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HEAVY MINERAL INVESTIGATIONS OF THREE BORES IN THE ROMA DISTRICT.

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CANBERRA.

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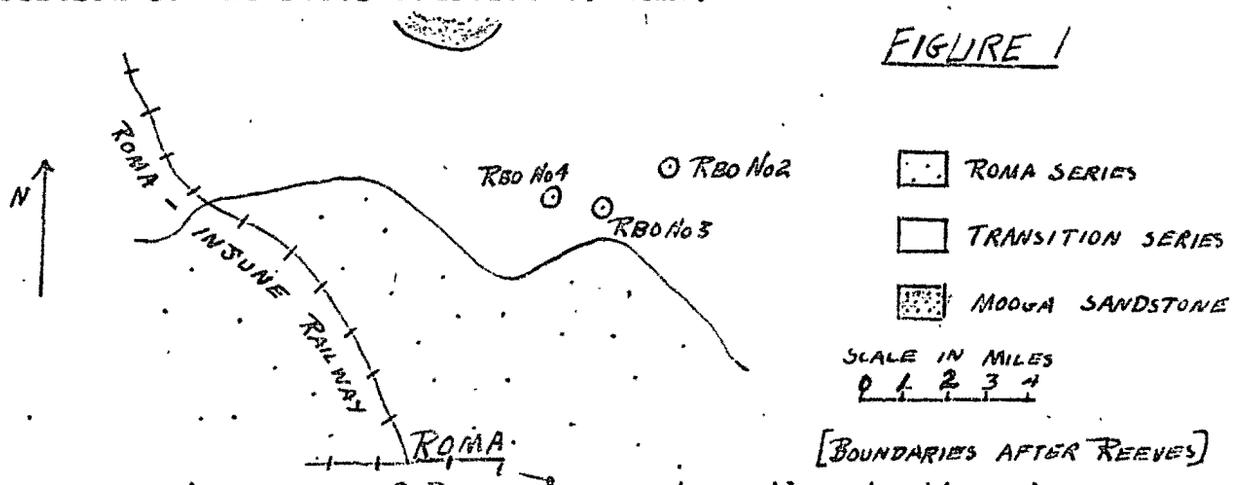
Heavy Mineral Investigations of Three Bores in the Roma District.

The following is a summarised account of an investigation into the heavy mineral content of three bores (Nos. 2, 3, and 4), put down by the Roma Blocks Oil Company. The positions of the bores and a short account of the geology of the area are given, together with results of the work to date, and an evaluation of the prospects of correlation by petrological means.

According to the regional map of the Roma district published by Reeves in the Bulletin of the American Association of Oil Petroleum Geologists (1947) the Triassic and Jurassic sediments strike approximately east-west, and have a gentle dip to the south. The three R.B.O. bores under consideration lie in what have been mapped as Transition Series, about 5 miles south of the boundary of the Mooga Sandstone (Upper Walloon), and are situated in a line very approximately parallel to the supposed strike of these sediments. Figure 1 shows the position of the bores relative to Roma.

FIGURE 1



A summary of Reeves' report on the stratigraphy of the Roma district is as follows.

Total thickness of exposed sedimentary strata approximately 11,000 ft.

Cretaceous	200 ft.
Jurassic	2,550 ft.
Trias.	1,000-3,000 ft.
Permo-carb.	7,000 ft. (maximum)

Unconformities.

Slight unconformity at base of Trias.
Marked angular unconformity between Upper and Middle Trias.

Oil horizons.

Reeves states that the principal oil and gas sands are encountered in grits and coarse grained sandstones near the unconformity at the base of the Bundamba Sandstone (Upper Trias.)

The depths of the three R.B.O. bores concerned in the heavy mineral investigation are as follows:

R.B.O.	No.2	4,050 ft.
"	No.3	3,629 ft.
"	No.4	3,660 ft.

Miss Crespin has found Lower Cretaceous foraminifera in grey shale from R.B.O. No.2 at a depth of 194 feet, and is of the opinion that the top of bores No.3 and 4 may also be Cretaceous. All samples for heavy mineral determinations were collected from below proved Cretaceous strata, although it seems likely that the top sample from R.B.O. No.2 (at 200 feet) may be Cretaceous in age. The residues of samples from the upper portions of all three bores are rich in ilmenite and leucoxene and some also contain abundant pyrite, but there seems little reason for assuming that they have been derived from a provenance essentially different to that of the sediments represented in the lower portions of the bores.

The main gas and oil shows in the three R.B.O. bores have been encountered in the bottom few hundred feet. If the sediments containing oil and gas in these bores are part of the Bundamba Sandstone, it seems that samples collected for heavy mineral determination have come from a vertical column in which no recognised unconformity should be encountered. Miss Crespin is of the opinion that, apart from the Cretaceous capping, lithological characteristics suggest the bores traverse only Jurassic sediments. Lithology is, however, an impracticable means of correlating between the bores, as the attached diagrams indicate.

Attempts at correlation of strata in the three bores by petrological means have followed several avenues. A search was made for some mineral, or minerals, which, by being confined to restricted portions of the bores, might be regarded as characteristic of certain levels. Similarly, the variations in colour, habit and inclusions of all minerals from the residues were noted, in the hope that certain specific varietal characteristics of some or one of the widely distributed minerals might be typical of certain horizons. Finally, estimations of the per cent. mineralogical composition of the residues from all samples from each bore were made, so that the variations in the ratios of the main constituents could be compared.

Only one mineral which may have a certain significance as a marker mineral, has been noted. This is celestite, which is confined mainly to a 300 feet interval in each bore near the bottom and to certain other restricted portions of bores 2 and 3. (Its distribution is plotted on the diagram showing the garnet percentages).

Celestite may be locally derived, but it is generally authigenic - here it apparently serves as a cementing medium, suggesting an origin due to percolating sulphate charged waters. Its presence may therefore be indicative of ground water conditions rather than provenance. In other words, any interpretation of structure based on the distribution of this mineral should be regarded only as tentative, or at the most, as confirmatory to other evidence.

Variations in the colour, habit and general appearance of the minerals of the heavy residues, though interesting, were found to be of little value. The etch-marks on garnet afford an example of this. On the whole, and with only minor variations, the etching of the grain surfaces becomes more pronounced with increased depth. Etching is generally only incipient from the surface of the bores to about 1,400 feet below sea level, and becomes increasingly

marked from 1,400 feet below sea level to the bottom of the bores. The lowest hundred feet of bore in the garnet rich sediments, i.e. that hundred feet just above the conglomeratic and granitic basement, contains garnet which is so strongly etched as to be skeletal in appearance. As etching is thought by modern authors to be due to the solution effects of ground waters, its value as a means of correlation is probably small.

Factors which have been noted and found of no use as criteria for correlation are the degree of rounding of the grains of the residues, colour variation in the tourmaline and zircon, and the nature of the inclusions in the grains. Both rounded, subrounded and euhedral grains of zircon, tourmaline, rutile and ilmenite are generally to be found in one residue. Zircon is predominantly colourless, but some purple and brown grains are found in most samples - tourmaline occurs in about half a dozen main colours, none of them restricted to any portion of the vertical column.

The most promising aspect of the investigation for correlative purposes has been the variation in the mineralogical compositions of the residues. If, for each bore, the per cent. of garnet in the residues is plotted against the depth of the position from which the sample was taken, and the three graphs compared, a certain correspondence can be seen. This correspondence is striking in some sections of the graphs. Garnet, being the main constituent of the residues, and a mineral which occurs in all of them, is the most suitable mineral for comparative purposes.

A certain overall similarity in the graphs of ilmenite and leucoxene can be observed in places, mainly in the bottom 1,000 feet of bores 2 and 3. The graphs of rutile and tourmaline may be considered to show, in a generalised way, some similarities in the lower portions of bores 2 and 3. The graphs of zircon from each of the three bores show little recognisable correspondence.

Tourmaline occurs as a small fraction of the residue, generally of the order of only 5 per cent. Small inevitable errors due to the grain-count method of per cent. estimation may significantly affect the apparent proportion of this mineral in the residue, and it is not therefore a very suitable subject for graphical representation.

Taken on a whole, the garnet per cent., which is really the ratio of garnet to the remainder of the residue, shows the most promise for correlative purposes. The graphs of mineral ratios, i.e. zircon: rutile, show as little correspondence between the bores as do the straight out per cent. graphs of these two minerals.

Generally speaking, the recognisable similarities of the various graphs can be seen mainly in those sections of the bores which are closely sampled. It is noteworthy that lithological correlation, where possible, ties in with correlation as interpreted from the graphical representation of garnet. This seems to indicate that the method, in this case, is sound, and that close sampling in portions where no lithological correlation is possible, may yield good results. Meanwhile, in view of the degree of correspondence which has already been observed between the three bores, it is considered that cores from other wells, if obtainable, should be investigated.

ROMA BLOCKS OIL COMPANY

Diagram showing *ILMENITE + LEUCOXENE* percentage of heavy residues from core samples of R.B.O. Bores 2, 3, & 4.

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Diagram showing ZIRCON percentage of heavy residues from core samples of R.B.O. Bores 2, 3, & 4

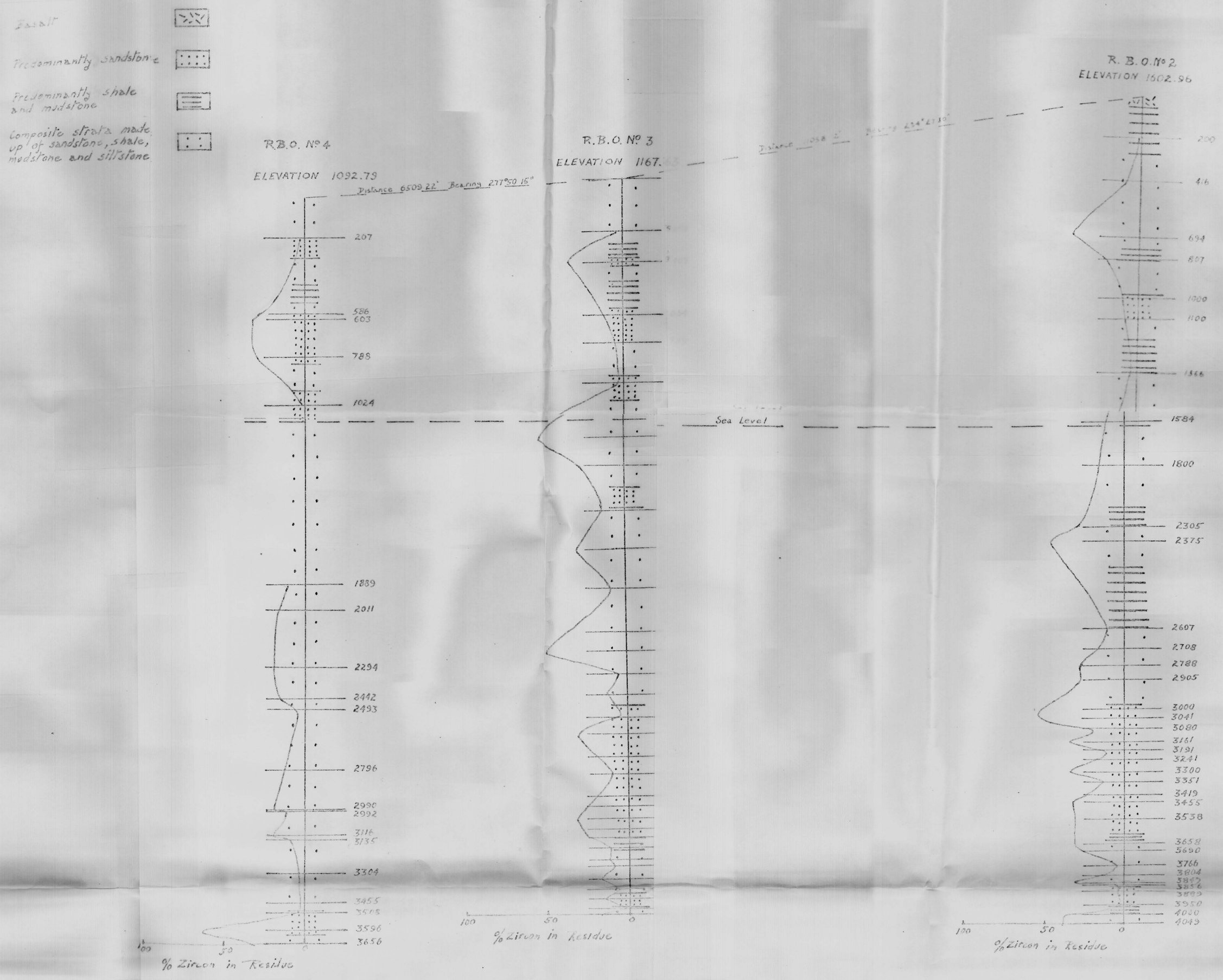

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Diagram showing *RUTILE* percentage of heavy residues from core samples of R.B.O. Bores 2, 3, & 4.

ROMA BLOCKS OIL COMPANY

Diagram showing GARNET percentage of heavy residues from core samples of R.B.O. Bores 2, 3, & 4.