

Original Article

Infrared Spectroscopical Analysis of Some Metamorphic (Granite) Rocks

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Abstract

The economic significance of rocks and minerals in fostering a nation's growth is underscored in this research topic, with a specific focus on India, notably the mineral-rich terrain of Tamil Nadu. The discourse navigates through various analytical methods employed for mineral scrutiny, centering on infrared-based identification. The investigation's objectives, encompassing the geological landscape of Tamil Nadu and strategic sample collection sites, are detailed. The intricate process of sample preparation for infrared studies is emphasized, along with meticulous procedures for spectrum recording and precautionary measures. Findings are interpreted against existing literature, emphasizing crucial parameters like crystallinity index, absorbance, and extinction coefficient. In the infrared analysis of rocks from diverse Tamil Nadu regions, a mineral profile emerges, featuring feldspar dioxide, garnet, chlorite, and ubiquitous quartz. Quartz, consistently present in all samples, is scrutinized through extinction coefficient comparisons. Keelaiyur stands out with the highest extinction coefficient, indicating superior quartz abundance and heightened crystallinity among samples. This research sheds light on the geological wealth of Tamil Nadu, accentuating the vital role of minerals in economic development.

Keywords: Rocks and Minerals, Quartz, infrared based identification, crystallinity index, absorbance and extinction coefficient.

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INTRODUCTION

The investigator is interested to study the importance of Rocks and minerals and their study by infrared method. The rocks are grouped into three large classes namely igneous rocks, sedimentary rocks, metamorphic rocks. The mineral characters of Metamorphic rocks are tremolite, kyanite, staurolite, talc, serpentine, mica and chlorite. Infrared spectroscopy is one of the foremost capable explanatory strategies which offer the plausibility of chemical distinguishing proof and is a powerful tool in identifying quantitative and qualitative analysis of the minerals present in geological samples. The collected samples from Tamilnadu, India are analyzed by infrared spectroscopic method and indicates the presence of quartz, feldspar, diopside, garnet and chlorite minerals. The obtained results are interpreted in light of available literature with special reference to crystallinity index, absorbance and extinction coefficient.

Scope of the Present Work

The present Investigation is to analyze and to obtain the constituent minerals of granite rocks with

special reference to Erode, Salem, Krishnagiri, Trichy, Madurai and Virudhunagar district of Tamilnadu, India.

REVIEW OF LITERATURE

Many workers have carried out investigation on quantitative estimation of minerals.

Infrared (IR) technique has been applied to study of soil mineralogy by Russell et al., (1970)


IR spectra of two minerals viz., Urkut quartz and Swedish feldspar were carried by Hlavay(1977)

The usefulness of IR spectroscopy in mineral Identification is illuminated by Kadma and Oinuma (1963)

Hunt and Turner (1953) have detailed that Minerals constituents of rocks were distinguished by comparing their spectra with the spectra of immaculate minerals.

General guidance on IR methods are given by (1996) work on IR spectra for selected minerals are tabulated by White (1971)

The Far-IR spectroscopic analysis of inorganic minerals were investigated by Kerr and Kovach (1969)

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Selection and Collection of Samples ;

For present Investigation different types of granitic sample were collected from different parts of Tamilnadu. They are listed below.



Table.1

| S.No. | Variety Name | Location | District |
|-------|------------------|-------------|--------------|
| 1 | Green Onyx | Sivamalai | Erode |
| 2 | Kashmir White | Keelaiyur | Madurai |
| 3 | Kashmir Gold | Keelaiyur | Madurai |
| 4 | Madura Gold | Keelaiyur | Madurai |
| 5 | Sivakasi Yellow | Tiruthangal | Virudhunagar |
| 6 | Red Wars | Jakkery | Krishnagiri |
| 7 | Jabarana Gold | Thogamalai | Trichy |
| 8 | Black | Mettur | Salam |
| 9 | Paradise | Sulamalai | Krishnagiri |
| 10 | Columbu Jabarana | Thogamalai | Trichy |

Experimental Design:

- Put 5 to 10 mg of sample into agate solution, then add 10 to 15 drops of ethanol to the mortar for wet grinding. Collision of samples is done only manually.
- 2 mg of sample is mixed with 40 mg of spectrally dry KBr powder.
- Products with 1 mm thickness and 13 mm diameter were prepared.

- Use a small hairbrush to transfer the mixture into the mold to press out any lumps.
- Place the object in a suitable sample and introduce infrared light for analysis.
- A Perkin – Elmer 1600 series FTIR Spectrometer provided by the Municipal Research Institute, Gandhigram, Tamil Nadu, India was used to record the spectra of the samples in this study. This measurement range is between 4000 cm⁻¹ and 400cm⁻¹

DATA ANALYSIS

Observed absorption frequencies of granite samples collected from various places of Tamilnadu, India

Table-2

| Sr. No. | Quartz | Feldspar | | Garnet | Diopside | Chlorite |
|---------|--------------------------|-------------------------|---------------------------|--------|----------|-----------------|
| | | Orthoclase | Albite | | | |
| 1 | 695.2 777.7 1081.6 | 540.0 640.1 | 586.3 1033.0 1444.0 | -- | -- | -- |
| 2 | 693.4 777.6 1083.2 | 539.6 642.3 | 585.6 1010.2 1443.1 | -- | -- | 450.0 3566.0 |
| 3 | 691.2 778.0 1080.6 | 535.8 643.7 | 582.0 1005.0 1442.2 | 1449.0 | 668.0 | 3566.1 |
| 4 | 694.4 777.5 1081.4 | 539.9 638.5 | 589.8 1041.0 1440.0 | -- | 668.1 | -- |
| 5 | 695.3 777.7 1081.4 | 540.6 640.3 | 586.0 1014.0 1443.0 | -- | -- | -- |
| 6 | 692.4 776.5 1083.6 | 535.8 645.6 762.2 | 588.2 1034.0 1440.0 | -- | -- | 450.2 3567.4 |
| 7 | 691.5 776.3 1081.2 | 540.7 640.5 | 586.3 1010.0 1442.9 | 1450.2 | 668.5 | -- |
| 8 | 695.3 777.3 1083.2 | 539.5 641.0 | 589.5 1037.1 1443.6 | -- | 668.0 | -- |
| 9 | 692.6 778.1 1081.7 | 538.8 642.3 | 586.2 1005.7 1443.6 | 1451.3 | 668.4 | 450.3 3567.4 |
| 10 | 692.4 777.0 1090.1 | 539.4 640.5 | 587.3 1009.9 1443.1 | 1450.5 | 668.2 | -- |

The extinction coefficient and crystallinity index of granite samples are tabulated

Table-3

| Sample No. | Extinction coefficient of quartz | Crystallinity Index |
|------------|----------------------------------|---------------------|
| 1 | 51.6417 | 0.8666 |
| 2 | 87.1298 | 0.8947 |
| 3 | 70.0580 | 0.6111 |
| 4 | 330.0743 | 0.5000 |
| 5 | 87.5261 | 0.7058 |
| 6 | 302.6020 | 0.5833 |
| 7 | 165.8436 | 0.8132 |
| 8 | 74.7153 | 0.7058 |
| 9 | 55.3600 | 0.8750 |
| 10 | 47.2410 | 0.8182 |

It is observed that site 4 is having a maximum extinction coefficient of 330.0743. This site is taken as reference to have maximum quartz.

The crystallinity index is significant to site number 4

Discussions and Conclusions of Findings

Infrared analysis of various rock samples collected from different parts of Tamil Nadu revealed the presence of quartz, feldspar, diopside, garnet and chlorite minerals.

The researcher determined the presence of Quartz in each region by comparing the extinction coefficient and crystallinity index of the samples.

Therefore, the quality of Quartz (Site number 4 - Keelaiyur) in Madurai District is higher than in other places of Tamilnadu

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Conflicts of interest

There are no conflicts of interest.

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