Diatom-earth (called also infusorial earth, diatomaceous earth, tripoli and kieselguhr) has been put to a great many uses, owing to its lightness, its abrasive power, its great absorbent power, and its low conductivity for heat. Foremost of its uses is that of an absorbent for nitro-glycerine, the resulting mixture being known as dynamite. The Wanneroo earth would not appear to be well suited for this purpose, owing to the high percentage of alumina in it, and also owing to the forms of the diatoms present in it. It is eminently suited for the manufacture of disinfectants by the absorption of phenol, etc., as well as for lining cold storage rooms, and railway wagons, and as an ingredient for refrigerating paint. Owing to the extremely small percentage of iron and other mineral impurity present, it would be an excellent source of silica for the manufacture of soluble and other glass. It could be used as an ingredient of metal-polishing powders and soaps. For all these purposes it would require to be calcined and crushed."

The Reputed Petroliferous Deposits of the Warren and the Donnelly Rivers.—Considerable attention having been directed to the reputed occurrence of petroleum in the country drained by the lower reaches of the Warren and the Donnelly Rivers, it has been considered desirable, owing to the fact that the conditions governing the occurrence of petroleum depend upon considerations of geological structure, that an examination of the locality should be made with a view of determining how far the conditions prevailing on the Warren and the Donnelly had any bearing on the future of the district.

The structure of the country drained by the Warren and the Donnelly is of extreme simplicity, as can be seen by a reference to the two sketch sections following, which may be regarded as typical of the country in this district.

A large quantity of bitumen is reported to be washed up and left by the receding waves all along the South Coast of the State, but more especially in that portion between Cape Leeuwin and Point D'Entrecasteaux, into which the Warren and the Donnelly Rivers empty themselves.* No trace, however, was seen by me of asphalt anywhere along the beach. Somewhat similar material has been reported as being found on the beach at many different localities round the shore of the Great Australian Bight. These fragments are washed up from sources at present unknown.

The formations exposed consist of:—

(*a.*) *Superficial deposits*, comprising sand dunes, alluvial deposits, etc.
(*b.*) *Basaltic lavas.*
(*c.*) A series of *sandstones, grits, clay shales,* and *coal seams,* and
(*d.*) *Crystalline rocks,* which form the floor upon which the other formations were laid down.

The Warren River.—The Warren River flows over the hilly country, composed of crystalline rocks, until within a short distance of the coast, when it eats its way gradually to the sea through the sand dunes and peaty swamps which extend for about five miles from the coast.

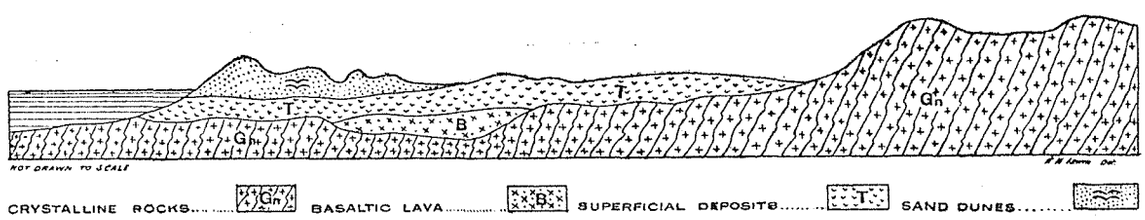
Emerging from the somewhat constricted valley in the hills, the river is flanked on either side by variable width of alluvial deposits. The full thickness of the deposits was not exposed in any single section. In several localities, within a mile or two of the coast, the section in the river exposes at one or two places a deposit of cement, discoloured by vegetable matter—in reality a carbonaceous sandstone. The cement, which rests upon a floor of clay of somewhat variable character, is of not great thickness.

It having been pointed out that this cement yielded mineral oil to such an extent as to warrant its being designated "petroleum rock," two analyses were made in the Departmental Laboratory of the deposit, without any trace of petroleum or asphalt (oxidised petroleum residue) being obtained. It, of course, is conceivable, from the fact that the deposit is exposed at the surface, coupled with the relatively high temperature prevailing during the summer months, that some at any rate of any oil stored therein might evaporate; any such loss would be comparatively insignificant.

The underlying peaty clay ("bituminous clay") also yielded, on analyses in the Departmental Laboratory, no trace of either petroleum or asphalt. Neither of the two deposits can in any sense be regarded as petroliferous.

The local discolouration of the sea in the vicinity has been held to be due to the escape of petroleum from those portions of the rocks which pass beneath the ocean. Owing to the state of the weather it was impossible for me to collect any of the yellowish scum appearing at intervals for analysis, but everything points to the fact that it merely owes its origin to the decomposition of seaweed and the like.

The crystalline rocks make their appearance on the beach beneath the sand hills at high-water mark, some distance to the North of Black Head, which lies to the South of the Warren River. There is every geological reason for believing that they extend Northwards and pass at a relatively shallow depth beneath that portion of the district drained by the lower reaches of Meerup Brook and the Warren River.



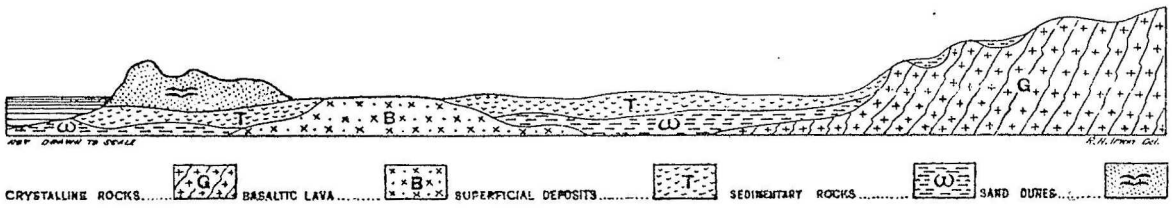
GENERALISED SECTION DOWN THE WARREN RIVER.
LENGTH OF SECTION 10 MILES

* H. P. Woodward. The South-Western portion of the Colony. Annual Report of the Department of Mines for the year 1894. Perth: By Authority, 1895, p. 9.

Owing to the fact that there are no data which will enable an idea to be formed as to the shape of the surface upon which the superficial accumulations rest, it is impossible to form any precise idea as to the actual thickness of the cover which conceals the underlying crystalline rocks and basaltic lavas; that, however, it cannot be relatively great, would appear obvious from an inspection of the ground. In close proximity to the beach, however, near the mouth of the river, the deposits would naturally be expected to be of a greater thickness than further up the valley.

The Donnelly River.—The country between the Warren and the Donnelly Rivers is of identical geological constitution to that exposed in the valley of the former.

The basaltic lava, however, rises to the surface a little to the North of Silver Mount, at a point about midway between the two rivers, and again makes its appearance in great force in that bold headland known as Black Head, some distance to the North of the mouth of the Donnelly.



GENERALISED SECTION DOWN THE DONNELLY RIVER.

LENGTH OF SECTION 15 MILES

On the tributaries of the Donnelly River, a series of sandstones, grits, and clay shales, together with one or two coal seams, are exposed. This series of strata is coterminous with that which occupies the country between the Donnelly and the Vasse. In the neighbourhood of Busselton these strata have been pierced by means of six bores, the deepest being 656 feet, at which depth the floor of granite and gneiss was encountered. At Newton, near Busselton, the base of the series was 329 feet from the surface, at which depth gneissic rocks were encountered. In these bores brown coals of variable thickness were met with in every case.

On Fly Brook, a tributary of the Donnelly, boring and shaft sinking was carried out some years ago, and a series of strata identical with that of the Vasse was encountered; seams of brown coal were met with at shallow depths, but in no case does it appear that any petroleum was encountered. The strata on Fly Brook reach a fairly considerable altitude, and have been laid down in irregular hollows of variable extent, on the surface of the underlying crystalline rocks. Owing to the configuration of the country, sections of those rocks are rarely exposed in the watercourses. Towards the coast these strata pass beneath the sand dunes, which effectually conceals them from view. There, however, is no evidence by which their thickness can even be conjectured, though all the available evidence points to the fact that these superficial deposits attain a greater thickness than in the Warren.

In the light of our knowledge of the geological structure of the valleys of the Warren and the Donnelly, it may be reasonably doubted whether the district can in any sense be regarded as being petroleum-bearing. No petroleum has been discovered in the district, nor does its geological structure seem to conform to that which regulates the occurrence of oil elsewhere.

There is nothing clearer, from all the evidence at present available, that the country is unlikely to rise to any importance as an oil-producing district.

Since this report was written, three bores have been put down in the neighbourhood, and, according to the bore journals supplied to the Government, they prove incontestably that the deposits in the valley of the Warren reach a much greater thickness than had been anticipated. The following are the details of the strata passed through in the bores, as supplied by the owners of the property:—

No. 1 Bore.

Nature of Strata.	Thickness.	Depth
	feet.	feet.
Sand and black mud	49	0
Basalt	32	49
Total	81	81

No. 2 Bore.

Nature of Strata.	Thickness.	Depth.
	feet.	feet.
Sand	504	0
Total	504	504

No core available, the boring being through loose sand.

No. 3 Bore.

Nature of Strata according to Bore Journal.	Thickness.	Depth.
	feet.	feet.
Incoherent sand	80	0
Black clay, interspersed with seams of sand	20	80
Quartz pebbles	10	100
Incoherent sand	52	110
Basalt, partly decomposed	21	162
Shale and brown coal	2	183
Bituminous sandstone	10	185
Brown coal, with particles of ashes, mud, pumice, etc.	10	195
Decomposed graphite	Thin seam only (?)	205
Scoriæ from pyrites, sand, mica, clay, artesian flow, fresh water, graphite, and small quantity of gas	60	205
Quartz pebbles and iron pyrites	2	265
Decomposed basalt; gas	18	267
Hard basalt; no water	30	285
Calcite	(?) 2	315
Black mud, apparently bituminous, volcanic matter, and black mud	5	317
Sand, charcoal, and decomposed basalt	9	322
Brown shale, pieces of basalt, iron pyrites, anthracitised matter	9	331
Quartz pebbles	1	340
Pumice, mica, etc.; graphite	8	341
Artesian flow, salt water, sand, scoriæ, ashes, coal particles, graphite	21	349
Apparent cement material of nature of lye, with graphite	(?) 1	370
Dry sand	106	371
Quicksand	25	477
Clay, with sand and shale	10	502
Sand, with garnets and mica (coal particles at 555ft.; slightly saline water at 565ft.)	78	512
Alternating fine and coarse calcareous sandstone, coherent where fine, incoherent where coarse; slight flow fresh artesian water, and fine particles of anthracite below 690ft.	140	590
Calcareous sandstone, fresh artesian water, gas, particles of coal, anthracitised lignite, fireclay, and fossils	(?) 3	730
Fine-grained sandstone, not hard enough to core	27	733
Sand	10	760
Alternating light grey and brown sand	20	770
Sand, with traces of shells, fossils, and anthracitised lignite, at about 820ft.	70	790
Fine-grained calcareous sandstone	40	860
Fine-grained calcareous sandstone, gradually altering in colour from light to dark yellow; coarse grained; not hard enough to core	17	900
Total	917	917

N.B.—The figures are taken from a tracing of the bore section, and as the thickness of the strata are not given in figures in every case on the tracing, they have been scaled off. The tracing appears to be only approximately drawn to scale, hence the figures of the strata given in this table may not be in every case absolutely correct.

A series of samples have been submitted to me from time to time by the Company, and the following is a description thereof:—

Nature of Strata.	Depth.
	feet.
Micaceous shale, with plant remains	Between 195–205
Débris of black sandy shale	322
Sand with fragments of dark shale	Between 492–503
Micaceous and somewhat sandy shale, and portion of a core of grit or quartzite	„ 503–572
Débris of clay shale	505
Coarse angular sand of quartz, felspar, a little mica, pale garnets (?) and fragments of pyritous shale	Between 550–570
Fine angular sand of quartz, felspar, and mica	„ 571–597
Fine angular sand of quartz, felspar, mica, and pale garnets (?)	„ 640–652
Angular sand of quartz, felspar, mica, with a few pale garnets (?)	„ 652–705
Coarse angular sand of clear transparent quartz and white felspar	„ 705–720
Fine angular sand of quartz, felspar, and a little mica	„ 720–722

In addition to the above, there are amongst the material submitted—

(*a.*) Fragments marked "portion of core from lower flow of basalt."

(*b.*) A tin containing fragments of a quartz sand cemented by carbonaceous matter, such as is found in many of the coastal swamps.

These two samples have no distinctive labels; hence it is not quite clear whether they were obtained from No. 3 bore, from which the other specimens have been derived.

Cue.—Having received instructions to visit Cue in connection with an application to carry out some diamond drilling in the district, Mr. Campbell, Assistant Geologist, was employed to collect the necessary geological data bearing on the question. Owing to the nature of the application, it became

necessary to examine a very large extent of country, which embraced an area of about 10 miles in length by about 6 in breadth.

A plan has been made by Mr. Campbell, with the object of throwing light on the proposal for prospecting the reefs at a depth. This plan shows the position and extent of all the reefs of the district, and, wherever possible, the amount and direction of their underlie.

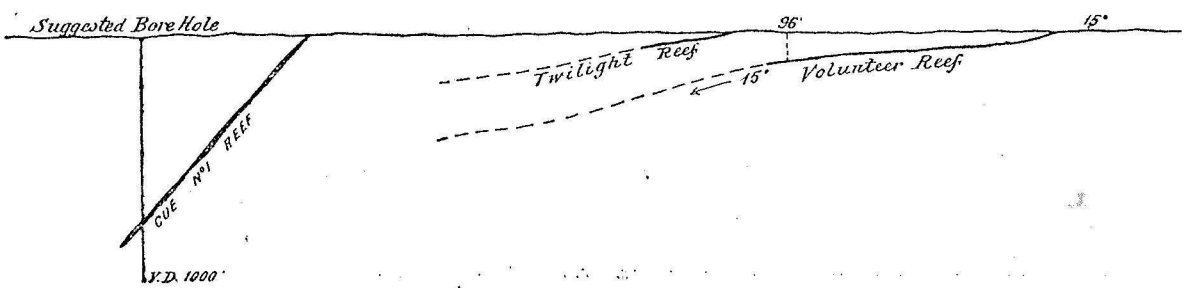
In the year 1897 I visited Cue at a time when enterprise seemed to be on the wane, and the returns showed signs of falling off. It was then pointed out in an official report* that—"The Cue district in its "geological structure is identical with that of the other productive goldfields in Australia and elsewhere, ". . . . . There is no falling off in the supply of ore available for crushing in the district as a whole, "although there are local variations in the dimensions of the reefs in almost every case. . . . . "So far, the reefs have shown themselves to be well defined fissure veins, in some cases, of large size, and, as "such, are likely to be as persistent in depth as anything in the nature of reefs ever can be. Local "fluctuations in the gold yield per ton are, of course, only to be expected in the future, but there are no "scientific grounds for believing that such large and well-defined reefs as those at Cue have, on the whole, "shown themselves to be, will not prove equally productive when followed to greater depths." This condition of affairs still obtains.

The reefs of Cue and Day Dawn are arranged along certain well-defined lines, which have been delineated on the plan, and their assumed continuity indicated.

After giving careful consideration to the whole question, it was recommended that (bearing in mind the general considerations which should determine the granting of State aid in this direction) the best assistance that could be rendered would be by means of a bore put down to the West of the Volunteer leases, just North of the township of Cue, at such a distance as would enable the drill to intersect the reefs at from 800 to 1,000ft.

Over this area there are certain well-defined and persistent parallel reefs which all underlie generally to the Westward. The Volunteer and the Twilight reefs both underlie to the Westward at an angle of 15° from the horizontal. The Cue One reef, which outcrops some distance to the West, underlies in a similar direction at an angle of from 50° to 60°.

A bore put down at a point about five chains East of the North-East corner of G.M.L. 217 would demonstrate the relation which may be called the horizontal reefs bear to the highly inclined. In such a bore the Cue One Reef, its present strike being measured, should be met with at about 800 feet from the surface. The Twilight Reef, if continuous, unless cut off by that last mentioned, should be met with at about 500 or 600 feet, and the Volunteer at about 300 feet lower down.



SECTION SHEWING THE POSITION OF THE VOLUNTEER, TWILIGHT AND CUE No1 REEFS.

In view of the fact that any boring carried out would confer a direct benefit upon the holders of the leased land adjoining, it was further suggested that a contribution on their part, on a basis to be mutually arranged, would not be unreasonable.

The Warden provisionally reserved such an area as would include the ground operated upon.

Lennonville, Boogardie, and Mt. Magnet.—During the year a short visit was paid to Lennonville, with the object of investigating its mineral resources.

It was found that the auriferous deposits were of two distinct types—viz., white quartz reefs and banded quartz or jasper veins (which in some cases proved to be exceptionally ferruginous), approaching very closely the banded hematite-bearing quartzites, which form such a conspicuous feature in some portions of the Murchison. The white quartz reefs present all the characteristics common to deposits of this nature; they are of later formation than the banded quartz veins, for in many cases they intersect the latter. These laminated quartz veins form the principal feature of the district, and, so far as they have at present been worked, have proved to be rich in gold, though it cannot be said that they have had that prospecting which their importance warrants.

The two types of deposits bidding fair to become of economic importance, it seemed that the greatest assistance the Department could render to private enterprise in the district would be in the direction of mapping these formations, in the hope of furnishing a reliable guide for the conduct of the operations of the prospector and the mining engineer.

From an examination of the Lennonville district, it was found that the ore deposits exhibited a remarkable parallelism, having a general North and South trend. They were found to sweep across country, with scarcely any interruption, for about four miles, and to extend both North and South far beyond the limits of the inspection.

* Cue Water Supply for Crushing Purposes. Perth: By Authority, 1897, p. 6.