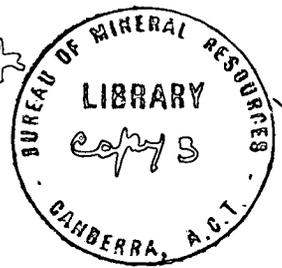


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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF
NATIONAL DEVELOPMENT

BUREAU OF MINERAL
RESOURCES, GEOLOGY
AND GEOPHYSICS



Record No. 1973/6

OIL TRACES IN THE TOOLEBUC LIMESTONE, CARPENTARIA
AND EROMANGA BASINS, QUEENSLAND

by

B.R. Senior and J. Smart

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Summary

Oil is present in cores recovered from the Lower Cretaceous Toolebuc Limestone in two shallow drill holes (BMR Croydon 1 and BMR Springvale 6) in the Carpentaria and Eromanga Basins, Queensland. The distribution of paraffinic hydrocarbons as determined by gas chromatography is remarkably similar in the two drill holes, even though they are 650 km apart. The widespread occurrence of the Toolebuc Limestone and associated oil points to the possibility of accumulations of hydrocarbons in favourable areas within the central portion of the Eromanga Basin.

Geology

The Toolebuc Limestone is present throughout most of the Eromanga Basin and the southern part of the Carpentaria Basin. The formation was penetrated in two BMR shallow stratigraphic holes and partly cored in each. The shallow stratigraphic hole BMR Croydon 1 was drilled by the Bureau in conjunction with the Geological Survey of Queensland as part of a regional geological mapping program of the Carpentaria Basin (Needham et al., 1971). BMR Springvale 6 was drilled as part of a program to investigate sediments with gamma-ray anomalies in the Springvale 1:250 000 Sheet area in the western part of the Eromanga Basin (Senior & Hughes, 1972). The location of the drill holes and the distribution and lithology of the Toolebuc Limestone are shown in Figure 1.

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Petroleum within cored intervals of the Toolebuc Limestone was first detected during examination of cores at the drillsites. Bituminous, dark-coloured siltstone and shale was recorded from both drill holes, and freshly broken core from Springvale 6 had a slight petroliferous odour.

BMR Springvale 6 is near the northwestern edge of the Lower Jurassic to Upper Cretaceous Eromanga Basin, and BMR Croydon 1 is near the southeastern margin of the Carpentaria Basin, which is of similar age. The Toolebuc Limestone, part of the Rolling Downs Group (Vine et al., 1967), is remarkably continuous throughout a large portion of both basins (Fig. 1) although it is only 3 to 80 m thick. Crystalline limestone is the most resistant part of the formation and the presence of limestone rubble and concretions at outcrop led to the inclusion of the word 'limestone' in the formation name. Smart (1972) has reviewed the Toolebuc Limestone in the Carpentaria Basin, where it was formerly called Kamileroi Limestone. He showed that the bulk of rock identified on well logs as belonging to this formation is dark calcareous shale and siltstone, with laminar to thinly interbedded limestone, together with a little fine black labile sandstone. Senior (in prep.) reports similar findings from the Central Eromanga Basin.

In the Carpentaria and northern Eromanga Basins, Smart (1972) showed that the interval of Toolebuc Limestone corresponded to a marked gamma-ray anomaly. However, farther south this relationship does not always hold. An interval of limestone and calcareous shale or siltstone corresponding to the Toolebuc Limestone is present, but the gamma-ray anomaly is commonly much thinner than this interval and is absent in places.

Near Springvale 6 there are several water bores in which drillers recorded flows of brackish or saline artesian water. A thin black labile sandstone bed near the base of the Toolebuc Limestone in Springvale 6 flowed slightly saline water (total dissolved solids 1780 ppm) to the surface at an estimated 750 litres/hour. The vast extent of the Toolebuc Limestone, together with the possible widespread occurrence of oil within it, the presence of porous and permeable beds, and an impervious overlying unit, all point to the possibility of economic accumulations of hydrocarbons in favourable areas in the Eromanga Basin. These could be on the flanks of the Cooper Syncline and Wilson Depression, where the Toolebuc Limestone is buried under as much as 1500 m of younger Mesozoic and Cainozoic sediments. Migration may well have been enhanced by depth of burial. The porosity and permeability demonstrated in Springvale 6, together with a cap rock of argillaceous sediments formed by the overlying Allaru Mudstone, indicate that the Toolebuc Limestone should not be overlooked in future petroleum exploration drilling.

In the Carpentaria Basin the presence of a porous and permeable interval within the Toolebuc Limestone has not been established, and the cover on the formation is less than 600 m onshore.

Petrochemistry

Table 1 gives the results of petrochemical analyses of core samples from BMR Croydon 1 and Springvale 6. Approximately 60 g of each core sample was crushed to pea-sized particles and extracted with toluene in a soxhlet apparatus. Extraction was continued for 24 hours, then the solvent was removed from the extract by rotary evaporation. The residue, a black viscous substance, was fractionated by column chromatography on alumina into paraffinic hydrocarbons, aromatics, polar compounds, and asphalt. Gas chromatography was

undertaken on the paraffins to determine the range of hydrocarbons. Chromatography charts (Fig. 2) show the similarity of the paraffinic hydrocarbons, which is remarkable, considering the large distance between the drill sites.

Analysis of cores of the Toolebuc Limestone from Mid-Wood Burketown No. 1 (Fig. 1) by BMR in 1965 showed a residual oil content of 1 to 5 percent of total porosity. The latter was measured at 22%, but owing to extensive drying fractures in the core the results are not reliable. The lithology of the interval was given in the completion report (Perryman, 1964) as "petroliferous blocky dark grey shale".

The Toolebuc Limestone has been intersected in numerous other BMR shallow stratigraphic drill holes and many drill cores contain bituminous shale. Apart from the examples quoted analytical work is incomplete or has not been attempted.

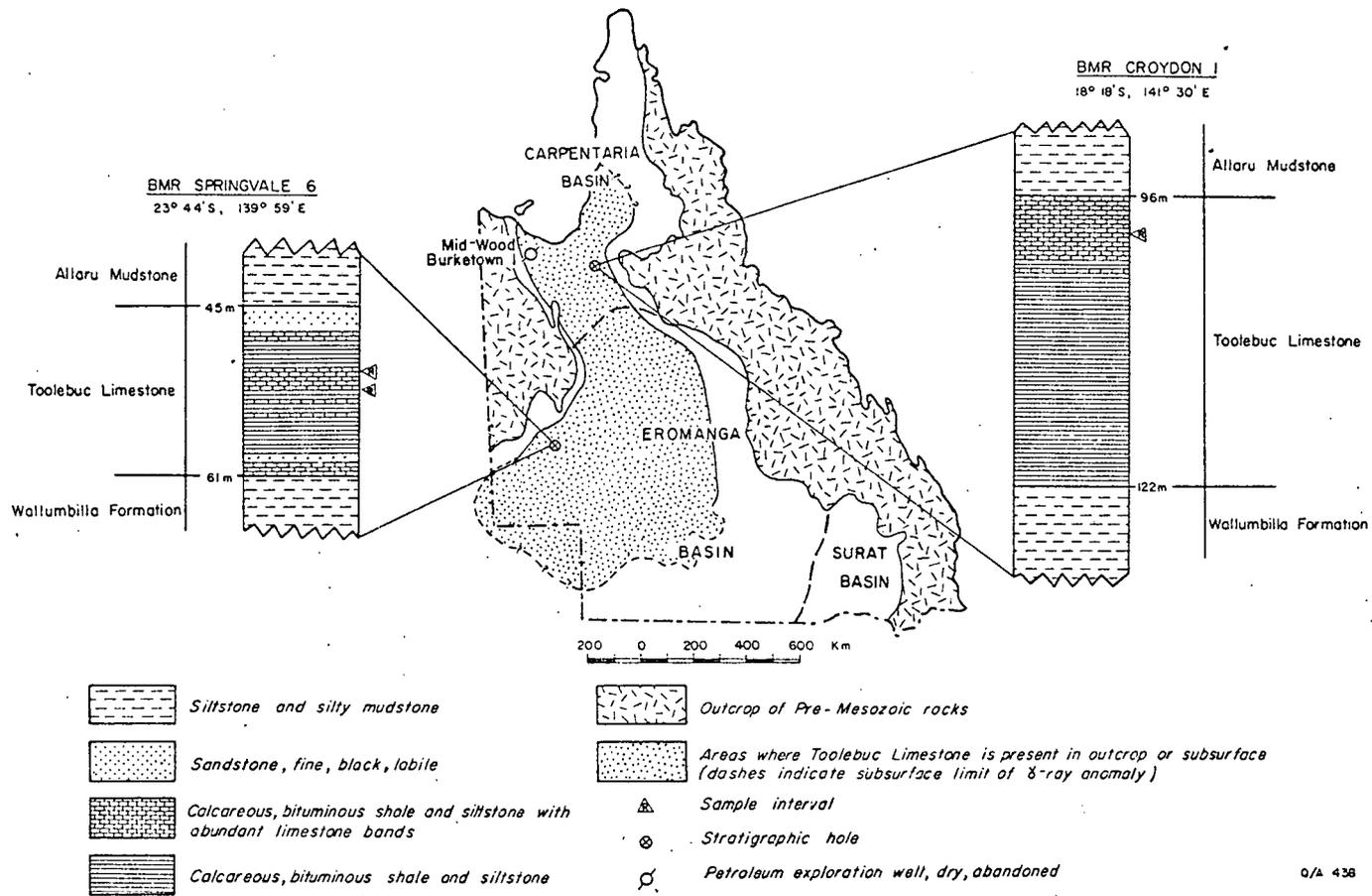
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TABLE 1 Petrochemical analysis of Toolebuc Limestone drill core

	BMR Springvale 6 Lat. 23°43' Long. 139°58'	BMR Croydon 1 Lat. 18°18'S Long. 141°30'E
Weight of extract	0.52%	1.15%
Composition of extract	Weight %	Weight %
Asphalts	15.0	32.4
Paraffinic hydrocarbons	14.1	4.4
Aromatics	42.8	2.2
Polar compounds	14.0	41.1
Oxygen Nitrogen and Sulphur compounds absorbed on alumina	14.1	20.0
Gas chromatographic analysis of the paraffinic hydrocarbons showed the distribution to be	C ₁₇ - C ₂₅	C ₁₇ - C ₂₄
Sample depth and BMR data retrieval numbers	51m 71050017 53m 71050018	104m 70790001

Analyses by the Petroleum Technology Laboratory, BMR; analyst, T.G. Powell



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