

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 quartz. Quartz, consistently present in all samples, is scrutinized through extinction coefficient comparisons. Keelaiyur in Madurai District 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.

KEY WORDS:

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

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, stautolite, talc, serpentine, mica and chlorite. Infrared spectroscopy is one of the most powerful analytical techniques which offer the possibility of chemical identification and is a powerful tool in identifying quantitative and qualitative analysis of the minerals present in geological samples. The collected samples from Tamil Nadu India are analysed 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 analyse and to obtain the constituent minerals of granite rocks with special reference to Erode, Salem, Krishnagiri, Trichy, Madurai and Virudhunagar district of Tamil Nadu, 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 reported that Minerals constituents of rocks were identified by comparing their spectra with the spectra of pure minerals.
- 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)

SELECTION AND COLLECTION OF SAMPLES

For present Investigation different types of granitic sample were collected from different parts of Tamil Nadu. 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	Jakkeri	Krishnagiri

7	Jabarana Gold	Thogamalai	Trichy
8	Black	Mettur	Salam
9	Paradise	Sulamalai	Krishnagiri
10	Columbu Jabarana	Thogamalai	Trichy

DATA ANALYSIS.

Observed absorption frequencies of granite samples collected from various places of Tamil Nadu. India.

Table-2

Site No.	Quartz	Feldspar		Garnet	Diopside	Chlorite
		Orthoclase	Albite			
1	695.2	540.0	586.3	--	--	--
	777.7	640.1	1033.0			
	1081.6		1444.0			
2	693.4	539.6	585.6	--	--	450.0
	777.6	642.3	1010.2			
	1083.2		1443.1			
3	691.2	535.8	582.0	1449.0	668.0	3566.1
	778.0	643.7	1005.0			
	1080.6		1442.2			
4	694.4	539.9	589.8	--	668.1	--
	777.5	638.5	1041.0			
	1081.4		1440.0			
5	695.3	540.6	586.0	--	--	--
	777.7	640.3	1014.0			
	1081.4		1443.0			

6	692.4	535.8	588.2	--	--	450.2
	776.5	645.6	1034.0			3567.4
	1083.6	762.2	1440.0			
7	691.5	540.7	586.3	1450.2	668.5	--
	776.3	640.5	1010.0			
	1081.2		1442.9			
8	695.3	539.5	589.5	--	668.0	--
	777.3	641.0	1037.1			
	1083.2		1443.6			
9	692.6	538.8	586.2	1451.3	668.4	450.3
	778.1	642.3	1005.7			3567.4
	1081.7		1443.6			
10	692.4	539.4	587.3	1450.5	668.2	--
	777.0	640.5	1009.9			
	1090.1		1443.1			

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

EXPERIMENTAL DESIGN

- Samples are usually subjected to various pre treatments in order to remove the organic matter and certain other minerals to improve the quality of the spectrum
- Wet grinding is carried out by placing 5 to 10 mg of the sample in agate mortar and then 10 to 15 drops of ethanol is added to mortar. The samples are ground mostly hand grinding.
- Sample of 2 mg is mixed with 40 mg of spectroscopic dry KBr powder. A pellet of 1 mm in thickness and 13mm in diameter is prepared. A small camel's hair brush is used to transfer the mixture to the die for pressing the pellet.
- The pellet is placed in a suitable sample holder and introduced in infrared beam for analysis.
- The Perkin -Elmer -1600 series FTIR spectrometer available at Gandhigram Rural Institute, Gandhigram, Tamil Nadu, India, is made use in present work for recording the spectra of the sample. This instrument has range of 4000cm⁻¹ to 400 cm⁻¹. This instrument is calibrated for its accuracy with the spectrum of standard polystyrene.

DISCUSSIONS AND CONCLUSIONS OF FINDINGS

The infrared analysis of the various rock samples from different areas of Tamil Nadu indicates the presence of Quartz, feldspar, diopside, garnet and chlorite minerals.

The availability of quartz among the various sites was determined by comparing the extinction coefficient of samples. It is observed that samples from site number 4 (Keelaiyur in Madurai District) having maximum extinction coefficient among all the sites with higher crystallinity. Therefore, the quality of the quartz from this site number 4 (Keelaiyur in Madurai District) is higher than the other sites.

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SAMPLES COLLECTED FROM DIFFERENT PARTS OF TAMILNADU

