LABORATORY WORK.

Mr. E. S. Simpson has, as usual, continued in direct charge of the Survey Laboratory. During the year 1911 the total number of samples dealt with amounted to 1,999 as against 1,733 in the previous year.

The assay work required by the State Battery Branch has been, as heretofore, carried out in the Survey Laboratory by an officer, Mr. Murray, whose salary becomes a charge upon the State Battery vote. The total number of assays performed in this connection is included in and forms the bulk of the work done for "Other Departments," set out at length in the attached table, showing the routine work performed during the year 1911.

Table showing Routine Work of the Geological Survey Laboratory during 1911.

Description.	Public.		Official.		
	Pay.	Free.	Geological Survey.	Other Departments.	Totals.
Samples Registered.	126	687	121	1,065	1,999
Assays for Gold	104	459	23	1,045	1,631
„ Silver	2	108	12	32	154
„ Copper	10	63	..	17	90
„ Tin	1	22	1	1	25
„ Lead	..	9	..	..	9
„ Tungsten	..	2	5	..	7
„ Nickel	..	5	..	..	5
„ Other Metals	4	16	..	1	21
Analyses complete	3	3	53	5	64
„ partial and proximate	5	4	33	1	43
Determinations and reports on minerals	4	226	28	13	271
Miscellaneous Examinations	6	15	41	5	67
Totals	139	932	196	1,120	2,387

Reporting, at my request, upon the work carried out under his more immediate supervision, Mr. Simpson states:—

At the beginning of the year there were two vacancies in the professional staff as shown by the Public Service List, viz., those of Senior and 3rd Assistant (Nos. 629 and 631). The former position was filled by the appointment of Mr. A. J. Robertson, B.Sc., who entered upon his duties on the 5th May. The other position (631) has not yet been filled. As the doubling of the field staff of the Survey during the year has greatly increased the work of the Laboratory, the logical outcome is that this work is getting far into arrears, with no immediate prospect of overtaking it. Extra assistance is urgently needed.

Details of such routine work as is capable of tabulation are shown in the accompanying table. In addition much time is spent in giving prospectors and others verbal information as to the value and uses of minerals, methods of preparing for market, etc.

Fees are charged for all umpire and check assays and for some few other classes of work done for the public. No fees are collected for the work done for other Government Departments nor for those numerous investigations made for prospectors under the "Free Assay Section" of the Regulations. Were the Laboratory credited with the value of this work as it should be, its finances would bear a very different aspect as the following figures show:—

	£	s.	d.
Revenue actually received for Pay Assays	106	11	6
Value at schedule rates of work done free for other Government Departments	833	0	0
Value at schedule rates of work done free for the General Public	733	0	0
Total expenditure of Laboratory on salaries and supplies	£1,265	0	0

In February the manuscript of a monograph on the Minerals of Kalgoorlie was handed to the Government Geologist. Later in the year several short articles were written for insertion in a Miscellaneous Bulletin.

At the request of the Museum authorities a revised Census of Minerals of the State was prepared for publication in a new issue of the Natural Science Section of the official Year Book.

By permission of the Government Geologist, a paper was read before the Natural History and Science Society describing some unusual petrifactions from Dandarragan. It described the conversion of coniferous wood of Mesozoic age into fluor-apatite (fluophosphate of calcium), and dufrenite (hydrated phosphate of iron).

Several collections of local minerals were prepared for distribution abroad.

Opportunity was found during the year to initiate an investigation into the clays of the State. Practically no official information is available with regard to these, though they are destined to form the basis of many permanent industries as time goes on.

Further information was obtained as to the actual quality of the gold in some locally-made jewellery. It was found, as on previous occasions, that the metal in some examples was well below the fineness stamped upon them.

During previous years some samples of Fergusonite (tantalate of yttrium) from Cooglegong were distributed with a view to opening up a market for the mineral. One of these samples was subjected to examination by Prof. E. Wedekind of Strassburg University. In conjunction with W. Maas, Prof. Wedekind published an article in the *Zeitschrift fur angewandte Chemie* (*Journal of Applied Chemistry*), which concluded thus:—

> As the result of our experience up till now, we feel justified in recommending the Australian fergusonite as a starting point for the preparation of tantalum salts, all the more because the preparations at present on the market are just as expensive as they are impure.

Since the new radio-active mineral, PILBARITE, was discovered at Wodgina, a keen lookout has been kept for other radio-active minerals. At a greater depth in the same lode, two further minerals have been found containing uranium, radium, and thorium. These minerals resemble, and may be identical with, two minerals, mackintoshite and thorogummite, previously

recorded from Texas, U.S.A. The chief constituents of the three Wodgina minerals are:—

	Mackintoshite?	Thorogummite?	Pilbarite.
Thoria, ThO_2	24·72%	24·46%	31·34%
Uranium dioxide, UO_2 ...	35·60%	none	none
Uranium trioxide, UO_2 ...	trace	37·33%	27·09%
Radium by calculation, centigrams per ton	11	10	7

All three minerals are of high commercial value, and representative samples have been requisitioned from England, France, and Germany for experimentation on industrial lines. A detailed description of their occurrence, composition, and properties is now in course of preparation.

RUTILE (oxide of titanium) has been known for some years to occur at Yulgering Spring in the Avon district. Recently a typical sample has been shown to contain:—

Titanium dioxide, TiO_2	94·97%
Iron sesquioxide, Fe_2O_3 ...	2·81
Chromium sesquioxide, Cr_2O_3	·33
Silica, etc.	2·36
	100·47

Its comparative purity having thus been established, efforts are now being made to open up the deposit and export the mineral. Its chief application is in the manufacture of titanium-steel rails.

AMBLYGONITE, a commercially valuable fluo-phosphate of lithium and aluminium, has been detected in specimens from a pegmatite vein at Ravensthorpe. It has previously been recorded from Ubini.

BARYTES (sulphate of barium) was discovered at Cardup Brook near Beenup, but samples submitted were not sufficiently pure to be of commercial value. A bulk sample yielded:—

Barium Sulphate, $BaSO_4$ ...	55·33 %
Silica, SiO_2	36·98 %

Three new metallic METEORITES have been examined during the year, two being from Premier Downs in the Eucla Division, the third from Mt. Dooling in the Ularring district. Descriptions of two of these have been prepared for inclusion in a Bulletin.

PETROLOGICAL WORK.

Mr. Farquharson, who had been specially appointed at Petrologist to assist in undertaking the whole of such work required in connection with the field operations carried out by the Department, reports upon his year's work in the following terms:—

My first care, after entering upon the duties of my office on the 20th April, 1911, was naturally to become as fully conversant as possible with the state of knowledge of the geology, and in particular of the petrology, of the colony in so far as it could be gathered from the specimens and publications of the Survey. Accordingly, with the exception of determining various specimens for the Mines Department, I spent the month of May in going over both the mineral and rock collections of the Survey in the Museum and the large collection of rock slides in the office. It was soon apparent that many of the identifications of rocks were not quite up to modern nomenclature. From May onwards, therefore, as opportunity has permitted, I have devoted considerable attention to naming the collections, with the object of ultimately forming an arrangement of the rocks of the State that will serve as a reference for the officers of the field staff and as a guide for the general public.

Apart from this work, from June to the end of December I have been busily engaged along a variety of lines. To begin with, there have been many determinations to be made of both minerals and rocks for prospectors and mining men, and even for settlers. One group of specimens identified is specially worthy of mention, viz., that sent down at intervals from a locality about 40 miles west of Mount Magnet and a mile or two north of Yoweragabbie. These included massive fibrous tourmaline—schorl rock—and corundum. When it is remembered that these minerals are very frequently associations of cassiterite, it will be obvious that a careful prospecting of the locality for tinstone is highly desirable.

There has further been a considerable amount of material reported on in connection with bores put down for water. In particular, the cores of the Cookernup bore down to a depth of 2,215 feet have all been carefully examined and described, and it has been shown that, while the supply got has, up to the present, been limited, bedrock has not yet been reached. Various specimens from other bores have been reported on, and in several cases information and advice have been given direct to those who have come for it. During the former half of the month of June I was occupied chiefly in determinations of numerous specimens from Southern Cross for Mr. St. Smith's report. Some of the results have already appeared in the Preliminary Report on that field. The striking feature of these rocks was the very large number of hornblendic varieties. From a consideration of them, it is certain that many are altered forms of gabbros and dolerites in which the original augite has been changed by dynamic action to hornblende or uralite, while the felspars have been bent, broken, or faulted. It would, therefore, appear that many of these rocks are very old plutonic intrusions, and that, subsequent to their consolidation, they have been acted on by great earth movements, evidences of which exist all over the State. As the result of these movements, large anticlinal and synclinal faults and fault-planes, as well as fissures, have probably been produced, and these planes of weakness thus produced have allowed of the penetration of orebearing solutions, which have doubtless accompanied late acid and basic intrusions. Sufficient evidence is not yet available to enable a theory, properly worked out and based on the results of modern petrological work, to be put forward, but there can be little doubt that the outcome of the more or less regional survey of the Kalgoorlie field at present being undertaken, together with the deductions of the all-important petrological work, will go far towards clearing up the structure of the interior of the State and towards a true explanation of the genesis of the ore-deposits, and thus tend to materially assist the mining industry. Determinations of a number of Kimberley rocks also occupied part of my time in June. The detailed results of the examination of these will appear in the Kimberley Bulletin. Suffice it to say here that conspicuous among the specimens are various fresh and amygdaloidal dolerites, some ferruginous sandstones, and three specimens of highly epidotic rocks, one an epidosite, the other two probably epidotised diorites or related rocks. One of these two has a mineral which, pending a chemical analysis, is to be referred to glaucophane.

The latter half of June, in accordance with instructions, I spent in a brief examination of the rocks of some of the mines on the Eastern Goldfields.

During July attention was paid to some rocks from Warrawoona, two of which are described in detail for a forthcoming Bulletin. The interest of these rocks is that the existence of metamorphosed sediments in this district has been definitely established and the views previously held by the Government Geologist as to the origin of the formations at least partly confirmed.

An investigation was also begun into the origin of the so-called Banded Ironstones, which form such a peculiar feature of the landscape and geology of the State. So far as the results of this research, extending at long intervals from August to December, have shown, some at any rate would appear to be weathered and altered forms of heavily pyritised hornblendic rocks. Very similar formations, called Amphibole-Magnetite rock, have been described in particular, from the Cuyuna Iron Range, Minnesota, in association with cherty iron carbonates, ferruginous cherts, etc. On a recent visit I paid to the Nemesis Mine at Tuckanarra in the Murchison Goldfield, specimens were obtained which appeared to show the passage from the ferruginoid schists on the surface to a rock almost identical with the amphibole-magnetite rock of the Cuyuna. The actual mineralogical determination of the amphibole has not yet been made out but it is probably, in part at least, the species grünerite. According to F. S. Adams, "this amphibole-magnetite rock was produced by partial anamorphism of the original iron formation due to heat and pressure developed by con-