Alexander G. D. Esson.

During the early part of 1924, Mr. Esson was occupied with a portion of his annual recreation leave for 1923, and thereafter in the preparation of "An Interim Report upon the Paynesville Centre and District," for the Annual Report for 1923, in addition to various details in connection with field plans necessary for further field work at Paynesville, and also in consultation with Dr. Larcombe, Acting Petrologist, regarding specimens of rocks submitted for examination, as well as in other multifarious duties necessitated by the nature of the geological work upon which he was engaged.

On Monday, February 11th, 1924, this officer left Perth for the resumption of his field work at the Paynesville centre and surrounding district, and he arrived back at the Head Office in Perth on Tuesday, September 23rd, 1924. The work covered in that time included an examination of about 300 square miles of country, some of which was carried out in very careful detail, but the main portion, as would be expected, was executed in a broad way. The final reports and maps of the Paynesville centre and district are now in course of active preparation, and ought to be available shortly.

Notes upon the results of various broad driving traverses have been prepared, and are to be found in that portion of this report dealing with the principal results of the year's field operations.

From the date of return to Head Office, Mr. Esson was occupied in the preparation of maps and final report upon Paynesville, in consultation and collaboration with the Acting Petrologist regarding specimens submitted for examination and correlation in various duties, and in annual leave for 1924.

In all 226 days were spent in the field, giving a percentage of total working days of 61.8 per cent. in field work. All the field work by Mr. Esson having been on the Murchison Goldfield.

PRINCIPAL RESULTS OF THE YEAR'S FIELD OPERATIONS.

1.—INTERSTATE ARTESIAN WATER CONFERENCE.

(A. Gibb Maitland.)

The Fourth Interstate Conference on the Artesian Water Supplies of Australia was held in Western Australia during the month of October. The Conference, which was attended by representatives from New South Wales, Victoria, South Australia, and the Commonwealth Government (unfortunately Queensland did not officially participate), sat in Perth between the 1st and 6th of October and again from the 14th to the 16th of October, the period intervening being occupied in travelling to the Gascoyne River for the purpose of enabling some of the members to obtain a personal acquaintance with the basal beds of the strata forming part of what is known as the North-West Basin.

The members attending the Conference were:—

Commonwealth—
- Thos. Hill, M.V.I.E., Chief Engineer, Works and Railways, Melbourne.

New South Wales—
- E. C. Andrews, B.A., Government Geologist.
- H. H. Dare, M.E., M.Inst.C.E., Commissioner for Water Conservation and Irrigation.

Victoria—
- W. Baragwanath, Director of the Geological Survey.
- A. S. Kenyon, State Rivers and Water Supply Commission.

South Australia—
- L. Keith Ward, B.A., B.E., Government Geologist and Director of Mines.
- J. G. Stewart, M.Inst.C.E., Engineer-in-Chief.

Western Australia—
- A. Gibb Maitland, Government Geologist, Chairman.
- P. V. O'Brien, M.Inst.C.E., Chief Engineer for Water Supply, Irrigation, and Drainage.
- F. W. Lawson, Engineer for Metropolitan Water Supply, and

The Permanent Secretary to the Conference—
- Mr. J. E. Slade, of the Water Conservation and Irrigation Commission, New South Wales.

One of the chief objects of these periodical Interstate Conferences is to ascertain the extent, the effective yield, and the amount of stability of Australian artesian supplies with a view to an equitable policy of conservation in order to make them serve as large an area and as large a population as long as possible. It may be of interest to direct attention to the fact, as pointed out on page 11 of the Annual Progress Report of the Geological Survey for the year 1912, that the Interstate Conference "virtually forms a part of that great modern scientific movement of the Conservation of the Natural Resources which is slowly but surely making itself felt throughout the whole civilised world."

Amongst the important matters dealt with during the course of the deliberations of the Western Australian Conference were: temperatures of artesian water at considerable depths; sources of supply of artesian water; chemical composition of the water; leakage of artesian water; palaeontology of the different water-carrying formations; diminution of bore flows, and the means to prevent exhaustion of the supply.

It has been found that in most areas there is an appreciable diminution in the yield from the artesian wells. In the case of Queensland, which draws its supplies from the Great Australian Basin, the following figures, as made available by the Government Geologist, relating to the diminution of the flow in the basin, are significant. Between the years 1914 and 1923 the yield from the artesian wells fell from 500,000,000 gallons to 300,000,000 gallons per day, although 300 additional bore holes were put down. This represents a diminution in the supply of water equal to about 4.6 per cent. per annum, or 6 per cent. if the yields are averaged with the number of bores; at this rate of diminution it has been estimated that in 50 years the basin will only be yielding 20,000,000 gallons of artesian water per diem, an amount about equal to that from 50 of the bores at the present time.

A lessening or even cessation of flow does not of necessity indicate a permanent exhaustion of a basin for there are always fluctuations in the level of underground water. Diminished yields due to (a) lateral leakage of the water; (b) choking of the bores as a result of "creep"; (c) accumulation of sand, fine mud, or some mineral product; and (d) wearing out of or defects in the casing are capable of remedy by methods known to engineers. A permanent decrease in the supply as a result of the

exhaustion of the head by an uncontrolled draft is, however, irremediable; hence in the absence of a healthy public opinion on the matter, legislative enactment is the sole preventative.

2.—GRAPHITE ON THE LOWER PALLINUP RIVER.

(A. Gibb Maitland.)

A brief account of the graphite deposit of the Lower Pallinup River appeared as Article 2 in the Annual Progress Report of the Geological Survey for the year 1923. Since that article was written the following report on a sample (1/3865) collected by myself, and submitted to the Government Chemical Laboratory has been received:—

Proximate Analysis (L. 898/24).

Volatile matter	6.54
Carbon	54.72
Ash	38.74
	100.00

"The gangue is mainly kaolin. This sample is of no value as a source of flake graphite owing to the graphite being present in minute scales. It contains too much mineral matter to be of use for foundry work or pencil making, but might be used for stove polish."

3.—NOTES ON THE COUNTRY IN THE VICINITY AND TO THE NORTHWARD OF ISRAELITE BAY, EUCLA DIVISION.

(A. Gibb Maitland.)

The period between the 12th May and the 26th July was devoted to a reconnaissance of the geologically little known country between Esperance, Israelite Bay, and Fraser's Range. The country was reached by an overland journey from Ongerup *via* Ravensthorpe.

An examination of the country between Norseman and Esperance had been made prior to the present journey by travelling from Norseman via Moir's Rock and the Fitzgerald Peaks, thence down the Salt (or Lort) River to the coast. From the mouth of the Lort River the road to Esperance was followed as far as Gage Lake, into which the Dalyup River discharges its waters, thence up the river to the Norseman road as far as the Government tank at the Salmon Gums. A return to Esperance *via* the Grass Paddocks and Bostock Swamp was made. The eastern margin of the country was examined from the Old Fraser's Range Road, *via* Mount Ridley, Clear Streak Well, and Boojebeenyer. The route followed, involving about 800 miles on horseback, enabled a general idea of the geology of the whole of the Esperance hinterland to be obtained, the salient features of which have been included in these notes.

The country in the neighbourhood of Esperance Bay and the hinterland is a tableland made up mainly of granitic rocks of which that [11847] from Mount Ridley is typical. Mount Ridley (N. 24) is a very conspicuous granite ridge trending generally east and west, with a fairly bold escarpment on the northern face. The ridge is about a mile in length, and the highest point rises to a height of about 340 feet above the level of the well.

At Cowalyina (Reserve 2790), several miles to the north of Mount Ridley, the granite has given place to granitic gneiss [11848], the foliation planes of which are vertical and have a dominant strike of northwest and southeast.

The surface of the tableland is of extreme irregularity, and is occupied by a series of salt pans and lakes. These dry or salt lake basins are exceptionally numerous; they are very variable in their outline, are in some cases many miles wide, and the area of some of them is very great. These salt lakes are often very isolated, though at other times loosely strung together, being separated by narrow divisions. Their resemblance to and connection with river channels may be noted in their elongated shape, of which Lake Raeside, over 100 miles in length, may be cited as a typical example. Lake Raeside constitutes the main channel of the central group of lakes forming an ancient water course flowing into the upper reaches of the Ponton River, which is the only defined water channel of any length. The Ponton River in parts of its course is a deep channel with well-defined banks and empties into a large clay pan at a point about 40 miles from where it crosses the Trans-Continental Railway line between Zanthus and Kitchener. Its course from the clay-pan is represented by a broad ill-defined channel trending southward for about two miles, when it loses itself in a large salt-bush flat broken by low banks of powdery gypsum. The flat represents the uplifted estuary into which the Ponton flowed north of Balladonia. The estuary of the Ponton is 120 miles due north of the coast line along the Great Australian Bight.

The series of which Lakes Dundas and Cowan form part are not lakes in the ordinary sense of the word, with a well-defined basin, but are merely parts of another independent river system which had its mouth in the Miocene Sea near Norseman, and the Archipelago of the Recherche near the Lort River. In traversing the Lort (or Salt) River in August, 1911, it was then a strong deep running river of salt water, almost a brine, owing to the fairly heavy rains which had fallen in the hinterland, and was carrying off the overflow from the lakes. A similar condition of affairs was noticed in 1919 by my colleague, Mr. Talbot, when traversing the Ponton; at that time, after a rainfall of two and a half inches, the upper reaches of the river were running very strongly with salt water derived from the salt lakes which form the upper portion of its course.

The existence of such river systems points to the fact that this portion of Western Australia had a heavier rainfall and was much better watered than it is at present, and implies a comparatively recent desiccation of the country which resulted from a regional uplift of about 1,000 feet. Such an uplift tends to cause the rainfall to become heavier on the coastal areas and lighter in the interior. The increase of rainfall in the coastal areas tends to hasten the lowering of their level by denudation and the cutting back of their channels, with ultimately the restoration of a more even distribution of the rain.

Many of the salt lakes contain gypsum deposits. The large lake to the east of Stennet's Rock (Reserve 3045)* has along its edge a deposit about 12 inches in thickness of small crystals of gypsum, whilst near the centre of the lake they are of larger size, often over an inch in length. The crystals in the centre of the lake are not perfectly formed, whilst those along the banks have as a rule all their edges rounded as a result of wind erosion.

Along the shores of some of the lakes horizontal beds of gritty ferruginous sandstone are met with.

*Lands and Surveys Department, Lithograph 11/300.