tude of about 900 feet above sea-level. Dr. G. J. Hinde, F.R.S., into whose hands the Department entrusted this material for examination, reports that the deposit is not merely local, but must have been formed in the open ocean at some distance from the coast-line, and probably at a considerable depth. This discovery is of considerable importance, and will have to be thoroughly examined some day, as it involves a whole series of important conclusions regarding the physiographical changes in the district, which depend upon the geological age of the deposit. The solution of the many economic questions involved in the stratigraphical research which such an investigation entails is of no less importance to the community than the purely scientific results which of necessity follow.

"(*i.*) Important additions have been made to the sum total of our knowledge in regard to the geological conditions obtaining in the various portions of the State in which artesian water occurs.

"My self-imposed task is now ended, and in the fulfilment of the task, I have endeavoured to show concisely how the Department came into being, the purpose for which it exists, how it carries out its work, something of what it has been able to accomplish, and how in the highest sense it has endeavoured to justify the conception that '*Geological Science is not only the interpreter of Nature, but the Servant of Humanity.*' "

PRINCIPAL RESULTS OF THE FIELD OPERATIONS.

The following reports of the different field officers give a brief account of the work each has been carrying out:—

A. GIBB MAITLAND, Government Geologist.

(1.) *Results of Boring for Artesian Water on the Eucla Plateau.*

In 1897* it was pointed out that (a) an enormous plateau of Recent and Tertiary Strata occupied the southern portion of the State, extending from the South Australian border to the neighbourhood of Israelite Bay (b) the strata consisted of porous beds into which the rainfall is rapidly absorbed and discharged seawards in the form of fresh-water springs, and (c) that the area was one in which artesian water occurred.

The subject was revived during 1900† in a special report on the "Extension of Artesian Water-carrying Strata from South Australia" in connection with the Transcontinental Railway line, the necessity for the selection of a well-watered route being of prime importance. It was suggested in that report that, in the event of the State undertaking any experimental boring operations, such should be carried out along a line due north and south, starting from any convenient locality at the head of the Australian Bight.

Operations were eventually commenced by the Government at Madura,‡ and a depth of 2,041ft. attained. The site of the bore lies about 110ft. above sea-level, at the foot of the Hampton Range, distant about 30 chains from the face of the escarpment, which is 350ft. in height. So far as could be judged by the cores submitted to this office for examination it appeared that the bore pierced about 903ft. of limestone, the Eucla Limestone of Eocene age, underlaid by shales, with occasional bands of dolomitic limestone. The bore did not, however, pierce the floor of crystalline rocks upon which these beds rest. In this borehole salt water was met at a depth of 100ft. 3in. A subartesian supply of salt water was struck at 905ft. and yielded a pumping supply of water at the rate of 29,000 gallons in 20 hours.

At 1,979ft. an overflowing supply of water at the rate of 1,000 gallons per diem was encountered, whilst at a depth of 2,041ft. good stock water was met with, which issued from a standpipe two feet above the surface at the rate of 5,700 gallons per diem. The bore, however, did not pierce the whole of the thickness of the water-bearing beds.

A second bore at an altitude of about 300ft. above the level of No. 1 was put down at a spot 30 miles north of Madura, and carried down to a depth of 430ft. in the Eucla limestone. This bore did not penetrate the underlying shales and sandy beds.

The third bore was situated at the 337 miles 61 chains peg on the surveyed route of the Transcontinental Line, at an altitude of 576ft. above sea-level. The borehole was carried down to a depth of 1,372ft., and judging from the record of strata supplied (the cores not yet having come to hand) it appears that the strata pierced consist of—

Eucla Limestone	603ft.	thick.
Shales	667	„
Fine and coarse sand with hard bands and granite boulders (sandstone) and conglomerate ..	74	„
Granite	28	„

In this bore subartesian water was met with in the sandy beds at the base of the formation, and rose to a height of 420ft. from the surface.

As would have been expected, the results of this boring indicate that the beds are getting very much thinner as the inner margin of the basin is approached, the Eucla Limestone having dwindled from 903ft. to 603ft., whilst the underlying shales diminished from 1,138ft. to 667ft. The first bore was not carried deep enough to pierce the sandy beds beneath the shales, hence there is no evidence available with regard to their actual thickness in this section.

In the year 1908 one of the Assistant Geologists, Mr. C. G. Gibson, devoted four months to an investigation of the geological features of a portion of the country lying along the route of the proposed Transcontinental Railway, and the traverses this officer made enable the eastern boundary of the basin to be defined with a near approach to accuracy; no attempt, however, was made to map the boundary of the basin to the north of the surveyed line.

So far as Mr. Gibson's observations were carried it does not appear, as the geological structure of the plateau indicates, that the sandy water-bearing beds below the Eucla Limestone outcrop near the margin of the basin, but impinge directly on the older granitic and crystalline rocks, which are concealed from view. The sandy beds receive the larger portion of the water along this junction, which to the north must reach a fairly high average elevation.

The catchment area of the Eucla plateau (Premier Downs) is along the northern and eastern edge of the crystalline rocks; this, which sends all its drainage on to the plateau, conveys the rainfall directly to the porous beds along the outer rim of the area.

There are no rivers on the Plateau, hence all the water which falls thereon, other than that lost by evaporation, is available for absorption by the strata upon which it falls.

No reliable estimates appear yet to have been made which enable the amount of water absorbed by the rocks to be arrived at. That such must be fairly considerable is, I think, evidenced by the fact that the Plateau is not drained by any rivers, which would carry off a certain portion of the rainfall, and that it lies within the 10in. to 15in. rainfall belt.

(*) Annual Progress Report, Geological Survey for 1897, p. 29.
(†) Annual Progress Report, Geological Survey for 1900, pp. 28-31.
(‡) Annual Progress Report, Geological Survey for 1903, pp. 33-34.

The hydrostatic pressure of the body of water in the inland portion of the strata has a tendency to force the water outwards and thus cause a permanent flow seawards. This water flows with a velocity due to the difference of level between the intake and the level of discharge, less the frictional resistance of the rock through which it penetrates, which is such as to make the water rise considerably above sea-level in any borehole which may be put down.

Sufficient data have now been obtained by the two deep bores to enable an approximate estimate to be made of the depth at which the subartesian water will be met with along the surveyed route of the Transcontinental Railway Line.

A very voluminous report upon the Mineral Wealth of the State was prepared for the International Conference on the Conservation of Natural Resources. As this has appeared *in extenso* in the pages of the *Australian Mining and Engineering Review,* Vol. 3, Nos. 25 and 26, it has hardly been deemed necessary to reprint it, more especially as it is about to be issued in a more amplified form in the forthcoming volume on the geological and economic resources of the State, which I have at present in preparation.

(2.) *The Geology of the Country between Sandstone and Lawlers, East Murchison Goldfield, from the point of view of Railway Communication.*

In October, 1909, a deputation from the northern districts, urging the construction of a railway from Sandstone to Lawlers, waited upon the Premier: after some discussion it was intimated that the Government Geologist or the State Mining Engineer would be instructed to make a report upon the country lying between the two localities.

It was not, however, until the 12th of October, 1910, that instructions were issued to me to send an officer over this route: there being no other member of the staff available, I decided under the circumstance to make the inspection in person, in company with Mr. H. W. B. Talbot.

A petition was presented to Parliament in 1909 advocating the construction of a railway from Sandstone to Lawlers in lieu of one from Leonora to Lawlers. One of the statements (4) in the petition was to the effect that "from the point of view of opening up new auriferous country the route via Leonora presents no advantages over the route via Sandstone."

It was therefore to the investigation of the question as to whether there was any auriferous country between the two localities that my attention was solely directed.

On the 12th of December, 1910, I was instructed by telegraph that my report on this work need only be brief and of a preliminary nature.

Leaving Sandstone on the 21st of November, nineteen days were devoted to work in the field, during which period an examination was made of the country within about twenty miles on either side of the road which connects Sandstone with Lawlers.

The results of the field work, coupled with the detailed information contained in the reports of Mr. C. G. Gibson, Assistant Geologist, and Mr. Montgomery, the State Mining Engineer, indicate quite clearly that the geological formation containing auriferous deposits occupies only a restricted area in the tract of country lying between Sandstone and Lawlers. The position of this is more or less accurately delineated upon the geological sketch map with which this report is accompanied.*

The auriferous area in which Sandstone lies has a length of about 25, and a width of about 20 miles. The eastern margin of this area is in the vicinity of the township of Maninga Marley, where active mining operations are at present being carried on. Full descriptions of the various mines will be found given *in extenso* in the latter of the two reports to which reference has just been made, and need not be repeated. The auriferous formation consists of a series of metamorphic sedimentary rocks, associated with vesicular greenstones which doubtless represent ancient lava flows.

The series is intersected by intrusive granite, occasionally in the form of dykes. A little to the north of Maninga Marley is a small though conspicuous ridge showing the intrusive nature of the granite: the strata forming the ridge consist of vertical beds of quartzite, mica schist, intersected along the bedding planes by veins of granite.

A traverse due north of Maninga Marley for about 10 miles showed the country to consist entirely of granite, which evidently occupied an extensive area in this part of the East Murchison Goldfield. To the southward the granite was followed for a distance of 14 or 15 miles down Everett Creek as far as the Lake Country, and from a commanding hill near the edge of the lake it could readily be seen that it extended as far southward as the eye could reach.

A very small patch of metamorphic rocks (quartzite, etc.), which represent a portion caught up by the granite outcrops on the main Lawlers road between Survey Stations J.H.R. 173 and 174: it does not, however, appear to have any great longitudinal extent.

To the west of Hell's Gates, and to the east of No. 5 Well on the reserve at Rocky Creek is a narrow strip of country which might possibly form the matrix of a few small auriferous deposits, containing as it does irregular patches of hornblende schist and massive amphibolite. The belt, however, is not of any great width even at its widest part, the southernmost extremity, where it gradually falls into the Lake, about ten miles due south of No. 6 Well on Reserve 8295, consists of metamorphosed sedimentary rocks (quartzites, etc.).

In the vicinity of Hell's Gates the granite is traversed by several very large and extensive quartz reefs, which may possibly merely represent another phase of the pegmatite intrusions, which are a marked feature in many portions of this district.

Granite occupies the whole of the country between Hell's Gates and Mount Holmes (Wallaby Knob). Mount Holmes is a conspicuous hill which from its isolation forms a well-marked feature in the landscape, and upon it Survey Station J.H.R. 196 has been placed. The normal coarse-grained granite of which it is composed is traversed by a greenstone dyke.

To the north of Mt. Holmes lies what is shown on the maps as the Boolygoo Range, better known locally as the Depôt Hills. Granite occupies the whole of the country until the base of the hills is reached, about 16 miles distant. Where an opportunity of examining these presented itself, they were found to be made up of iron-bearing quartzites, which dip westerly at an angle of 45 degrees. These metamorphic sediments are invaded by intrusive granite: so far as my own personal observations were carried, there were no auriferous deposits to be seen.

* Not reproduced.