

1 1.0079

A

APPLICATION

3 6.941

C

CALCULATION

8 15.999

H

HARMONISATION

9 18.998

I

INFORMATION

5 10.811

E

EXPERIMENTATION

22 47.867

V

VISION

5 10.811

E

EVALUATION

4 9.0122

D

DEDICATION

**ACHIEVING MINERALOGICAL UNDERSTANDING WITH
X-RAY DIFFRACTION SOLUTIONS FROM SGS**



1.0079

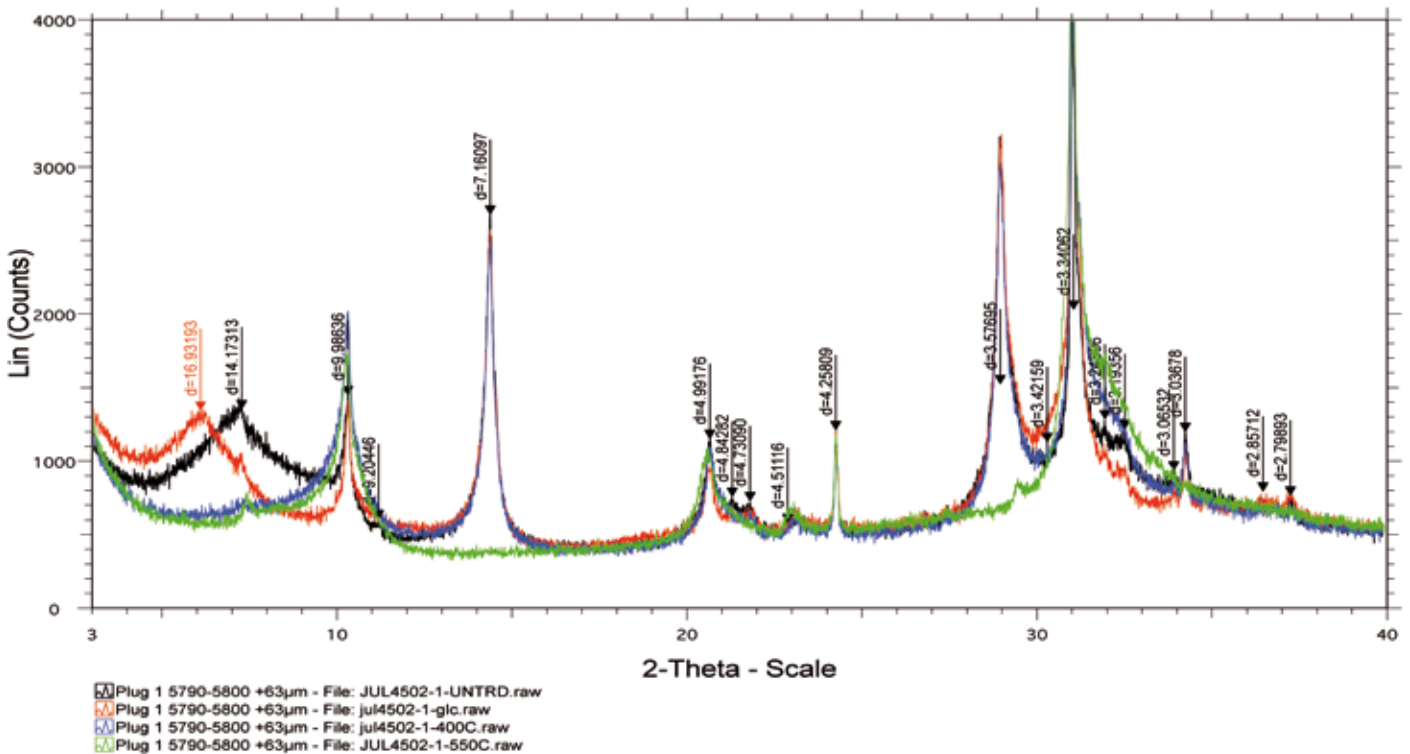
ANALYSIS

TO ACHIEVE AN UNDERSTANDING OF ROCK FORMING MINERALS AND CLAY SPECIATION

Our Advanced Mineralogy Facilities make use of all the latest technologies available for mineralogical analysis. As part of these services we offer X-ray Diffraction Analysis (XRD), which is used to determine bulk mineral assemblages based on the diffraction of X-rays interacting with a rock sample. The analysis provides the weight distribution of the rock forming minerals such as quartz, calcite and dolomite as well as giving a detailed clay speciation for specific clay minerals such as illite, chlorite and kaolinite. This latest generation of equipment is four times faster than previous generations whilst also producing pattern results. Because of its unique ability to resolve clay minerals, XRD is the standard choice for analyzing clay mineral assemblages.

SGS utilise the state-of-the-art Bruker D8 Advance x-ray diffractometer equipped with a 90 sample Auto Changer allowing fully automated 24 hour operation. This combination ensures that you receive quick, high quality and precise results.

PLUG 1 5790-5800 +63µm



XRD APPLICATIONS FOR THE OIL AND GAS SECTOR

Geology

- Determination of bulk mineralogy;
- Provenance studies;
- Measurement of the relative amounts of different carbonate minerals present; and
- Delineation of diagenetic facies.

Petrophysics

- Identification and quantification of clay minerals to improve shaly sand models;
- Recognition of potassium feldspar and other minerals that may affect the Gamma Ray measurement;
- Detection of minerals that may adversely effect resistivity measurements; and
- Correlation to multi minerals models.

Engineering

- Identification of quartz rich zones within shale formations (high quartz contents being associated with more brittle rock);
- Identification of clay minerals that may present problems during drilling or completion;
- Location of siderite and other potential scale producing minerals; and
- Identification of scales.

THE PROCESS

We use two different methods for analysis of the X-ray diffraction patterns.

Reference Intensity Ratio (RIR) Analysis

RIR is a method for quantitative analysis of XRD results. The RIR method is based upon scaling all diffraction data to the diffraction of standard reference materials. The algorithm assumes that the combination of all phases identified amount to 100% of the sample, errors can occur if there are non-crystalline phases present.

The Rietveld Analysis

The Rietveld method also known as Full-Pattern Analysis is a powerful and relatively new method that does not rely on standard reference materials.

The Rietveld method uses the whole XRD pattern rather than just a few identified peaks and their intensities. The method requires knowledge of the crystal structures and elemental composition of all phases of interest in the pattern. A least squares analysis is used to fit the whole pattern providing a more accurate and precise result than the any peak-intensity method. Samples with a large number of mineral phases and minerals with chemical or structural variability may cause problems with the analysis. In particular the phyllosilicates can prove difficult to resolve.

THE TESTS

Mineral identification and interpretation is performed by matching the diffraction pattern of the sample with patterns of reference materials. Our skilled mineralogists are experts at interpreting these results.

- Qualitative XRD Analysis: all minerals identified by X-ray diffraction analysis are reported and grouped into major, moderate, minor and trace amounts. Identification and classification of abundance are based on relative peak heights and mineral crystalline structure.
- Semi-Quantitative XRD Analysis: Mineral abundances (by weight %) are calculated by Reference Intensity Ratio or Rietveld method. XRD analysis will be reconciled with a whole rock analysis plus the analysis of any other major elements contained in the sample and reported.
- Clay Speciation XRD Analysis: due to their poor crystallinity, clay mineral can be difficult to analyze using standard techniques. In this method the sand and silt fraction and clay fractions are separated by centrifuge. The two fractions are then analyzed separately. The clay fraction is analyzed again after being treated with ethylene glycol and again after heating.

WHY SGS?

SGS is the world's leading inspection, verification, testing and certification company. Recognised as the global benchmark for quality and integrity, we employ over 64 000 people and operate a network of more than 1 250 offices and laboratories around the world. We are constantly looking beyond customers' and society's expectations in order to deliver market leading services wherever they are needed.

We provide innovative services and solutions for every part of the oil, gas and chemicals industry. Our global network of offices and laboratories and our dedicated team allow us to respond to your needs, when and where they occur. Our reputation for independence, excellence and innovation have established us as the market leaders in providing services that improve efficiency, reduce risk and deliver competitive advantage for you.

TO LEARN MORE ABOUT XRD SOLUTIONS FROM SGS, CONTACT OGC@SGS.COM OR VISIT WWW.SGS.COM/OGC FOR MORE INFORMATION.

WWW.SGS.COM