EUROPEAN REGION TECHNICAL CENTRE

REPORT No RL-83-29

INVESTIGATION OF WELL FILL MATERIAL

CLIENT- PHILLIPS
DATE- 26 November 1983
D.S. CONTACT- R COOPER

AUTHOR(S)
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INFORMATION REQUESTED

Identify the material which has collected in the well (COD /11-7).

SAMPLES RECEIVED

A 500 ml plastic bottle containing a fluid-solid mixture was received.

All chemicals used came from laboratory stock.

RESULTS OF TESTING

The fluid component was an oil-water mixture.

The solids component was identified as crushed proppant (probably sintered bauxite) with some formation fines (ie, quartz).

METHODS OF INVESTIGATION

Some of the solids component was seperated from the sample, washed and dried (at 150°F). It was then examined by X-ray powder diffraction (XRD), Scanning electron microscope with energy dispersive analysis by X-rays attachment (SEM/EDAX) and Optical microscopy.

XRD

The diffractometer trace recorded peaks which were unambiguously assigned to Alumina and quartz. The peak areas suggested that they were in the ratio of 75% "Al_2O_3" to 25% SiO_2 ($\pm$ 5%).

SEM/EDAX

The energy spectrum recorded revealed that Al, Si were the major elements present with traces of Ti, Mg and Fe.

Data was recorded on samples of two commercially available proppants from Carborundum and Norton. The similarity of peak shape and intensity can be observed in photos 1-3.

OPTICAL MICROSCOPY

Visual examination of the sample showed two types of grains were present. The colourless subangular to rounded grains were quartz and the opaque angular grains were sintered bauxite. For comparison, some grains of sintered bauxite were crushed with a mortar and pestle and then examined. Grains having similar shape and optical contrast to those of the sample under investigation were produced (See photos 4-6).

CONCLUSION

Laboratory investigations show that the well fill material consisted of crushed proppant and formation fines in an oil-water fluid.

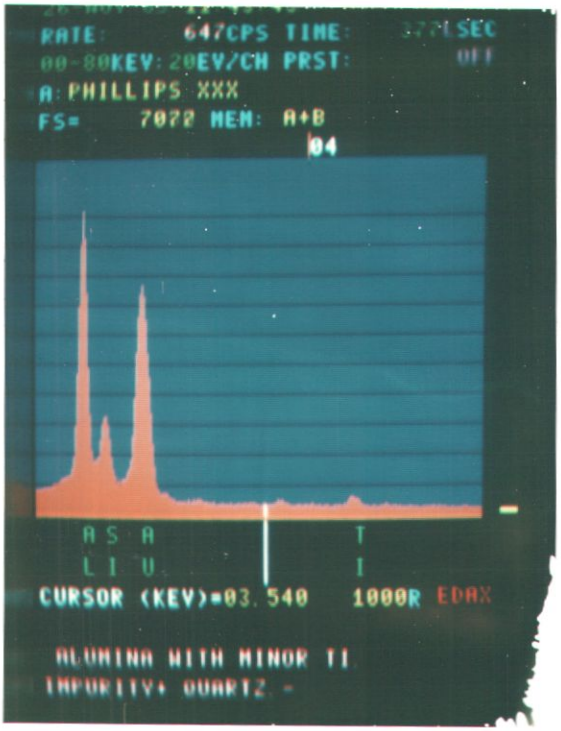

Photo one:

EDAX spectrum from well-fill sample (Au is gold introduced during sample preparation).

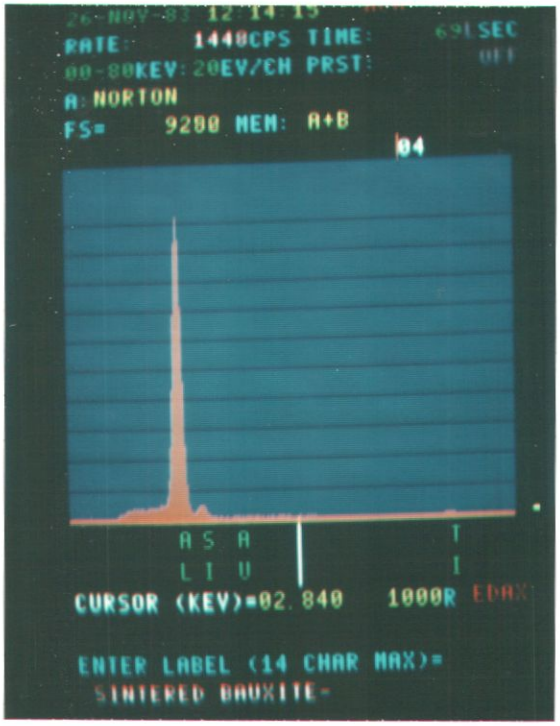

Photo two:

EDAX spectrum of a sintered Bauxite.

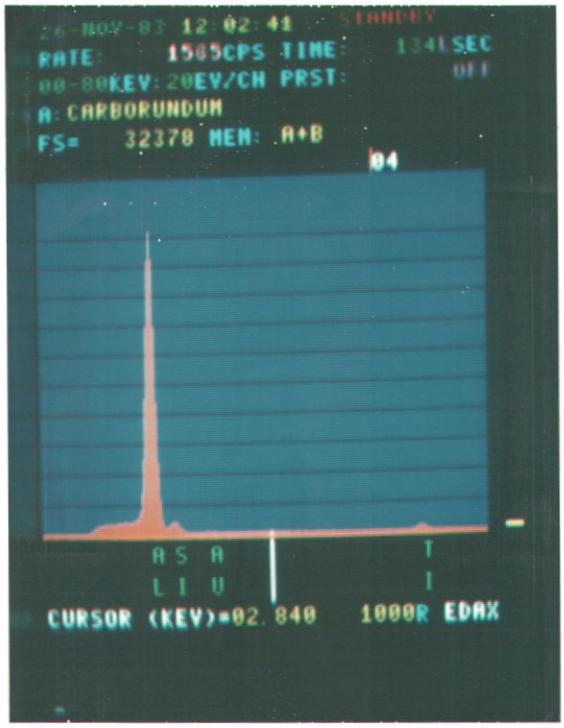

Photo three:

EDAX spectrum of a commercial bauxite.

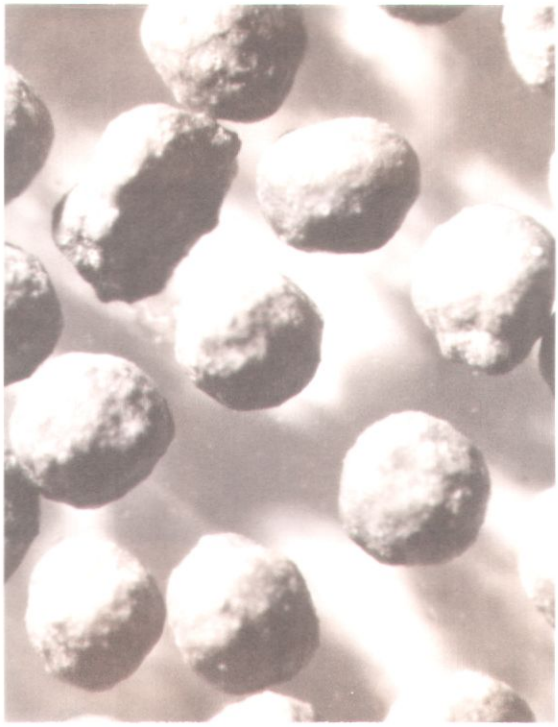

Photo Four:

Photomicrograph of commercial bauxite (magnification x 10).

Photo Five:

Photo micrograph of crushed commercial bauxite (Magnification x 10).

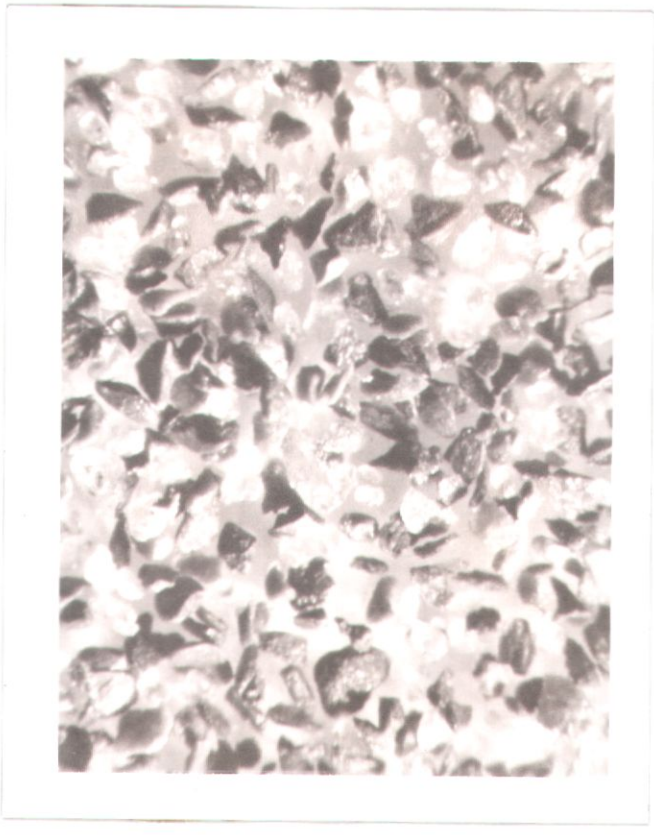

Photo six:

Photomicrograph of Well-fill material (magnification x 10).

CRUSH RESISTANCE TEST USING PROPPANT USED

A standard crush resistance test was carried out on a sample of the proppant used on the job.

Forty grams of within-range (20-40) material was placed in the load cell and various pressures were applied to give the necessary stress values on the proppant.

The stress loads were applied for 2 minutes, after which the proppant was removed from the load cell and sieved through a 40 mesh sieve.

The amount of material passing through the sieve after each stress was determined to find the percentage of proppant crushed at each stress.

RESULTS

Initial undersize material = 0.17%

Percentage crushed after 10,000 psi stress = 5.25%
Percentage crushed after 12,000 psi stress = 8.75%
Percentage crushed after 14,000 psi stress = 15.25%
Percentage crushed after 16,000 psi stress = 18.00%
Percentage crushed after 18,000 psi stress = 21.57%