

mass of rough porphyry hills. The soak is situated just below the point where the creek issues from a low rocky gorge. This soak is capable of being deepened and appears to be reliable.

Meewajarra soak lies about two and a half miles southwest of Cairn H.P. 41 on the western side of the Barrow Range, opposite a wide gap at about the middle of its length.

Winburn Rocks gnamma hole lies on the eastern side of the Barrow Range, about six miles east of the Cairn H.P. 41.

Bilbring rock hole lies at the base of a bare granite outcrop about thirty-five chains south of the Cairn H.P. 42 on Lightning Rock.

Of the above-mentioned waters only the rock holes at Spring Granite, Windarro and Brelyalee, and the soaks at Choogidda, Gamminah, Weelgryne and Barlee Spring can be considered as possibly of a permanent character.

2.—SUMMARY OF THE PETROLOGICAL REPORT ON THE ROCKS FROM THE WARBURTON RANGE AREA.

(R. W. FLETCHER, B.Sc.)

The Warburton Range Area consists of a folded series of fragmental rocks, comprising shales, mudstones, sandstones, grits and conglomerates, with intercalated acid and basic flows and sills which have in places completely metamorphosed the sediments.

The basic sill or flow rocks include three important types which outcrop repeatedly, due to folding, throughout the area. These are the Spilite (abitisised basalt), Greenstone (chloritised basalt), and Epidosite (epidotised basalt) types respectively. Certain rocks, described under the heading "Miscellaneous Rocks," represent single limbs of folded flows or sills outcropping south of the Warburton Range only.

The three principal types are characterised by amygdaloidal structure which is particularly well-marked in the spilites and epidotes. The greenstones are coarser in grain and less amygdaloidal, so that they appear to represent the more central portions of flows or sills. All three are similar to each other in micro-texture and mineralogical constitution but they differ in mineral proportions. The principal minerals are albite, chlorite, epidote, amphibole, iron ore, leucoxene, calcite and quartz. In the spilites, albite, iron ore and leucoxene are very abundant, while chlorite, epidote, calcite and quartz are more frequently found as amygdules; in the greenstones, chlorite, amphibole and epidote are the common minerals; and in the epidotes, epidote is far in excess of the other constituents. All three types have well-defined plexal fabrics, the laths consisting principally of albite (in the spilites), chlorite (in the greenstones) and epidote (in the epidotes).

In view of the field association, and the general similarity in structure, micro-texture and mineralogical constitution, it is considered that the three types represent phases of the same magma. The differentiation was probably caused through circulating solutions and gases during the final stages of consolidation.

An attempt has been made to correlate these basic rocks with similar rock types from other parts of Western Australia and sufficient evidence obtained to prove definitely that the Warburton Range rocks are more closely allied to the basic flows and sills of

the Nullagine formation in the Kimberley and North-West Divisions, than to any other known rock series in Western Australia.

The acid sill rocks include a variety of porphyries such as felspar-porphyry, quartz-felspar-porphyry, granite-porphyry, granophyric-porphyry and biotite-rich-porphyry. It is impossible to determine petrographically whether these types are all phases of the one sill or whether they represent several different sills, for they are all more or less similar in composition. The principal differences, those of texture and structure, are due to different rates of cooling, and to different degrees of mechanical deformation which occurred during the final stages of crystallisation. The minerals of the porphyries belong to three stages of development, the phenocryst stage (quartz, alkalic felspar, iron ore and green mica), the groundmass stage (quartz, alkalic felspar, micas and iron ore), and the hydrothermal-pneumatolytic stage (quartz, biotite, epidotes, calcite, fluorite, tourmaline and pyrite).

The rocks described by Farquharson as "dyke porphyries" belong to this group of acid sill rocks, but I can find no relationship between the so-called granular-porphyries (which are really metamorphic rocks) and the true porphyries. The "granular porphyries" are, however, related to the partially metamorphosed (recrystallised) granite outcropping in the north of the area, in the vicinities of Bentley Hill, Spring Granite and Gneiss Hill, and it seems evident from the general metamorphic character of these acid rocks, that they belong to some earlier period of igneous intrusion. On the other hand the accessory-rich granite in the vicinity of Mt. Squires is very similar in mineralogical constitution to the sill porphyries, and there can be no doubt that this granite and the porphyries are co-magmatic and are of the same age, the granite being probably the feeder of the porphyry sills.

An analysis of one of the porphyries agrees very closely with that of (5404), described as an acidie (felsite) lava, from the Nullagine formation in the North-West Division. Incidentally, Mr. Forman observed, independently, the similarity in the hand specimens of this rock (5404) and some of the Warburton Range porphyries.

In addition to the acid and basic rocks of sill and flow origin, there are, in the northern part of the area, numerous dykes of epidorite and dolerite, which may be related, on one hand to the basic flows and sills of the Warburton Range Area, and, on the other hand, to the ultrabasic plutonic mass of the Cavanagh Range. It is suggested, on very slender evidence, that the three groups, corresponding to the three phases of igneous activity, plutonic, hypabyssal and extrusive, may be co-magmatic.

The sedimentary rocks include shales, mudstones, sandstones, grits and conglomerates, some of which have undergone partial, or almost complete, metasomatic changes. The principal molecules introduced during the metasomatism were lime and silica. In the vicinity of the slowly cooled porphyries rich in minerals belonging to the hydrothermal-pneumatolytic stage of crystallisation, the sediments have been completely recrystallised and new mineral assemblages formed. However, in both the metamorphosed and un-metamorphosed sediments, tourmaline has developed as a result of the pneumatolytic action connected with the final stage of crystallisation of the porphyries. There is fairly strong evidence to show that the meta-sediments are the metamorphic representatives of the normal fragmental rocks.

Correlative evidence indicates that the Warburton Range assemblages of acid and basic flows and sills and interbedded sediments, belong to the Nullagine formation.

3.—SUMMARY OF A REPORT ON A SAMPLE OF STINKSTONE (STINKSTEIN) FOUND IN A LIME DEPOSIT ON BOOLARDY STATION, MURCHISON DISTRICT.

(T. Blatchford, B.A., and F. G. Forman, B.Sc.)

From the inspection carried out in the field and from information otherwise obtained, we have arrived at the following conclusions:—

1. Most of O.P.A. 236H is occupied by granite on which may be shallow surface deposits, but deep basins would be most unlikely.
2. The stinkstone is not confined to the spot where it was first found, but was located in four other places by us, so it is probably fairly common.
3. Where found it was evident that the stinkstone was definitely a variety of travertine limestone, usually the darker variety, occasionally the yellow, but never the really white.
4. The stinkstone does not occur in a regular limestone bed similar to oil-bearing limestones in other countries, but is a surface deposit.
5. Confirming field evidence, analyses of the samples collected show no signs of petroleum.
6. In our opinion, therefore, the occurrence of stinkstone at Boolardy Station has no bearing whatever on the possible occurrence of mineral oil in that area.

4.—FINAL REPORT ON THE CORRELATION OF THE ARTESIAN BORES IN THE METROPOLITAN AREA, PERTH.

(F. G. Forman, B.Sc.)

Investigation shows that the information available is insufficient and of too doubtful a character to be used in the production of an accurate sub-surface contour map, indicating the depth below the surface of the various artesian water beds.

The reasons for this conclusion are as follows:—

1. The majority of the bore records available depend on drillers' logs only for a description of the strata passed through. A comparison of the drillers' logs with determination of the strata made by officers of the Geological Survey in the few instances where the cores have been examined by them, shows the drillers' determinations to be often much in error and of very doubtful value.
2. In those cases where sections of the cores have been preserved, there are insufficient samples to allow of these cores being used for accurate correlative purposes.
3. There is great uncertainty in many of the boring records as to the exact depth at which the flows began, in many instances there being in the record simply a note of the amount of flow in gallons per day at a particular depth, the depth at which the flow started being omitted.

4. It has been the custom to record the temperature of the water and its static head only after completion of the bores so that these records for correlative purposes are of doubtful value. The same applies to water analyses.

5. On a study of the bore logs in the Claremont District, it appears that the strata are displaced between the Claremont No. 1 and No. 2 Bores. Lack of information as to the direction and amount of throw of this fault and the possibility of faulting in other parts of the Metropolitan Area make any sub-surface contour plan, drawn without more information than is at present available, of very doubtful value.

The following conclusion have been reached as the result of this investigation:—

The base of the coastal limestone series, consisting of current bedded calcareous sandstones, lies at elevations varying from sea-level to as much as 180 feet below sea-level in different parts of the Metropolitan Area.

Underlying the coastal limestone series there are lacustrine deposits of soft calcareous shales and sandstones passing downwards into a series of marine beds of calcareous shales or mudstones, sandstones and impure limestones. All the beds present are extremely lenticular.

Under the Metropolitan Area there are three distinct artesian water-bearing horizons. These horizons can be distinguished by water analyses, static heads and temperatures of the various flows. The horizons when contoured from bore to bore are found to be unconformable and it is suggested that the water-bearing horizons lie on the surfaces of the unconformities, because of the frequent occurrence of extremely coarse sands and small boulders in the water-bearing zones. These sands are in distinct contrast to the fine-grained nature of the other sediments throughout the series.

Of the three horizons, the upper two have a limited distribution. The upper horizon is met with in the bores in the vicinity of the city and at Osborne Park, and it is thought that the bores of the Guildford District also draw their water from this horizon. The second horizon is met with in the bores in the Leederville District and in the King's Park bores on Mount's Bay Road. The third horizon covers a larger area, having been encountered in all bores of sufficient depth.

In the attached table the various bores in the Metropolitan area have been divided into groups according to which horizon each bore derives its main supplies of water. In the case of those bores which draw by separate casings from two horizons, the separate flows have been listed in their respective groups. Details, where available, of water analyses, temperatures and static heads are also shown.

Three main artesian water horizons can be recognised and these have been named, for purposes of reference, according to the district in which each horizon has been chiefly exploited by boring. As will be seen from the table, these are the Claremont-South Perth, the Leederville and the City horizons, which occur in that order from the lowest upwards. Owing to the relatively isolated positions of the bores at Fremantle, Guildford and Midland Junction from the remainder of the bores in the Metropolitan Area these have not been correlated, as it is considered that too great an uncertainty exists to allow of this being done.