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ANNUAL REPORT 1955

Petrological and Chemical Laboratory

by

W. B. Dallwitz

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General

There are two ways in which a summary accountsof the work done in the petrological laboratory might be presented. The first is to give a full list of localities and sources from which rocks and minerals were examined, together with some information on results where appropriate; the second is to give a general statement on the types of investigations undertaken and a brief outline of the more interesting results and conclusions arising therefrom. The report will be presented on the second plan, as the first scheme would involve a tedious recital wherein the more important points would be obscured.

The work of the chemical section is more easily dealt with; one chemist was engaged in geochemical prospecting in the Northern Territory during the field season, one was employed in the laboratory during the first three months of the year, and another for the last three months.

A. Petrology, mineralogy, mineragraphy, spectrography, and X-Radiography.

For the greater part of the year four officers were engaged in this type of work, and towards the end of the year one additional officer was appointed. One laboratory assistant was engaged in preparing thin sections and autoradiographs.

Specimens from about 85 localities or sources, in addition to miscellaneous rocks and minerals and beach, dune, and stream sands sent in by prospectors, companies, field geologists, and members of the public, were examined. However, most of the specimens were collected by Bureau field geologists working in the Northern Territory, Queensland, Western Australia, and New Guinea.

Numerous secondary and primary uranium minerals from the South Alligator River area, Rum Jungle, and elsewhere were identified. An interesting mineral identified in ore from the Sleisbeck No. 4 deposit is meta-tyuyamunite, a hydrated calcium uranium vanadate.

In June a quartz spectrograph was put into operation, and in September an X-Ray diffraction apparatus for taking powder photographs of minerals was set up. Both pieces of apparatus were used where necessary in the identification of minerals, and have proved to be extremely useful adjuncts to optical and microchemical methods in the examination of both non-opaque and opaque minerals. In fact, some determinations would have been virtually impossible without recourse to X-Ray and spectrographic techniques.

Rum Jungle ore deposition and associated phenomena.

As opportunity offered study of a comprehensive suite of ores and rocks from the Rum Jungle uranium deposit was undertaken. This work is not yet completed, but it is hoped that a rational account of the processes of mineralization in that area will be presented.

South Alligator River Area, N.T.

Mineragraphic and X-Ray studies have shown that the Palette and El Sharana uranium deposits are of primary origin.

Daly River Area, N.T.

Petrological study of granodioritic and metamorphic rocks from the Mt. Litchfield district and an area south thereof has confirmed field evidence pointing to two periods of plutonic intrusion, the older probably of Archaeozoic age.

A.B.C. Uranium Prospect, N.T.

The rock favourable for uranium mineralization was found to be a fine sedimentary tuff interbedded with basaltic flows and agglomerate, and not a rhyolitic dyke-rock, as postulated from field evidence alone. It is probable that it represents sedimentary rock pulverised by a steam explosion associated with the basaltic volcanic activity.

Radioactive deposits, Cloncurry - Mt. Isa area, Queensland.

A petrographic and mineragraphic report on selected radioactive rocks and minerals was prepared. Identification of some of the radioactive minerals was impossible because of fine-grainsize and the intrinsic difficulty in specifically determining metamict minerals, namely complex columbates, tantalates, and titanates. At the time when the specimens were examined the spectrograph and X-Ray plant were not yet set up.

Many of the deposits appear to contain the complex minerals mentioned; in others radioactive iron oxides-hematite, hydrated iron oxides, and magnetite - are present, and only one, the Mary Kathleen, was found to contain pitchblende or uraninite. Even if certain of the ores are of commercial grade, difficulties in extraction of uranium will arise because of fineness of grain, the refractory nature of some minerals, and the presence of abundant carbonate, which will entail heavy consumption of acid.

Carpentaria Geosyncline, Queensland.

Study of the basic igneous rocks of the Mt. Isa - Cloncurry area continued.

Preliminary petrological work on these rocks included the preparation of descriptions and partial descriptions of some 150 slides of specimens collected throughout the area. Basic rocks from a large anticlinal structure in the Soldiers Cap and Duchess areas received more detailed attention, including optical mineralogical study and model analyses. Five representative specimens were chemically analysed.

It has been shown that the basic igneous cycle can be divided into three major phases. An understanding of the order of emplacement, form, and type of the igneous bodies, and of the regional metamorphic and metasomatic changes which they have undergone, is a necessary preliminary to an investigation of their relationship to copper mineralization in the region.

The Duchess area has been chosen for the study of this problem of mineralization. A map of the traverses made in the vicinity of the Duchess orebody has been prepared, and the points where specimens were collected have been plotted. Selected samples have been submitted for preliminary quantitative spectrographic determination of copper, chromium, cobalt, vanadium, and nickel (see also below).

In addition to the above-mentioned research projects about sixty rocks of various kinds were identified and described to help in the preparation of a geological map of the Cloncurry-Mt. Isa area.

Miscellaneous investigations.

Listed here are localities from which a considerable

number of rocks has been examined for Bureau field geologists. The studies were undertaken mainly to describe and identify representative specimens, and the petrologists have either drawn no independent conclusions or have confined their comments to genetic and theoretical aspects only. It has, with a few exceptions, been left to the field geologists to interpret the significance of the results presented to them.

(a) Newcastle and Gregory Range, Queensland. Some comments were made on the probable relationships of granites and porphyries in this area, and it was concluded that most of the porphyries were extrudéd upon an eroded surface of granite.

(b) Nulla Nulla and Lolworth areas, Queensland. Basalts and associated trachyte.

(c) South East Papua.

(d) New Guinea and New Hebrides (volcanic rocks).

(e) Rouna Dam Site, near Port Moresby, Papua.

(f) North East Papua (including some chromite-bearing rocks).

(g) Woody Woody, W.A. (manganese minerals replacing siliceous collapse breccias in limestone).

(h) Daly River area, N.T.

(i) South Alligator River area, N.T.

(j) Bynoe Harbour district, N.T. (Madigan's prospect; radio-activity due to concentration of thorium by lateritic processes in hematitic cementing material in sandstone).

(k) Carnarvon Basin, W.A. (detailed description of sediments to provide information on depositional environment and provenance).

(l) Coronation Hill, N.T.

(m) Edith River, N.T.

(n) Upper Sepik district, New Guinea.

(o) Various localities in Papua and New Guinea.

(p) Mt. Philp, Queensland (description of specimens of iron ore; genesis of the deposits).

Quantitative Spectrographic analysis.

The spectrograph and accessory equipment were set up for quantitative determinations, and standard plates for some elements were prepared. Preliminary estimations of copper, chromium, cobalt, nickel, and vanadium in basic rocks near the Duchess copper orebody, Queensland, suggest that there is a systematic variation in the concentration of these elements outwards from the lode. The officer who started this investigation later joined the staff of the National University, and will continue the study there. The purpose of the work is to provide information on the genesis of the Duchess orebody in particular, and Cloncurry-Mt. Isa copper lodes in general.

B. Chemistry and Geochemical Prospecting.

On the purely chemical side the following materials were analysed:

(a) Two andesites from Mt. Lamington, Papua.

(b) Several limestones from the neighbourhood of the Woody Woody manganese deposits.

(c) Fifty two diamond-drill samples from the Manton Dam (N.T.) self-potential anomaly were tested for lead, copper, and zinc with negative result.

(d) Lead ore from near junction of Molonglo and Murrumbidgee Rivers, A.C.T.

(e) Uraninite from the Palette prospect, South Alligator River area, N.T.: determination of uranium, thorium, and lead percentages; preparation of lead iodide precipitates for isotopic analysis. The purpose of this work was to enable age determinations to be made in the University of Western Australia.

(f) Suspended matter in Canberra reticulated water.

In addition numerous qualitative tests were carried out on radioactive and other minerals to aid in their identification, a method of prolonging the life of diamond drill bits by etching with acid was evolved, spectrographically pure iron oxide was prepared, and a spectrophotometer and flame photometer were put into operation. The spectrophotometer was used in uranium determinations.

On the geochemical side reports on the previous year's field work in the Northern Territory were prepared, samples from the vicinity of the Montana mine, Tasmania, were tested, and field work was carried out in Tasmania and the Northern Territory (at Namoona, in the South Alligator River area, and at Tennant Creek).

During the 1954 field season the geochemical party in the Northern Territory was engaged on a programme of biogeochemical prospecting. The main purpose of this work was to discover whether any plant which might serve as a specific indicator of uranium exists in the Territory. After extensive testing of a large number of plants growing in areas known to be mineralized with uranium it was found that no specific indicator-plant exists, although a number of species, and especially Xanthostemon paradoxus, do accumulate uranium in their tissues. Some extension of uranium mineralization was traced in the Sleisbeck area by testing leaves and twigs of Xanothostemon paradoxus. Soil testing was carried out concurrently with the testing of plants, and it was concluded that, in general, the former is a quicker and more direct method of prospecting for uranium.

A short time was spent in testing soils in the vicinity of the Montana lead mine, Zeehan, Tasmania, and additional samples collected by officers of the Geophysical Section were tested. From the tests carried out it appeared that it would be possible to outline a geochemical lead anomaly in the area.

Samples from the Manton Dam self-potential anomaly, N.T., gave negative results for uranium, but disclosed weak lead and copper anomalies. Subsequent assays of drill sludge samples from this locality (see above) showed that not even traces of copper, lead, and zinc could be detected by ordinary assay methods.

During the 1955 field season surveys were carried out south-east of Darwin using a caravan fitted out as a laboratory. As a result of extensive traverses, set out on a grid pattern, at the Namoona lead prospect, two major and several minor anomalies were outlined. The economic significance of these anomalies is still to be tested by the company which holds the area.

The remainder of the field season was spent in the South Alligator River, Sleisbeck, and Turn-off Creek areas. Eighteen hundred and ninety eight soil samples and 75 botanical samples were tested for uranium; these were taken from areas of known mineralization and also from previously untested areas. Several new anomalies were discovered, but it was not possible, during that season, to thoroughly investigate their significance. However, the general conclusion reached was that, although geochemical methods were somewhat more sensitive than the ordinary geiger counter, the slightly

more detailed information obtained by geochemical methods of soil sampling did not justify the additional effort and expense involved. Twenty samples of water from the South Alligator River and its tributaries were tested for uranium; several tributaries were found to contain significant amounts of that metal.

In December tests for lead and copper were carried out in the Tennant Creek district. The upward extension of a lead lode recently discovered in underground drill-holes at the Peko mine was detected at the surface beneath a cover of at least twenty-five feet of soil. Particularly interesting results were obtained through testing numerous outcrops typical of quartz-hematite lodes for copper; these lodes showed no visible copper minerals at the surface. The amounts of copper detected in different bodies ranged from nought to several hundred parts per million. Diamond drilling results from two of the lodes tested by geochemical methods suggest that such testing will be of great value in narrowing down the search for copper-bearing lodes in the area, because it appears that only those quartz-hematite bodies giving medium to high copper tests will be worth exploring further.