and limestone rises, also calcareous shales, and blue limestone bands striking N.E. Near the Pasmore river there are some low scarped hills of horizontal conglomerate on white and colored pipeclay. Between the Pasmore river and Curnamoona station there are similar shales, limestones, &c., for a short distance dipping beneath a wide plain which extends eastward into New South Wales. These same plains also continue southward to the Toolabys, which cluster of hills are composed of greenish clay slates and sandstones; the country thence consists of low hills and plains and undulations, the whole of which is covered with quartz drift and ferruginous sandstone.

sandstone and slaty shingle, which indicate the existence of slate rocks beneath the surface. Near Nellingho are hills of hard quartzite bands interstratified with soft slate and calcareous rocks, with quartz veins, and metamorphic and micaceous slates in alternate bands, also containing quartz veins. Pieces of granite and porphyry are seen on the surface, which are derived from dykes traversing the formation. Between Nellingho and Koonamore are ranges covered with quartz drift and limestone; here the softer calcareous slates are decomposed, leaving only the quartzose bands exposed; quartz reefs are frequent. Southward of Koonamore plains of red loam with sandhills are succeeded by clay slate and quartzite, and still further south by ranges of the same formation, together with greenish micaceous clay slate, and micaceous sandstone. Quartz veins are numerous, and the flats and low hills are white with quartz drift.

The general direction of strike of the main line of quartz reefs at Waukaringa is about E.N.E., and the dip southerly, at an angle of from 25 to 35°. The thickness of these reefs varies from a few inches to about 20 feet; the quartz is as a rule of a highly ferruginous character, and associated with iron ore and a ferruginous gossany formation. The veins occur in and between bands of quartzose sandstone, quartzite, sandstone, clay and calcareous slates, which form synclinal and anticlinal curves and undulations, and are highly jointed and cleaved.

Richman's line lies further south, and strikes N. 53° E., with a north-westerly dip of from 35 to 55°. The character of the quartz and the bed rock are similar to the main line of reef.

Blackfellow's reef to the north-west of the above line is said to have yielded the coarsest gold yet found in this locality. The vein, which is very thin, consists of quartz with carbonate of iron, iron pyrites, and oxide of iron in greenish clay, slate, and argillaceous sandstone. These lines of reef outcrop towards the summits of low ranges; others traverse the valleys between. The proportion of gossany quartz and iron ore found in them is considerable; the gold is found in both in a very finely-divided state. The lodes are strong and extend for long distances, and will doubtless be found to continue to considerable depths when followed. Very little work, however, has been done to the greater number of the claims, which have probably been taken up for speculative purposes. A few miles westward galena containing on assay 12ozs. 14dwts. 19grs. of silver per ton has been found in an excavation a few feet deep on a ferruginous quartz lode. Of four assays of gossany quartz from the main line of reef, three contained only traces of gold, while the fourth yielded at the rate of 2ozs. 12dwts. 6grs. to the ton.

The country near Nellingho, Koonamore, and Waukaringa is all likely country for alluvial gold, which, however, does not appear to have been looked for to any extent, the absence of water preventing prospecting operations. From the general character of this country it is not likely that boring for artesian water will prove successful, for reasons set forth in my report of April 9th, 1883.

North-eastward of Waukaringa the rocks are a continuation of the same formation; calcareous varieties are, however, more frequently met with: they are capped in places by quartz gravel, similar to the Pliocene gravel of other goldfields.

About twenty-two miles from Waukaringa, granite country begins, and continues eastward to Mingary Creek, alternating with areas of metamorphic and other slaty rocks. In the granite of the Ethieudna Hills, veins of quartz, hematite, and mica slates occur. Two miles S.E. of Mount Victoria, a copper lode has been found, and is being prospected and ore raised from a shallow depth; specimens of gold are found in the ore and quartz from the mine; the lode lies parallel to a dyke of soft bluish granite and decomposed serpentinous clay traversing hard granite of the ordinary kind. These soft granitic dykes in granite are not uncommon here, and are indicated on the surface by smooth road-like spaces between rough boulders of granite. Mica schist bands also occur in the granite and occasional veins of quartz. The alluvium is charged with magnetic iron sand. From Mount Victoria to within sixteen miles of the province boundary the country is granitic and metamorphic, the granite being in masses over a large area and in dykes traversing mica slate and clay slate. Near Boolcoomatta there are hornblende and micaceous gneissic rocks, with coarse granite dykes and greenstone. A quartzose sandstone and felspathic rock has been excavated here and crushed for gold; it is stained with green and blue carbonate of copper. Eastward of this place vertical cleaved clay and mica slates strike N.E., associated with quartz and iron ore lodes, greenstone, and granitic dykes. Afterwards granite again appears and dips under extensive plains near Mingary Creek, which continue thence to the boundary of the province. Water has been found by sinking in all the formations met with on this route at comparatively shallow depths, from the sandstone and purple shale formation down to the granite and metamorphic rocks.

A considerable portion of the country, as shown by sections Nos. 1 and 2, is underlaid by a limestone formation, which is always found to be favorable to the natural storage of water underground. The following is a list of the principal wells met with on the route, with the formation in which each occurs:—

1. Near Beltana station.—Well, in calcareous conglomerate (an old spring deposit), good water.
Other wells, in limestone, shale, and slates, yield tolerably good water at a shallow depth.
2. Six-mile Camp.—Well, in purple shales, good water.
3. Nuccaleena.—Well, in purple shales, calcareous clay slates and flags, good water.
4. Ten miles east of Wirrielpa Station.—Well, on plain, in alluvium on limestone.
5. Limestone Spring, near Tooth's Knob.—Well, a few feet deep in limestone, good water.
6. Near Tooth's Knob head station.—Well, in limestone on quartzose sandstone.
7. Between Tooth's Knob and Pasmore.—Spring, in limestone near low table hills of conglomerate, on white and yellow pipeclay.
8. Atripena Water.—A large spring in the bed of the Pasmore river, in limestone conglomerate, on massive limestone.
9. Siceus river.—Well, in sand and clay.
10. Curnamoona station.—Tubed bore well, 377ft. deep, through clay and sand drift; good water rising to within 40ft. of the surface. It is quite probable that if this tube were put down lower, sufficient pressure would be obtained to send the water to the surface.
11. Waukaringa station.—This well is down 90ft., and the water lies within 40ft. of the surface. In sinking, micaceous and argillaceous sandstone were passed through, which strata outcrop at the surface but a short distance off.
12. Waukaringa.—Well, ten chains north of No. 11.
13. The Government bore lies to the north-east of these wells, on the strike of the same strata.
14. Eight miles south-east of Mount Victoria.—Well, in white granitic rock under alluvium; good water.
15. Bimbowrie

15. Bimbowrie woolshed.—Well, in micaceous schist.
16. Near Boolcoomatta station.—Well, in quartzose sandstone, at a deserted mine, close to an outcrop of rock, stained with copper carbonates; good water.
17. Oonatra.—Well, 18ft. to water, in granite (under alluvium) which outcrops lower down the creek and forms a bar across it which probably acts as a dam.

THACKARINGA TO YANDAMA CREEK *via* MOOLEULOOLOO HILLS.

From Thackaringa, close to which place the metamorphic rocks lie near the surface, and after crossing the border, the low undulating downs and plains of granite and metamorphic rocks dip under plains of soft loam with basin-shaped depressions, containing fine silt pierced with cracks and holes. These plains continue to the Mooleulooloo Hills, where the metamorphic clay slates and sandstones again come to the surface and rise to an elevation of about 200ft. above the plain. These plains are chiefly composed of red loam and sand, with soft silt depressions, claypans or hard depressed floors, and dry lakes. Further north these depressions become deeper, and the sand ridges commence: they have a general north-easterly trend, and are very regular in their occurrence from here to Yandama Creek; they are composed of loose red sand, and vary in height from 30ft. to 50ft., and are placed in roughly parallel rows at distances of from a few chains to a quarter of a mile apart, being separated by long reaches of clay and silt flats. Outcrops of jointed sandstone and calcareous grit, apparently horizontal, were observed at one or two places only. On the surface of the hard claypans, as well as on the soft friable silt flats or dry lakes, there are frequently scattered more or less waterworn stones of a yellow flinty rock, ferruginous sandstone, and small pebbles of many kinds of quartz. The whole of the country from Mount John and the Mooleulooloo Hills, and the neighboring ranges, northward to the Queensland boundary, in latitude 26°, and westward to the Diamantina river, and probably far beyond it, and between the Queensland and New South Wales boundary and the Flinders Range, belongs to one vast formation, which, by the fossils found in it, has been determined to belong to the Cretaceous period. Fossils lately brought from near Cootamoorima in the neighborhood of the Peake, by Mr. Chambers, prove the same formation to extend westward into that country.

The Cretaceous and Tertiary Rocks.—The above-described area occupies a low-lying position, not far above the general level of the sea; it is therefore not often that there is an opportunity of studying the composition of the material, or obtaining fossils. Most of the fossils found have been obtained from wells in Queensland and New South Wales. The strata consists of brittle clays and calcareous shales, with bands of limestone and gypsum, clay, ironstone, and ferruginous sandstone, and sandy beds; they are, as a rule, generally horizontal or gently undulating, and have a thickness, so far as at present known, of 300ft. to 400ft. Overlying this formation are beds of sandstone, argillaceous sandstone, kaolin, grit, and pebble conglomerate, forming table-lands and hills almost invariably capped by a thin bed of yellow and red flinty quartzite or jasper rock, the total thickness varying from 100ft. to 200ft. The pebbles found in this conglomerate consist of agate, jasper, calcedony, opal and colored quartz, flint, white and crystallized quartz, and fossil wood, showing a brilliant polish or glaze. The composition of these supererectaceous beds is the same over wide areas from the Warrigo river in New South Wales to the Diamantina. The topmost bed of yellow flinty quartzite or porcelainised sandstone, which forms the capping of the tableland formation, varies in thickness from 10ft. to 30ft.; it has a conoidal fracture, and sometimes shows an amorphous structure, at others encloses grains of sand or quartz pebbles (often coated by hyalite and opalline quartz), in which case it may be considered a conglomerate. It also occurs as rounded masses and pebbles of yellow flinty rock, cemented together into a rough conglomerate. This porcelainised rock is intensely hard, and its particles are at a tension; the most common appearance it presents is that of hard red or yellow boulders fitting close together, splintered, cracked, and jointed into rounded and roughly prismatic shapes; it lies in patches on the argillaceous sandstones and clays, forming in some places a mere coating, in others a deposit of 30ft. or 40ft. thick. Large and small cellular boulders and slag-like masses, with hollow stalactitic forms, are often found. Whether in masses or pebbles the rock is invariably glazed, so as to present a shining red or yellow surface. The most likely theory that can be advanced to account for the formation and glazed surface of this rock is that it has been formed by the infiltration of siliceous water from hot springs into beds of loose sand or porous sandstone, the stalactite-like forms of some of the specimens from Cooper's Creek, the occurrence of siliceous cores round nuclei of cemented sand in loose sand and fragments of quartzite cemented together by silica seem to prove this. The downs which flank the table-lands and hills are undulating and level plains, covered as a rule with a pavement-like coating of blocks and pebbles, or a red and yellow glazed porcelainised quartzite and flinty rock resting on soft yellow and reddish clayey loam; the glazing of these stones is also probably due to the action of siliceous water. The table-lands and hills composed of these supererectaceous rocks are elevated to a height of some 100ft. to 250ft. above the level of the surrounding plains; though generally horizontal, they are sometimes inclined at a low angle. On the Nilpie Nilpie Creek, the flinty quartzite forms steep bluffs, and also occupies the creek flat below, and undulates beneath the soft silt flats.

In the same neighborhood there are some jointed claystones, red sandstones, and conglomerate showing in the bed of the creek, which appear to belong to an older formation, perhaps Devonian. The greatest elevation of these rocks here above sea level is from 400ft. to 500ft. As the elevation of the Cretaceous and overlying formation here is greater than anywhere else in the district it is to be expected that older formations should appear at the surface. The elevated table-lands and hills occupy the country north and south of Cooper's Creek, in the vicinity of the eastern boundary line to Haddon station, near which place the range branches off eastward and northward into Queensland; Kirby's Knob, Mt. Kingsmill, Edinboro' Castle, and Kertietia Hill, being some of the chief points of elevation. The Grey Ranges of New South Wales and Queensland belong to the same formation.

Overlying the Cretaceous and superincumbent hard rocks are deposits of loose and consolidated clay, loam, silt, and sand, gypsum, limestone, &c., all of Tertiary and recent age.

What are known as claypans, are hard areas of clayey sand, generally circular or elliptical, surrounded by sand either in ridges and hills or in level plains, occurring all over the Cretaceous country. Clay and silt flats, also bounded by sand ridges, are as well common over large areas. The clay flats are hard, while the silt plains and flats are of a soft friable character and traversed by fissures and holes, caused by the sinking of the ground through the dissolution of limestone below.

Strewed over the surface of many of the plains and flat areas lie fragments of gravel, ferruginous sandstone and quartzite with agates, calcedony, and other pebbles derived from the table-land formation, which prove the existence of these beds beneath the surface at no great depth. Limestone, in rounded and stalactitic shapes, also exists under similar conditions.

Sandhills

Sandhills and ridges cover a large portion of the Cretaceous country. They extend in long ridges with accompanying mounds in more or less parallel lines, in patches, isolated hills and ridges, and undulating plains for miles across country, covering up the surface. The sand is usually brick red above, and grey and yellow below, and very fine grained. The fine red sand constituting the upper portions of the ridges is loose and shows no sign of stratification; the grey semi-consolidated sand and sandy clay at the base shows a roughly horizontal stratification.

Along the sandhill country between Innamincka and Hadden station there are isolated red and yellow sandhills and ridges at some distance from the main body. The same can be noticed on the Cooper and Diamantina at intervals along the courses of the river flats. The prevailing strike or bearing of these ridges in the northern portions of the territory which they cover is about N.N.W. and N.W., while southward and to the east of the Flinders Range it is N.N.E. and N.E.

In crossing the country from the eastern boundary to the Diamantina, sandhill country is met with at intervals the whole distance; sometimes the ridges are close together, at other times separated by spaces of stony desert or plain a mile or more in width, but always keeping a general parallel course. They rest indiscriminately on the clay flats and plains or the stony downs, their elevation above these varying from 10 to 70 or 80 feet, and width from 100 to 200 yards at the base. There is no evidence of the sand having been blown along the surface, or transported from a distance by water flowing over the surface of the ground, which is, as a rule, quite clear of sand between the hills. I have reason to believe that in many cases, particularly in those of the isolated ridges and mounds traversing the stony desert at long distances apart, the sand has been derived from an underground source through the pressure of subterranean water. There was in all probability an outlet at one time connecting the old Cretaceous sea which occupied the centre of Australia with the ocean. If we suppose a sudden or gradual closing up of this outlet to have taken place through the subsidence of the land, or any other cause, the water not having any vent to escape by, would accumulate in the porous strata until under sufficient pressure to force its way to the surface along cracks or through holes caused by such pressure, and bring with it the sand, in a similar manner to the present mud and sand springs. The eruption of sand in large quantities would cause a subsidence of the surrounding area, whereof there is evidence in the valleys of the Cooper and Diamantina, and thus have created the great lakes into which these rivers now flow. About thirty-five miles south-east of Clifton Hill station, on the Diamantina, there are two parallel red sand ridges traversing a stony plain in a north-north-westerly direction; the plain is covered with a pavement-like coating of flinty quartzite stones. On the east side blocks and boulders of the same rock are scattered about, amongst which are numerous low circular mounds of white clayey sand, the centres of which are formed of blocks of stones piled up, which are encircled by other smaller blocks, and these by scattered stones, the whole bearing the appearance of having been erupted by springs from below. At numerous other places similar appearances present themselves; mounds of sand, gravel, and clay, and scattered stones occurring on the surface of many of the plains and flat areas, the presence of which it is difficult to account for in any other way, as there are no rocks at a higher level in the neighborhood from which the sand or gravel could have been washed. On the top and sides of several of the sandhills, also, pieces of crystalline limestone and blocks of quartzite were seen embedded in the sand. Previously to the deposition of the sand, by whatever cause, the region covered by it was probably a plain or shallow lake. At present there are many lakes connected together by natural canals or creeks which receive the overflow from the rivers, the general level of the country being so nearly alike that water coming down the Cooper to Innamincka when in flood may flow southward into Lakes Blanche and Frome, south-westerly into Lake Eyre, and northward into Lake Goyder and the other lakes near it. The flood waters of the Cooper and Wilson flow back up the Warry Warry and other creeks, causing the waterholes in them for long distances up to be filled by water running in a contrary direction to the fall of the creeks, which is very slight. These creeks are therefore supplied by water coming both from the hills above their sources and from their outlets. The creeks rising in the table-land range flow through the stony downs and into sandhill country, through which they pass in the form of flats with occasional waterholes, which are filled during flood time. On the deposition of the sand, some of the creek courses must have been covered up, in which case the existence of sanded up waterholes and lakes may be inferred beneath the sandhill country. Beds of salt and gypsum underlie the surface of some of the dry lakes, claypans, and sand plains, and represent the ancient beds of lakes which have been covered up. In the neighborhood of Monti Collina station on the Strzelecki Creek and southwards the sand ridges are low and of a yellowish grey color, and merge into undulating country of plains without sand.

BLANCHEWATER TO BELTANA.

Along the borders of the Flinders Range, between Blanchewater and Mulligan Springs, the soft undulating, loamy clay is spread over with a coating of gravel and rock fragments, consisting of quartzite sandstone, slate, quartz, &c., derived from the range, and flinty quartzite from the table hills. Inclined table hills of conglomerate, made up of similar material, with quartzite boulders and indurated claystone, resting on grey-yellow kaolinised and sandy slates, make their appearance here. Near Freeling Water, on the McDonnell Creek, the older rocks rise above the plains, as kaolinised clay slates and limestone, with numerous quartz reefs and veins. Near this junction are boulders and gravel detritus, which point to the existence of a conglomerate bed between the older slaty rocks and the horizontal deposits of the plain.

The clay slates and metamorphic sandstones here are highly cleaved and jointed, by which means the bedding has been obliterated in many places. These continue to Pindelpa Creek, and are overlaid by beds containing quartzose and calcareous bands and limestone, with many quartz veins. West of Pindelpa the road passes over plains and flat country of gravel and conglomerate, underlain by flaggy limestones. Flinty quartzites in isolated cappings and table hills are to be seen in the vicinity of Yerelina Creek; thence to Mount Lyndhurst, over successive synclinal and anticlinal troughs of interbedded limestones, clay and calcareous slates, quartzose sandstones, and quartzites. Near Deception Creek, in a cutting, highly inclined and vertical, quartzites and calcareous and kaolinised slates appear; and also at Puttapa in a grand anticlinal, and near Beltana. The only igneous rock observed was a greenstone dyke near Leigh Creek.

Quartz in veins and reefs, oxide of iron, and ferruginous sandstone, quartzite and limestone outcrops, and igneous and granitic dykes indicate the presence of mineral lodes in the localities in which they occur. From Freeling Water to Beltana, and thence to Thackaringa, the ranges crossed *en route* show frequent evidences of the existence of such.

Copper mines have been worked in this district for some time. Most of the older calcareous, slaty, and metamorphic rocks met with are of a character likely to be mineral bearing. Near Thackaringa, in metamorphic

morphic and granite country, similar to that near Booloomatta and its neighborhood, galena lodes are found, striking E. and W.N.W., with dips of from 20 to 35°, which will probably continue westward in that direction.

The geology of this part of the country is rather complicated, the rocks having been thrown into numerous anticlinal and synclinal undulations, which have, in all probability, been accompanied by faults and dislocations, and require a detailed examination, before the stratification can be properly understood, for a considerable distance across the strike of these rocks, and others forming the Flinders Range, during which it is to be expected that fossils will be found whereby their geological horizon can be fixed.

The following is a general list of the rocks referred to in this report, in descending order, with their ages provisionally :—

1. *Tertiary*.—Sand, clay, gravel, and conglomerate; gypsum and rock salt.
2. *Cretaceous*.—Table-land formation, sandstones, kaolin, grit, and conglomerate; clay and sandy beds with gypsum, ironstones, sandstones, limestones, and calcareous clays in horizontal beds.
3. *Devonian (?)*.—Clay-stones and conglomerates skirting the Flinders Range and elsewhere.
4. *Silurian (?)*.—Limestones, clay-slates and shales, quartzites, calcareous slates, sandstones, silicious and conglomeratic limestones.
5. *Metamorphic*.—Clay-slates, mica slate, and schists with granite dykes.
6. Granite and greenstone.

SPRINGS.

The Mulligan Springs are situated near the northern end of Lake Frome, some twenty miles to the east of the Flinders Range, in the Cretaceous formation. Two wells, some 6ft. or 8ft. deep, lie close together, the water slightly overflowing at the surface. There are low mounds of fine and coarse sand and silicious and calcareous rock close by, and outliers of table-hill formation in the neighborhood. These table-hills are composed of the usual yellow flinty quartzite, which here is devoid of any appearance of sand grains, and contains cavities coated with hyalite and other opaline coatings. Along the escarpment of one of these table-hills there are rounded, partially concentric nodules of ferruginous quartzite, with hyalite, calcedony, and traces of opal in the cavities. These springs are similar in geological position to the mud springs of the Darling and Warrego rivers; they are natural artesian wells, and indicate the pressure of subterranean water, which is trying to force its way to the surface.

Blanchewater Springs.—In the vicinity of Blanchewater station, near Lake Blanche, there are several sets of flowing springs, also in the Cretaceous clay formation. Willow Hill Spring rises out of black peaty ground, with deposits of calcareous tufa and iron ore and limestone, surrounded by soft cretaceous clay plains, with ridges of yellow flinty quartzite.

Within a mile or two lie another set of springs, occupying an area of several acres, and consisting of fresh, salt, and bitter water—all occurring over the same area, and often within a few yards of one another. A deep gully near shows a section of undulating and horizontal beds of sandy clay, calcareous sandstone, and gypsum layers, capped by gravel. The water lies on a level with, and is banked up a little above, the surface, the ground in the neighborhood being of the nature of a bog—in some places covered with vegetation, in others coated with a white efflorescence, an analysis of which has shown to contain an unusual amount of alkaline carbonates.

St. Mary's Pool.—In the bed of the MacDonnell Creek is also a flowing spring, in similar formation, below escarpments of the same quartzite or porcelainised rock which is generally found capping the table hills.

On some of the hard blocks of quartzite and quartzose sandstone near this place there are marks somewhat resembling the impressions of the feet of human beings, kangaroo, birds, &c., which are considered to be fossil tracks. On examination they appear to be merely rough imitations of such, the smooth surface of the rock having been removed by some hard instrument to a slight depth, the pitted marks of such action being plainly visible. Besides this, in one case, the plane of the supposed impression is at an angle with the planes of bedding of the rock.

Evidences of Extinct Springs.—Between Mulligan and Blanchewater, at several points, in groups rising in small, roughly dome-shaped masses above the surface of the soft clay of the plains, are semi-concentric masses of iron ore (hematite), which are doubtless the remains of old spring deposits. In the same neighborhood similar shaped circular protuberances of limestone come to the surface, which I take to be also the old outlets of extinct calcareous springs. The surface of the ground over a large extent of country here is covered with pieces of gravel of iron ore, in addition to nugget-like pieces of porcelainised rock, from which circumstance the watercourse flowing through it is called Dreary Creek. In the sections shown in some of the creek banks bands of ferruginous claystone and ironstone are found, as well as ferruginous conglomerate.

As previously shown, water is rather plentiful in the older rock formations, although it cannot be determined before sinking whether it will be brackish or fresh. The numerous beds of limestone which are interstratified with the other rocks are, as mentioned above, favorable to the storage of water in caves and hollows and underground streams. The occurrence of calcareous conglomerate and tufa on the surface of the older rocks, and in gullies and creeks traversing them, points to the eruption of water charged with lime at some not very remote period. The Flinders and other ranges lying to the south of the plain and sandhill country act as a dam to prevent the subterranean water from reaching the sea; this gives rise to the natural artesian springs, such as Mulligan, Blanchewater, &c., &c. This area is colored green on the map. The natural artesian wells show that in those localities water will rise to the surface when the water-bearing strata have been pierced. Whether it will do so all over the area above mentioned depends on the level of the land, the depth of the formation, the undulations of the bed rock, &c. It is, however, certain enough that water will be found in sufficient quantities by sinking to a moderate depth. By tubing back the salt water met with in sinking, a bore may be carried down—as the strata are horizontal—from one stratum through into another, with the certainty of getting water of a different quality. I believe that the lowest bed underlying the plains, from my present observations, is a boulder conglomerate and gravel, and that limestone rocks underlie this over a considerable part of the area, both of which things are in favor of there being vast supplies of underground water. Besides the water to be obtained beneath the lowest beds, other waters may be met with at shallow depths, such as in watercourses and holes which have been filled up with sand or other material. The deep subterranean water may also be expected sometimes in a porous stratum near the surface, into which it has been forced by the pressure of gravitation, gas, or steam.

August 1st, 1883.

HENRY Y. L. BROWN, Government Geologist.

PLANS

BELTANA to WAUKARINGA about 140 miles. Horizontal Scale 4 miles to 1 inch. Vertical, 2000 feet to 1 inch.

SILURIAN AND METAMORPHIC	DEVONIAN ? OR SILURIAN	CRETACEOUS AND TERTIARY
--	--	---

Waukaringa

Mt. Victoria

Bimbowrie
Station

Oonah
Water

WAUKARINGA to THACKARINGA, about 100 miles.

Thackaringa
N.S. WALES

Thackaringa

Mooloolooloo Hills

Yandama
Creek

THACKARINGA to YANDAMA CREEK, Via Mooloolooloo Hills, about 150 miles.

GRANITE
GREENSTONE &c.

SILURIAN
AND
METAMORPHIC

CRETACEOUS
AND
TERTIARY

Beltana

M^r Lyndhurst
Station

BELTANA N.N.EY TO LAT. 26° (Queensland B^y) about 370 miles.

Freeling
Water

Blanchewater
Springs

Monti Gillina
Station

Innaminka

Cooper's Cr.

Haddon
Station

QUEENSLAND
BOUNDARY
Lat 26°

about 100 Miles

about 70 Miles

DEVONIAN ?
OR
SILURIAN

CRETACEOUS
AND
TERTIARY

P 559.4
S 526

f559.4
S526