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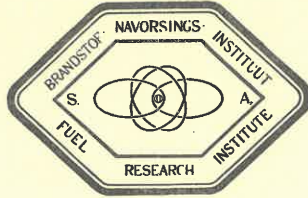
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REPORT No. 43
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VAN 1950



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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

BRANDSTOF-NAVORSINGS-INSTITUUT VAN SUID-AFRIKA.

SUBJECT: OIL BEARING SANDSTONE OBTAINED FROM BOREHOLE NO.1
ONDERWERP: OIL BEARING SANDSTONE OBTAINED FROM BOREHOLE NO.1

ON KALABASVLAKTE 3749, NEWCASTLE DISTRICT.

DIVISION: CHEMISTRY.
AFDELING:

NAME OF OFFICERS: P.C.DAVIS, C.C.1a GRANGE & S.D.COETZEE.
NAAM VAN AMPTENAAR:

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

REPORT NO. 43 OF 1950.

OIL BEARING SANDSTONE OBTAINED FROM BOREHOLE NO. 1.
ON KALABASVLAKTE 3749, NEWCASTLE DISTRICT.

SUMMARY:

During September 1950, the Institute was notified that portions of the core from a borehole drilled on the farm Kalabasvlakte 3749, were apparently impregnated with oil.

Samples of the core were obtained and examined and it was concluded that this oil was of natural origin having the characteristics of a paraffin base crude oil.

While drilling for coal on the farm Kalabasvlakte 3749, Newcastle district during September, 1950; (see approximate borehole position on accompanying map) oil-bearing sandstone was struck at a level well above the coal horizon by the Natal Coal Exploration Company.

The company immediately informed the Geological Survey Office, and officers of that department and the Fuel Research Institute visited the borehole site to examine the core obtained from it.

The following strata were intersected :-

	<u>Depth</u>				<u>Thickness.</u>	
	ft.	ins.	ft.	ins.	ft.	ins.
Soil	0	0	- 24	0	24	0
Weathered shale	24	0	- 30	0	6	0
Transition sandy shales, banded.	30	0	- 64	0	34	0
Banded laminated shaly sandstone	64	0	- 78	0	14	0
Coarse and finer sandstone.	78	0	- 145	0	67	0
Laminated shales and sandstone	145	0	- 211	3	66	3
Sandstone with shale. <u>Oil-bearing</u>	211	3	- 214	3	3	0
Sandstone with shale.	214	3	- 223	6	9	3
Sandstone. <u>Oil-bearing</u>	223	6	- 225	9	2	3
Sandstone with some shale bands.	225	9	- 230	0	4	3
Sandstone. <u>Oil-bearing</u>	230	0	- 231	7	1	7
Sandstone with shale bands.	231	7	- 234	0	2	5
Sandstone. <u>Oil-bearing</u>	234	0	- 243	6	9	6
Sandstone with shale bands.	243	6	- 261	0	17	6
Limestone.	261	0	- 265	6	4	6
Laminated sandstone with shales with limestone bands varying from 1" to 12"			265'	6 -		

Drilling of this hole continued but no further occurrences of oil bearing formations were reported.

The oil-bearing sandstone was brought to the Fuel Research Institute and a representative sample collected from the different oil-bearing bands, and then crushed to pass a $\frac{3}{16}$ " sieve; 8000 grams of the crushed oil-bearing sandstone was distilled in a metal retort up to 200°C. yielding a condensate consisting of 64.0 grams of water and 8.3 grams of oil.

The residue was thoroughly extracted at room temperature, firstly with petroleum ether (60°- 80°C fraction) then with benzene and finally with carbon tetrachloride, the following weights of oil being obtained after removal of the solvent :-

Extracted with petroleum ether	90.1 grams.
" " benzene	8.7 "
" " carbon tetrachloride	6.3 "

The following table shows how the volume of water plus oil recovered from the sample was arrived at :-

<u>Liquid.</u>	<u>Wt.gm.</u>	<u>S.G.</u>	<u>Volume (ml.)</u>
Water	64.0	1.00	64.0
Oil (volatile up to 200°C.)	8.3	0.806	10.3
Oil (solvent extrac.)	105.1	0.869	121.0
Total	177.4	-	195.3

The specific gravity of the oil-bearing sandstone was found to be 2.62. Thus the volume used for extraction =

$$\frac{8000}{2.62} = 3052 \text{ ml.}$$

and hence the pore space in the sandstone occupied by oil and water =

$$\frac{195.3}{3052} \times 100\% = 6.4\%$$

Certain portions of the core appeared to be much richer in oil than other portions, but the above figure would represent an overall average for all the oil-bearing bands.

INVESTIGATION OF THE OIL.

Fraction distilled up to 200°C.

The oil on top of the condensate was separated from the water and the water and the oil were weighed separately.

Weight of water = 64 gms.
Weight of oil = 8.3 gms.

The light brown oil was distilled at atmospheric pressure and the specific gravity and refractive index of the different fractions were determined, the results appearing in Table 1.

TABLE 1.

	<u>Fraction</u>	<u>Weight</u>	<u>S.G. at 55°</u>	<u>Refr. Index</u>
1.	175 - 200°C	1.7 gm.	0.788	1.447
2.	200 - 225°	1.9 "	0.796	1.452
3.	225 - 250°	2.5 "	0.815	1.460
4.	250 - 285°	1.7 "	0.825	1.464

All the fractions were practically colourless.

Fraction extracted with petroleum ether:

On removing the solvent from the petroleum ether extract 61 grms. of a fluorescent dark-coloured oil was obtained. It was distilled at atmospheric pressure; 6.1 grms of a colourless, volatile liquid, probably residual petroleum ether which was used for the extraction, distilled over between 90 - 115°C. A small amount, 0.6 gm., distilled between 115 - 270°C. On account of the possibility of decomposition occurring at a higher temperature the residue was distilled in high vacuum (3 mm.), and the following fractions were collected :

TABLE 2.

High Vacuum Distillation of Oil and Analysis of Products.

	<u>Fraction</u>	<u>Weight</u>	<u>S.G. at 55°C.</u>	<u>Refr. Index.</u>	<u>Br₂ Reaction</u>
1.	Up to 115°C	3.9 gm.	0.827	1.463	Nil
2.	115°-140°C.	6.5 "	0.839	1.468	Nil
3.	140°-190°C	6.6 "	0.861	1.470	Nil
4.	190°-225°C	15.8 "	0.886	1.500	Nil
5.	225°-275°C	4.3 "	0.905	1.505	Nil

Fractions..../

Fractions 1 and 2 were faintly coloured liquids. Fraction 3 was darker coloured and after some time waxy material separated from the liquid. Fractions 4 and 5 were coloured and solidified at room temperature.

Fractions 2, 3 and 4 were combined and distilled at atmospheric pressure. The fraction distilling between 270° - 350°C was collected and tested for anthracene. The result was negative.

A part of fraction 5 was dissolved in a mixture of benzene and alcohol and cooled down in a mixture of ice and salt. The solid which separated was filtered off and washed with a mixture of alcohol and benzene and was eventually heated with alcohol to remove the benzene. The wax obtained had the following analysis:

<u>% C.</u>	<u>% H.</u>
85.3	14.6

The congealing point of the wax was found to be 48°C.

Fraction extracted with benzene:

On removal of the benzene a black tarry product was obtained. This was distilled in high vacuum. Practically nothing distilled over and as fumes evolved the distillation was stopped.

Fraction extracted with carbon tetrachloride.

Very little of a black tarry product was obtained. This was distilled in high vacuum, but decomposition took place and the distillation was stopped.

CONCLUSION:

Oil-bearing sandstones have been encountered in several instances in boreholes in the Klip River area in Natal, but the present case seems to be the first occasion on which an attempt

has..../

has been made at rapidly evaluating quantitatively and qualitatively the oil present in the sandstone.

The oil extracted may be described as being comparatively non-volatile and of a paraffinic nature, fairly rich in paraffin wax. The oil is not unlike the oil collected from the seepage which occurred in Durban Navigation Colliery in 1944.

From the available analytical data it is concluded that this material is a natural petroleum.

(SGD.) P. C. DAVIS,
C. C. la GRANGE.
S. D. COETZEE.

PRETORIA.

12th. December, 1950.

