

## Rapid Phase Analysis of Mineral Powders using Unisantis XMD-300 X-ray Diffractometer with X-Ray Polycapillary Optics technology

### Abstract

Rapid XRD mineralogical phase analysis is critical to any geological exploration work.

This study illustrates quick data acquisition and analysis for an unknown geological sample from western Turkey using the Unisantis XMD-300 Polycapillary Optic Parallel Beam X-ray Diffractometer.

It was observed that the complete analysis could be carried out successfully in less than 10 minutes.



### Introduction

X-ray diffraction is a unique tool for the identification and quantification of crystalline and amorphous phases present in any unknown sample. The peak/ line positions and relative intensities of the diffractogram are compared with the reference 'fingerprint' patterns of known compounds available in the ICDD PDF database and the phases identified.

The demand for rapid analysis of geological exploration samples on-site has necessitated development of compact and easily transportable XRD's with low power X-ray tubes and Position Sensitive Detectors (PSD's) reducing the analysis time to a few minutes.

Low beam intensities from low wattage X-ray tubes however produce low quality diffractograms that adversely affects the outcome in applications like phase identification/ quantification, unit cell indexing and crystallite size analysis.

The high intensity resulting from the use of polycapillary lens in the XMD-300 X-ray Diffractometer and high speed of data collection due to the Linear Position Sensitive Detector yield good quality diffraction data rapidly with a high signal to noise ratio which makes phase identification easier.

Table 1. System Configuration	
Unisantix XMD-300 Diffractometer	
X-Ray Tube	50 W; Air cooled; Cu anode
Incident Beam Optics	Polycapillary collimating lens
Tube Voltage	45 kV
Tube Current	0.8 mA
Detector	Position Sensitive Detector
Sample Stage	Standard sample stage with laser alignment

The complete scan was recorded by measuring 7 times a 10° interval during 60 secs, which corresponds to the active length of the PSD. These measurements were subsequently concatenated.

The diffractogram obtained for a powdered rock sample collected from the Adapazari region, using the above instrumental configuration is given in Fig.1.

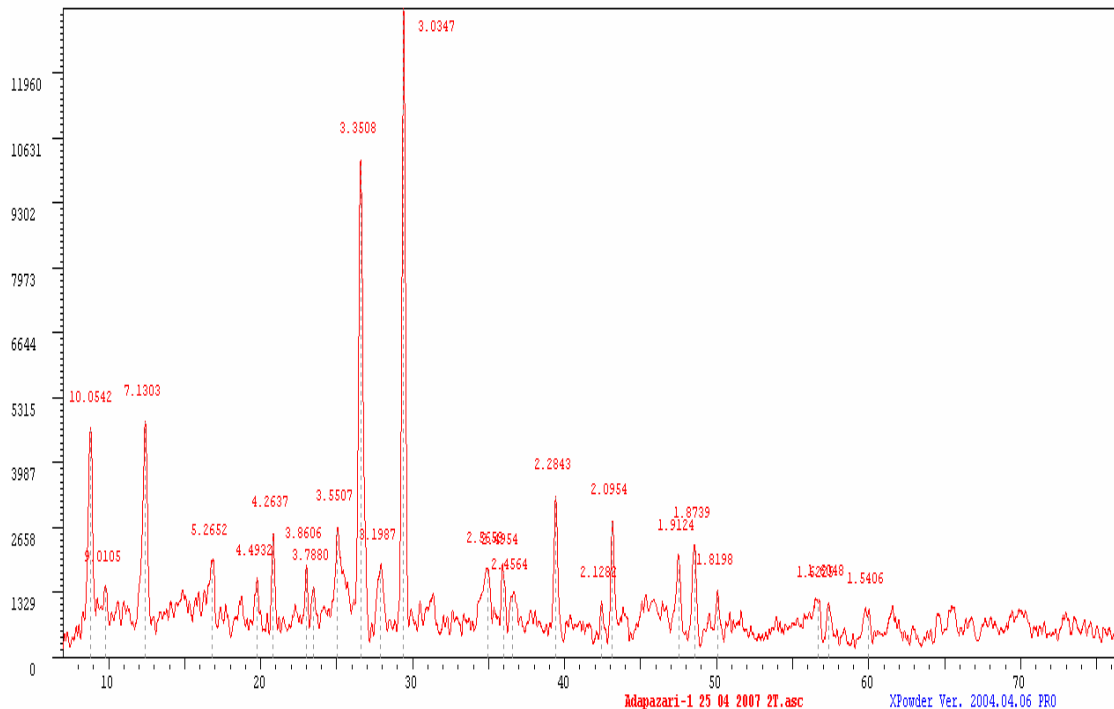


Fig.1. XRD Pattern of Adapazari rock sample obtained from Unisantix XMD-300

Search-match was carried out on the diffractogram obtained for the above rock sample followed by quantitative phase analysis using the RIR (Reference Intensity Ratio) method. The result is given in Fig.2.

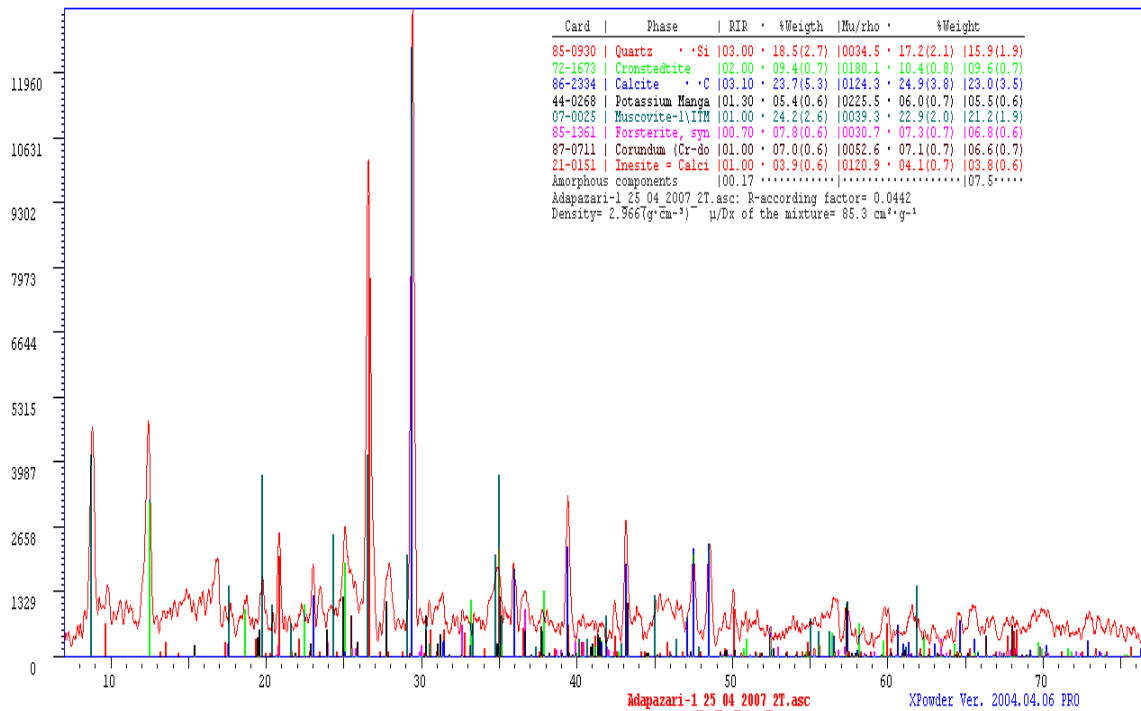


Fig.2. Mineral phases identified in the Adapazari rock sample and Quantitative analysis results

## Results

Analysis of the smoothed and background corrected diffraction pattern shows that the Adapazari sample is multiphase in composition and consists of eight mineral phases viz. Quartz, Calcite, Cronstedtite, Potassium Manganese Oxide, Forsterite, Chromium doped Corundum, Muscovite and Inesite.

Detection and quantification of the minor phases was also possible with the minimum detected value being 3.8% for this sample. The ICDD PDF stick patterns for the best search match results are shown along with the quantitative analysis results.

The analytical results and graphics can be integrated into WINDOWS™ and MSOFFICE based packages for reporting and documentation.

It may be noted that the XRD data in this study for the entire 2Theta range was collected in only 7 minutes with high intensity and excellent signal to noise ratio.

## Conclusions

The present study demonstrates that Unisantis XMD 300 Polycapillary Optic X-ray Diffractometer provides rapid and reliable data that is highly suitable for all X-ray diffraction studies such as phase identification, phase quantification, crystallite size measurement and unit cell indexing.

The quality of diffraction data obtained

using a low power tube is exceptionally good.

It may be noted that due to its parallel beam geometry the data provided by XMD is without any instrumental errors known to be associated with conventional powder diffractometers such as sample displacement error, sample transparency errors, etc.,

## Company profile

Unisantis Europe GmbH is a global leader in development and manufacturing of innovative X-Ray analytical instrumentation, complete solutions and software for structure and elemental analysis using proprietary Polycapillary optics known for best beam collimation. Success in research has enabled Unisantis Europe GmbH to develop new cutting-edge X-ray technology, applications and products for the market. Our products have particular applications in material characterization, life science and industrial analysis.

Unisantis instruments incorporate a new range of user benefits, including transportability and multi-functionality all comprised in compact, bench top, user friendly, environmentally safe and low energy consumption equipment.

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