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Laboratory Reflectance Spectra of 160 Minerals, 0.4 to 2.5 Micrometers

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1.0 ABSTRACT

The purpose of this report is to provide reflectance spectra of 160 minerals in both digital and printed form. In order to demonstrate the effect of particle size on reflectance, the spectral data for 135 of the minerals are presented at three different grain sizes. These are 125-500μm, 45-125μm and <45μm. Ancillary information is provided with each mineral spectrum, which includes the mineral name, mineralogy, supplier, sampling locality and our designated sample number. The purity of every mineral sample was evaluated by X-ray diffraction (XRD). The composition of certain minerals known to deviate strongly from idealized end-member compositions was determined by electron microprobe analysis. The compositional information obtained by microprobe analysis and accessory minerals identified by XRD are noted with the ancillary information. In addition, the spectrum acquired from the coarsest grain size available for each sample was processed with a feature-finding algorithm to quantify the characteristics of the spectral absorption features.

All the reflectance spectra presented here are provided in digital form on IBM-compatible 3.5" diskettes located in an envelope inside the back cover. Also included on diskette is a program for displaying the spectral data and searching for spectral features that runs on an IBM-compatible PC with standard VGA graphics.

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2.0 INTRODUCTION

This publication presents laboratory reflectance spectra of 160 minerals in both printed and digital form. No attempt has been made to investigate the causes of the spectral features observed. Excellent theoretical studies dealing with the causes of these features are available in the open literature. One of the most comprehensive studies was published by Hunt and his coworkers in a series of papers between 1970 and 1979. Since then, several catalogues of reflectance spectra have been published, including Clark et al., 1990; Lang et al., 1990; and Urai et al., 1989.

Data for 135 of the minerals are presented at three different grain sizes: 125-500μm, 45-125μm, and <45μm. This study was undertaken to illustrate the effect of particle size on the shape of the mineral spectra. Ancillary information is provided with each mineral spectrum, including the mineral name, mineralogy, supplier, sampling locality, and our designated sample number. Generalized chemical formulae were obtained from Fleischer (1983) or electron microprobe analysis, when available. The purity of each mineral sample was evaluated by X-ray diffraction (XRD), and identifiable accessory minerals, if present, are noted with the ancillary information. In addition, the characteristics (wavelength position, depth, area and asymmetry) of absorption features in the spectrum that were derived from the coarsest size fraction of each mineral sample have been quantified by using a feature-finding algorithm.

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3.0 DOCUMENT LAYOUT

Initially, this publication describes the methodology used to derive the mineralogical and spectral data presented in Appendix B. This discussion is followed by a description of the algorithm developed to identify and parameterize absorption features in the spectral data. The results from the application of this algorithm to the spectral data are also presented in Appendix B.

The spectra presented in Appendix B are separated into classes according to the dominant anion or anionic group present, which is the classification scheme traditionally used in mineralogy. Each mineral class is a separate subsection of Appendix B. Classes include arsenates, borates, carbonates, elements, halides, hydroxides, oxides, phosphates, silicates, sulphates, sulphides and tungstates. The silicate class has been subdivided further into subclasses based on the degree of polymerization of the silicon tetrahedra. These subclasses include cyclosilicates, inosilicates, nesosilicates, phyllosilicates, sorosilicates and tectosilicates. A mineral class index and an alphabetical index of minerals are presented in Appendix A.

Appendix C discusses the results obtained from applying the feature-finding algorithm to a series of test case spectra.

The digital spectral reflectance data for each mineral are provided on IBM PC-compatible 3.5" diskettes in an envelope in the back of the report. Also provided is a program called DISPEC.EXE for displaying and processing the digital spectral data. Included with the program are procedures for calculating hull quotients/differences and locating and quantifying spectral features. The program runs on an IBM-compatible PC with standard VGA graphics. Instructions to install and operate DISPEC.EXE are provided in the READ.ME file on the same diskette.

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4.0 METHODOLOGY

4.1 Sample Origin

The majority of non-clay minerals used in this report were obtained from Ward's Natural Science Establishment, Rochester, New York; the Burnham Mineral Company (Burminco), Monrovia, California; or from an in-house collection. Most of the clay minerals were obtained from the Source Clay Mineral Repository, University of Missouri, Columbia, Missouri. In all cases, the supplier of the sample is listed in the ancillary information describing each sample.

It was not possible to obtain sufficiently large quantities of all natural minerals, particularly oxides and some clays. In these cases, synthetic minerals were used. In all cases, XRD data for the synthetic mineral agreed with the data reported for the natural mineral in the *Mineral Powder Diffraction File Data Book* (Joint Committee Powder Diffraction Standards, 1980).

4.2 Sample Preparation

Mineral samples were pulverized with a steel percussion mortar. A magnet was used to remove metallic impurities introduced during this procedure. The pulverized sample was then ground with mortar and pestle and separated into different size fractions by wet-sieving with distilled water or 2-propanol (for water-soluble minerals) in nested sieves. The size fractions selected for reflectance measurements were 125-500μm, 45-125μm, and <45μm, which correspond to fine-to-medium sand, coarse silt to very fine sand, and medium silt to clay, respectively. In certain instances, only one grain size was analyzed due to the nature and/or paucity of the sample (e.g., cristobalite, clay minerals).

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4.3 X-ray Diffraction

The purity of each mineral sample was evaluated by using standard XRD methods described in Klug and Alexander (1954). A Norelco water-cooled X-ray diffractometer, equipped with a vertical scan goniometer and focusing monochromater was used for the analysis. All samples were analyzed by Ni-filtered, CuK α radiation. Diffraction lines were recorded on a strip chart recorder at a scan rate of 1° (2θ) per minute over the angular range of 4° to 65° (2θ).

The *Mineral Powder Diffraction File Search Manual and Data Book* (Joint Committee on Powder Diffraction Standards, 1980) was used to identify crystalline phases. Additional XRD data were obtained from Borg and Smith (1969) and Berry and Thompson (1962). Identification of clay mineral phases was facilitated by techniques and diffraction data presented by Carroll (1970) and Brindley and Brown (1980).

The XRD criteria used to determine the purity of our samples were based on the number and intensity of diagnostic peaks. If impurities were identified in a sample, a semiquantitative estimate of their abundance was made by XRD. Several limitations of XRD analysis are applicable to our results. Many crystalline substances are strong diffractors of X-rays and can be detected when present in concentrations as small as 1-2 percent. Other materials diffract X-rays less efficiently and yield diffraction patterns of measurable intensity only when they constitute a major portion of the sample. As a result, certain minor constituents cannot be identified by XRD alone. For example, many of the feldspars have suffered minor incipient alteration, which manifests as small features in the Beckman spectra (for example, the sharp feature around 2.2μm in Sanidine TS-14A). No alteration products were identified by XRD in the Sanidine sample. The problems associated with the detection limits of XRD analyses are discussed in detail in

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Klug and Alexander (1954).

4.4 Electron Microprobe

Chemical composition data were acquired by electron microprobe analysis for some of our minerals known to deviate significantly from idealized end-member compositions. These analyses were undertaken with the Cameca CAMEBAX electron microprobe at U.C.L.A. Chemical compositions were obtained from polished grain mounts in the wavelength dispersive mode by using 15 keV accelerating potential, 1.5 nA° absorbed current and 20s counting intervals. Compositionally well-characterized silicate minerals from the U.C.L.A. collection were employed as standards. Raw data were reduced according to the ZAF correction scheme (Henog et al., 1982). Results for major elements are believed to be accurate to ±1%. Quantitative chemical compositions presented for minerals in Appendix B represent the average of three or more individual analyses and are indicated by an asterisk (*) following the chemical formula.

4.5 Spectrophotometer

Hemispherical reflectance measurements in the visible and short-wavelength region of the electromagnetic spectrum (0.4 to 2.5μm) were made by using a Beckman UV5240 spectrophotometer (Price, 1977). The Beckman UV5240 incorporates a single-pass monochromator and utilizes a diffraction grating as its dispersing element. The sampling interval is .001μm, from 0.4 to 0.8μm, and .004μm, from 0.8 to 2.5μm. The sampling width of our instrument is listed in Table 1. Our instrument has been modified with an integrating sphere rotated 90°, which facilitates measurement of powdered samples and soils by allowing the materials to remain in the sample holder in a horizontal position. The

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instrument configuration and beam path are illustrated in Figure 1.

For reflectance measurements, the size-sorted samples were poured into aluminum sample holders that measured 3.2 cm in diameter and 0.5 cm in depth. The upper surface was carefully smoothed with the edge of a stainless steel spatula. Smoothing with a spatula may compact the sample and introduce some preferred orientation of grains. However, every effort was made to minimize these effects. The sample was then placed in the sample compartment where it and a Halon reference standard were illuminated alternately by monochromatic radiation from a high-intensity halogen source lamp. Halon, a trade name for polytetrafluoroethylene powder, has been shown to be a good diffuser of incident radiation over the spectral range of the 0.2 - 2.5μm region (Weidner and Hsia, 1981). However, Halon does have a small absorption feature near 2.2μm (Figure 2C). This feature is manifest in spectra with a high reflectance in the 2.0 - 2.5μm region (Figure 2A). In order to correct this Halon artifact, the spectra were multiplied by the reflectance of Halon vs a perfect diffuser given in Weidner and Hsia (1981). The correction largely removed the influence of the Halon absorption feature in our spectra. The success of the removal can be seen by examining the corrected gold spectrum (Figure 2B), which should be flat in the 2.0 - 2.5μm region.

5.0 FEATURE CHARACTERIZATION

5.1 Introduction

A feature-finding algorithm was developed at JPL to automatically identify and quantify the characteristics of absorption bands in spectral data. The algorithm calculates the wavelength position, depth, area, and asymmetry of absorption bands based on a set of user-defined rules. The program to execute this algorithm is included as a module in the larger program (DISPEC) provided on IBM PC-compatible diskettes at the end of this report. The feature finder was applied to hull-difference spectra calculated from the spectrum obtained from the coarsest grain size of each mineral. DISPEC also includes modules for calculating the hull quotients/differences and for displaying spectra.

5.2 Hull Differences/Quotients

The continuum removal techniques, commonly referred to as hull quotients/differences, were developed by Green and Craig (1985). The technique is analogous to fitting a rubber band over a spectrum to form a continuum or hull (Figure 3). The hull is divided into the original spectrum to produce a hull quotient (Figure 3 - top), or the difference between the hull and original spectrum is subtracted from a constant to obtain a hull difference (Figure 3 - bottom). For this report, the hull difference technique was used with a constant of 100. The advantage of the hull difference technique is that the depths of features remain constant with respect to the hull (Figure 3). By contrast, a feature that has the same depth with respect to the hull as another feature but which has lower values than the other feature will be preferentially enhanced with the hull quotient technique (Figure 3). The original spectrum could be used instead

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of the hull quotient/difference but is not recommended since the depth, area and asymmetry of a feature will be influenced strongly by its position on the background continuum. In the following description of the feature-finding algorithm, "spectrum" refers to the hull difference spectrum.

5.3 Feature - Finding Algorithm

Initially the lowest reflectance value in a spectrum is identified. Tests are then performed on the minimum point and, if necessary, the points to the left of the minimum, to locate the left edge of the feature. First, the wavelength value of the minimum is checked to see if it is the first value in the spectrum. If this test is false, the value of the minimum is tested to see if it equals the maximum value in the spectrum. If either of these tests is true, the minimum is considered to mark the left edge of the feature. If both tests are false, the slope change between the minimum and the point to the left of the minimum is calculated. If this slope change is positive, the tests decribed above are performed on the point to the left of the minimum. If both tests are false, the slope change between the point to the left of the minimum and the point to *its* left is examined. This procedure of testing then calculating the slope continues until the point is found where one or both tests are true or the slope change is negative and greater than a user-specified amount. This point marks the left edge of the first absorption feature.

The same tests are performed on the minimum and points to the right of the minimum to locate the right edge of the feature, except that the wavelength of the minimum is checked to see if it is the last value in the spectrum rather than the first.

The wavelength position of the feature minimum and the left and right edges are recorded, and all the values within and including the values at the feature edges are set

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to the maximum value in the spectrum. The procedure outlined above is then repeated until: 1) the number of user-requested absorption features has been found; 2) the depth of an absorption feature is less than the user-specified, minimum-acceptable depth for an absorption feature; or, 3) no more features can be found.

Once all the features have been found, the *area*, *asymmetry*, and *depth* of each feature is calculated by using a **copy** of the hull difference spectrum. The processed spectrum cannot be used because all the values were set to the maximum value in the process of finding each feature.

The *area* of the absorption feature is calculated in two parts: the part between the left edge of the feature and the minimum, and the point between the minimum and the right edge of the feature. The area to the left of the mimimum is obtained by calculating the area of the trapezoids whose tops are marked by the maximum value in the spectrum. The base points are marked by each pair of points, starting with the minimum value and the value to its left and continuing to the left edge of the feature (Figure 4). The areas of these trapezoids are summed and constitute the area of the left-hand side of the feature. The procedure is repeated by using the points to the right of the minimum to calculate the area of the right-hand side of the feature. The *area* of the feature is the sum of the left and right areas.

The *asymmetry* of the absorption feature is calculated by dividing the area on the left-hand side of the feature by the area on the right. As a result, features in which the area on the left-hand side is greater than the area on the right-hand side will result in asymmetry values greater than 1. Conversely, features in which the area is greater on the right-hand side will result in asymmetry values between 0 and 1.

The *depth* of the feature is calculated as the maximum value in the spectrum

minus the value at the minimum and is positive.

If a minimum occurs at the beginning or end of the spectrum, it and the values to its left or right edge are set to the maximum value and the minimum is not recorded.

Not only can the user set the minimum acceptable slope, feature depth, and the number of absorption features to search for, but also the user can request that the spectrum be smoothed before feature searching with a moving average filter. These user-defined parameters establish thresholds that absorption features must meet in order to be identified. By varying these parameters, it is possible to optimize the results for the quality of the original spectral data. The feature-finding algorithm was applied to a set of artifical test spectra to explain, in detail, the intricacies of the program: These results are described in Appendix C.

6.0 DISCUSSION

During the course of applying the hull-difference and feature-finding techniques to the spectral data, various characteristics of each technique were recognized. These are discussed below.

(1) The feature-finding algorithm worked better on hull difference spectra than on reflectance spectra. This characteristic relates to the test in the feature-finder, which checks to see if a point is equal to the maximum spectral value. The maximum value of the hull difference is 100 (the constant) and occurs when the spectrum impinges on the hull. If this test is false, the slope is calculated between the point being tested and the adjacent point; if the slope is negative and greater than a user-specified amount, the point being tested marks the edge of the feature. If the hull difference were not used and if there were a spectrum with a single feature superimposed on a background that was

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increasing, the right edge of the feature would be identified at the end of the spectrum and the feature would have a very large area (Figure 5 - top). This problem does not occur if the hull difference of the spectrum is used, since the background is removed (Figure 5 - bottom).

(2) During the initial processing we discovered that due to the difference in signal to noise of the spectral wavelength range between 0.4 and 0.8μm, when the sampling interval is 0.001μm and greater than 0.8μm, and where the sampling interval is .004μm, a different set of rules was necessary for each wavelength range. That is, if the rules were optimized so the program found very small features at wavelengths greater than 0.8μm and the number of absorption features requested had not been met, the program would then identify the noise below 0.8μm as small features until the number of features requested was satisfied. Initially we processed the spectral region between 0.4 and 0.8μm with a different set of rules than the region between 0.8 and 2.5μm. This solved the noise problem, but many iron-related absorption features centered on 0.8μm were missed because their minima were located on the edge of the spectrum. Minima that occur on the edge of the spectral region processed are lost by using the continuum-removal techniques. This happens because the first and last points are automatically set to 100 (the constant) since these are the tie points of the hull (Figure 3). Therefore, we calculated hull difference spectra on the wavelength region between 0.4 and 1.1μm and between 0.8 and 2.5μm and used a different rule set for each region to compensate for the different noise characteristics. This meant that there was an overlap region between 0.8 and 1.1μm that was processed with two different sets of rules.

In the overlap region there were small features that were identifed by using one rule set and not identified by using the other rule set. For example, in the Scorodite

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spectrum (A-02A), two features were identified between 0.8 and 1.0μm with the set of rules for the longer wavelength portion, but only one feature was identified between 0.8 and 1.0μm with the set of rules for the shorter wavelength portion.

Large absorption features in the overlap region may have different wavelength position, depth, area and asymmetry values with each set of rules. Since the sets of rules used for each wavelength region are fairly similar, these differences in absorption band characteristics tend to be small. The greatest variation in the parameters of a feature in the overlap region results from the different levels of smoothing used with each set of rules. In general, greater smoothing with the shorter wavelength rule set causes a feature in the overlap region to be broader and shallower than with the longer wavelength rule set. For example, see the absorption feature between 0.9 and 1.0μm in the Colemanite spectrum (B-01A). If the feature is asymmetric, the position of the minimum may also shift slightly, see for example the feature between 0.9 and 1.0μm in the Ulexite spectrum (B-03A).

(3) Although every spectrum was initially processed with a standard set of rules for each wavelength region, noise was clearly identified as a feature in certain spectra. In these cases, the slope parameter was varied until the noise was no longer identified as a feature. Generally the slope needed to be varied more in the shorter wavelength portion of the spectrum where noise levels fluctuate more. The standard minimum acceptable slope change used in the shorter wavelength region was 9.0; the most extreme slope change used was 49.0 for the spectrum of Lithiophilite (P-04A). By contrast, the standard minimum acceptable slope change used for the longer wavelength region was 5.0; the most extreme slope change used was 34.0 for a Brucite sample (OH-01A).

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(4) Since the feature-finding program relies on a negative slope change to mark the edge of a feature, shoulders in the spectrum are not identified. Instead, they are included as part of the nearest absorption feature (for example, the shoulder near 1.3μm in Dickite [PS-03A]).

(5) If the user sets criteria for absorption features that are not appropriate for separating real features from noise, the program will find both. This is often annoying to the user, but the program is unable to utilize the wealth of knowledge the user has in deciding what is or is not a real spectral feature; all it has is a set of user-specified rules that are either true or false.

(6) If a minimum occurs outside the spectral range, but its wings extend into the spectral range, a minimum will be introduced by the hull difference technique (see Mimetite, A-01A). The mimimum identified in the hull difference spectrum will be shifted with respect to the actual minimum outside the spectral range. Such a feature is clearly erroneous and should be ignored.

(7) The effect described in (6) can also result if sample reflectance increases slightly at either end of the spectral range. In certain samples, we have noted a slight increase at the blue end of the spectrum (see Rutile, O-02A), this may be due to blue scatter caused by dust on the mirrors. This increase results in a feature being identified that is not actually present and should be ignored.

(8) While every effort has been made to test and debug the DISPEC program, it is experimental software and does not adhere to any particular set of software standards. As a result, problems will undoubtably arise and the program output should be evaluated with caution.

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7.0 DIGITAL SPECTRAL DATA FORMAT

The spectral data presented in Appendix B are available in digital form on IBM PC-compatible 3.5" diskettes in the back of this publication. Each diskette contains a number of ASCII files. Each file contains 2 lines of text followed by 826 lines of data. Each data line has either one or three columns of reflectance values, one for each grain size. Each data line is the reflectance at a discrete wavelength position; the wavelength value for that line is contained at the same line number in the file BECK.WAV. If the mineral was available in only one grain size, the ASCII file contains only one column of numbers, for example Kaolinite PS-01A. The first line of header includes the mineral name followed by the sample number. The ASCII filename is the sample number without the hyphen. The second line of header lists the size fractions for the subsequent data columns.

The naming convention for the ASCII files is as follows. The first one or two letters of each filename indicates the class to which the mineral belongs (Table 2). The number following the mineral class designation is unique to a particular mineral type. For example, all calcite samples have the same number (C-03). The sample number is followed by a letter that refers to a particular sample (for example, C-03A). A complete listing of file names, referenced to their mineral names, can be found in Appendix A.

The mineral spectra described in this report are available on-line in the Pilot Land Data System (GSFC, 1991) at the Jet Propulsion Laboratory. These spectra are part of a larger spectral database containing spectral reflectance data for minerals, rocks, soils, and other land surface features from 0.4 to 2.5μm, and from 0.3 to 22.0μm. Each spectrum is described fully in terms of its acquisition parameters and format. In addition, the original sample from which the spectral data were acquired is described fully,

including its geographic location, mineralogy, current storage location, and collector information. Extra copies of this publication or information regarding on-line or off-line access to the spectral database can be obtained from:

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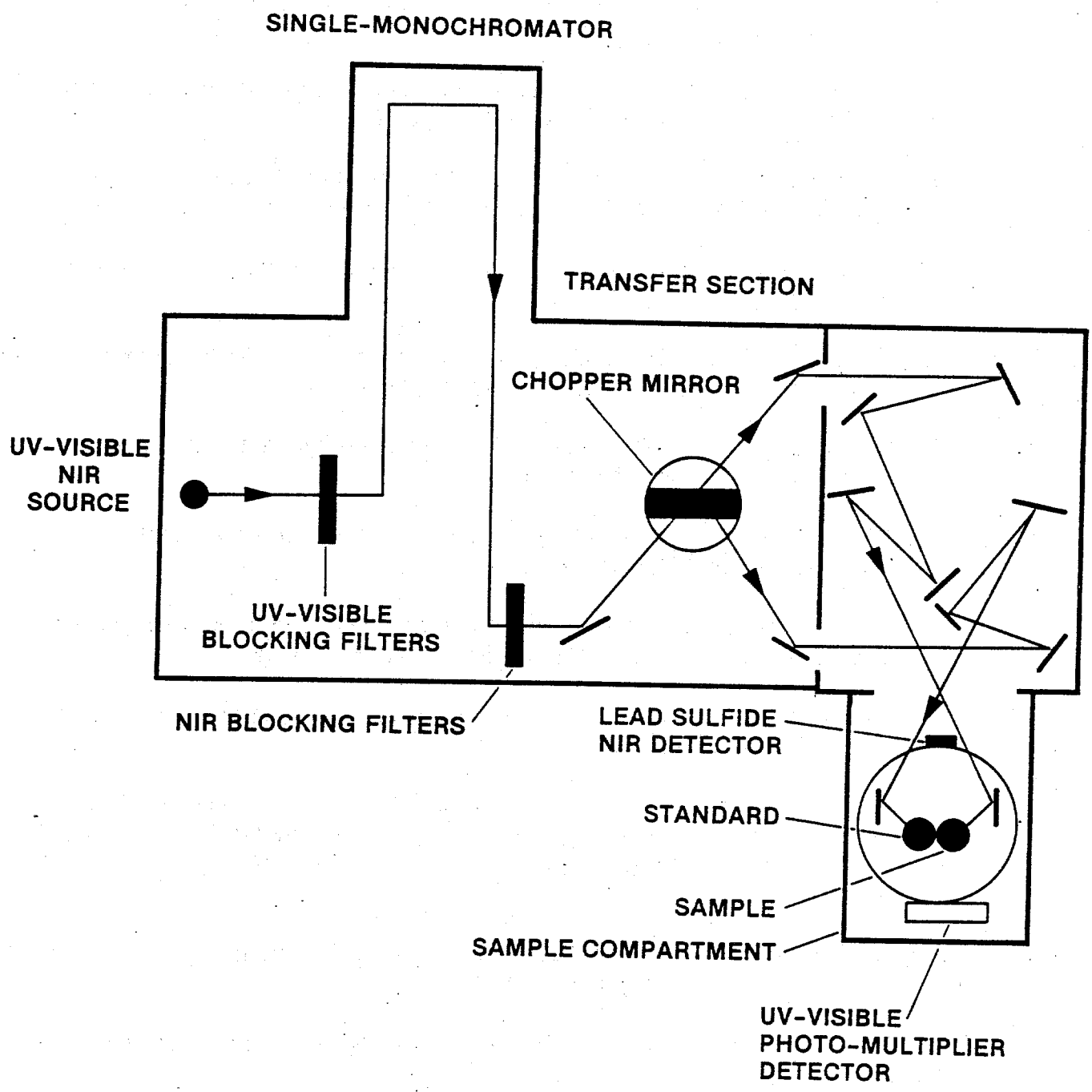

Figure 1. Schematic diagram of the Beckman UV5240 Spectrophotometer.

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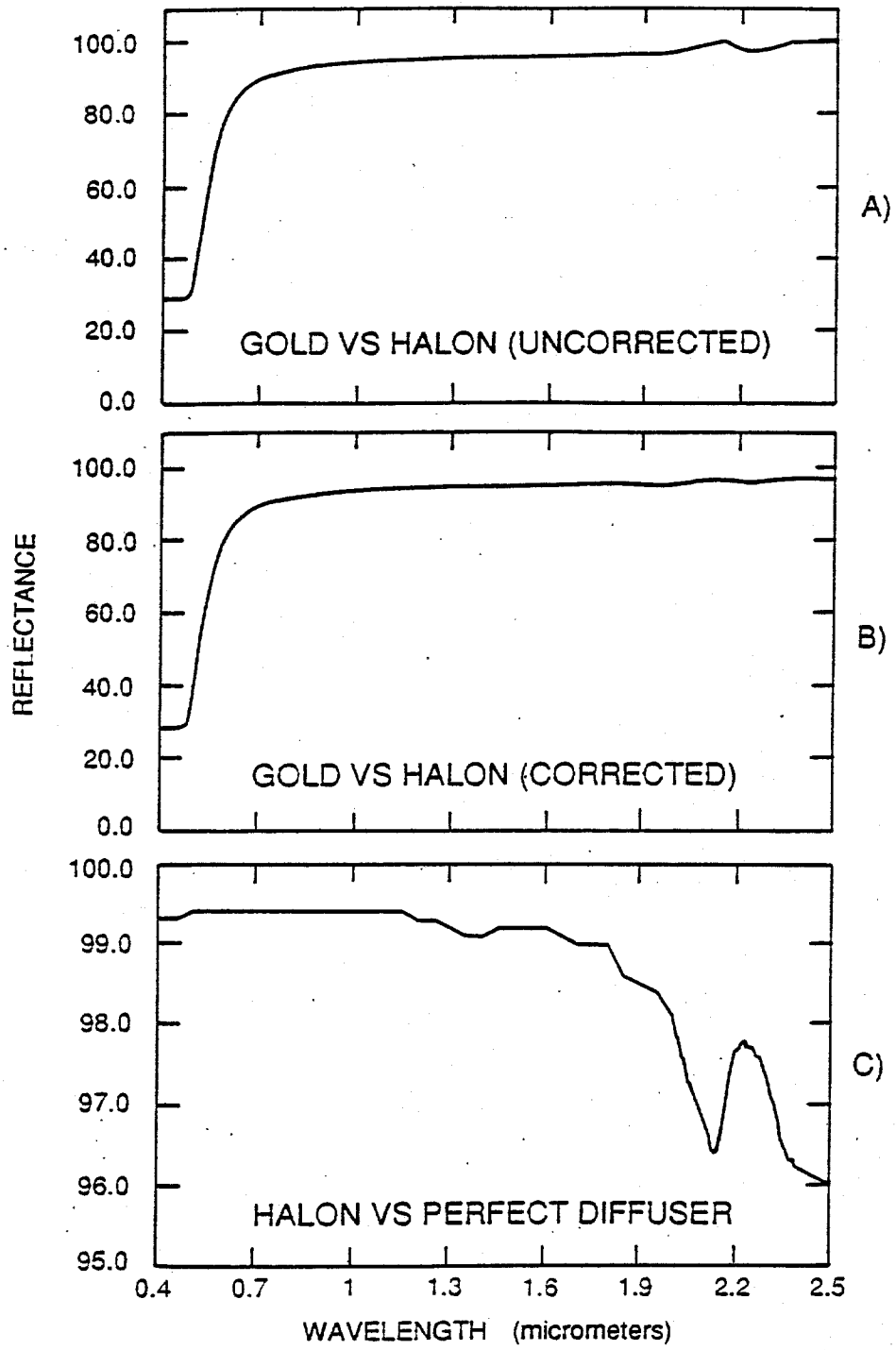

Figure 2. A) - Spectrum of gold versus halon showing the 2.2μm absorption feature in Halon. B) Spectrum of gold versus Halon after applying the halon correction.
C) - Spectrum of Halon relative to a perfect diffuser from Weidner and Hsia (1981).

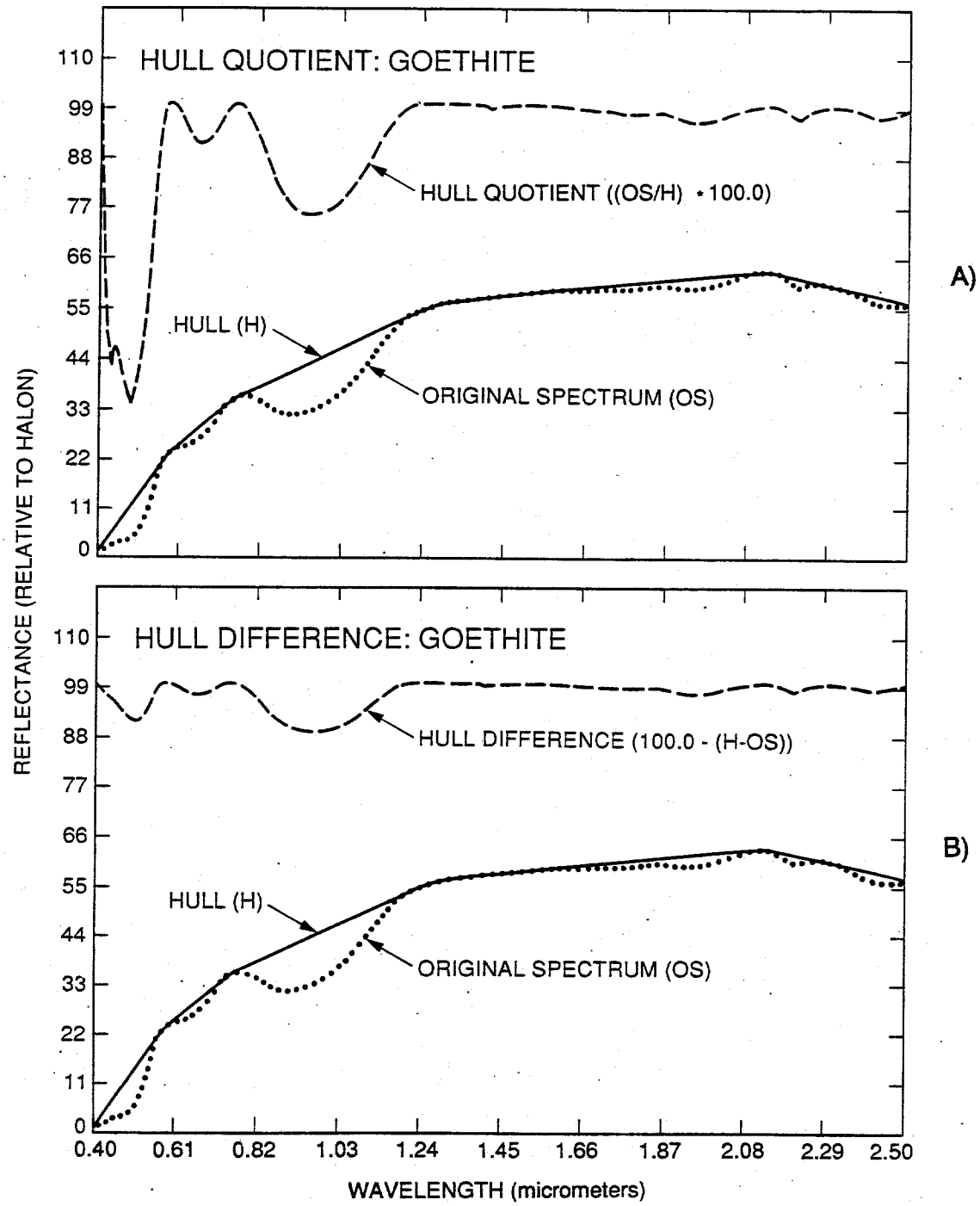

Figure 3. A) - Goethite spectrum with hull and hull quotient. B) - Goethite spectrum with hull and hull difference.

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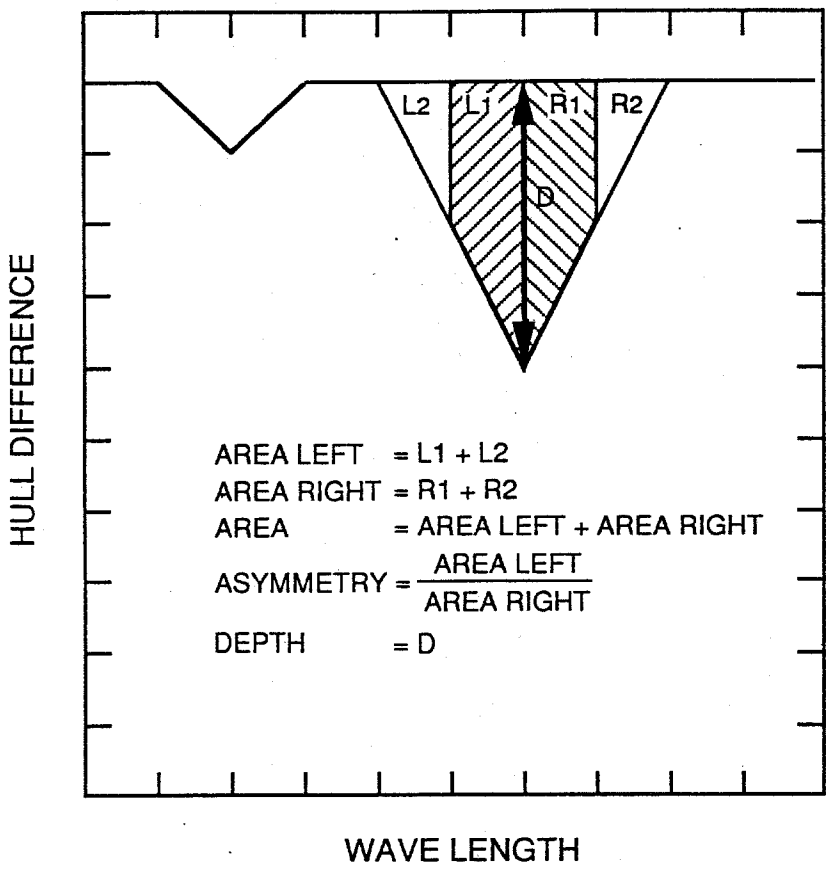

Figure 4. Schematic diagram of the method used to calculate the wavelength position, depth, area and asymmetry of an absorption feature in a hull difference spectrum.

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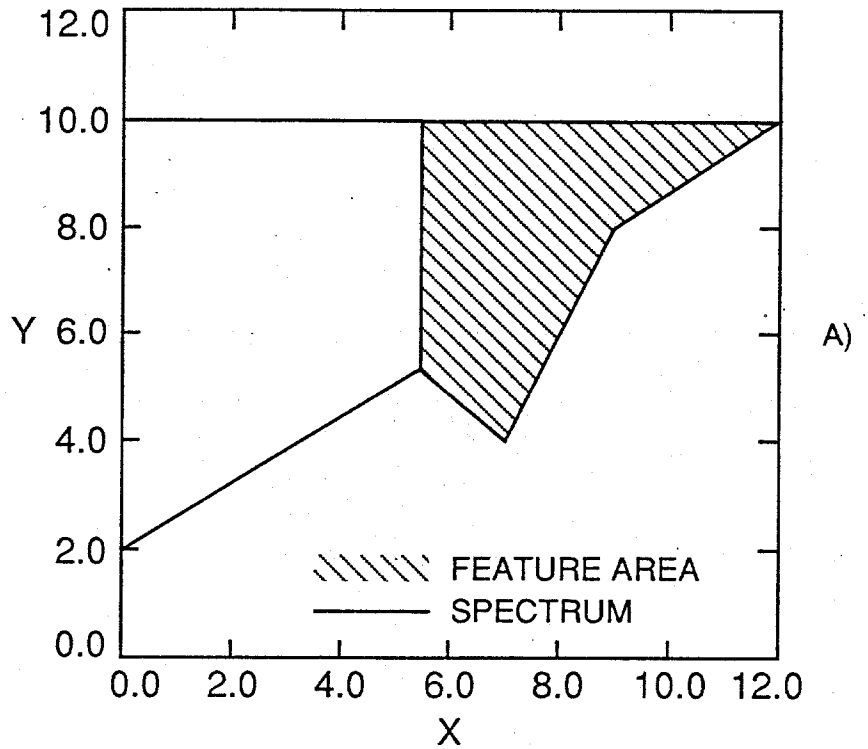

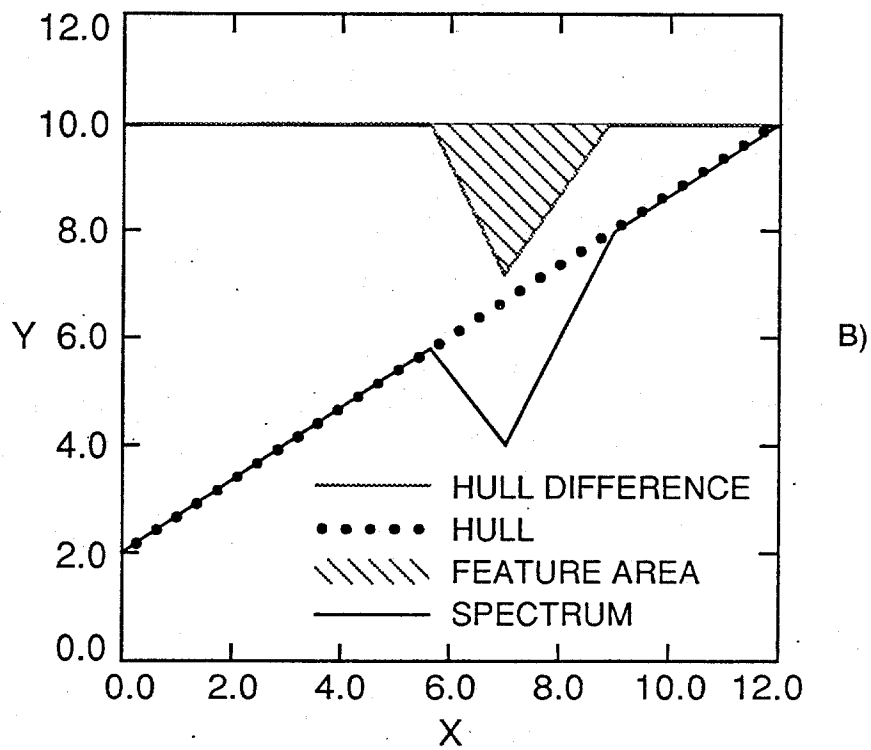

Figure 5. A) - Area calculated by the feature finder for a single feature on a sloping background. B) - Area calculated for the same feature by the feature finder after the removal of the background with the hull difference technique.

TABLE 1

Band Center - vs - Bandwidth (Nanometers)

Infrared	
Band Center	Bandwidth
2500	38
2450	31
2400	25
2350	22
2300	27
2250	22
2200	20
2150	20
2100	20
2050	19
2000	18
1950	18
1900	17
1850	14
1800	12
1750	12
1700	11
1650	11
1600	11
1550	9
1500	8
1450	7.8
1400	7.1
1350	6.6
1300	5.6
1250	5.5
1200	5.6
1150	5.6
1100	5.5
1050	5.8
1000	7.0
950	9.0
900	11.0
850	17.0
800	19.0

Visible	
Band Center	Bandwidth
800	4.2
775	3.1
750	2.4
725	1.8
700	1.4
675	1.1
650	.09
625	.72
600	.63
575	.74
550	.72
525	.72
500	.70
475	.75
450	.81
425	.97
400	1.30

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TABLE 2

MINERAL CLASS DESIGNATION

	Mineral Class	Abbreviation
	Arsenates	A
	Borates	B
	Carbonates	C
	Elements	E
	Halides	H
	Hydroxides	OH
	Oxides	O
	Phosphates	P
	Sulphates	SO
	Sulfides	S
	Tungstates	T
SILICATES	Cyclosilicates	CS
SILICATES	Inosilicates	IN
SILICATES	Nesosilicates	NS
SILICATES	Phyllosilicates	PS
SILICATES	Sorosilicates	SS
SILICATES	Tectosilicates	TS

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APPENDIX A
MINERAL CLASS INDEX AND ALPHABETICAL INDEX

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MINERAL CLASS INDEX

Mineral Group	Mineral Name	Sample Number	Digital File name	Page No.
Arsenates	Mimetite	A-01A	A01A	B-4
	Scorodite	A-02A	A02A	B-6
Borates	Colemanite	B-01A	B01A	B-10
	Kernite	B-02A	B02A	B-12
	Ulexite	B-03A	B03A	B-14
	Tincalconite	B-04A	B04A	B-16
	Howlite	B-05A	B05A	B-18
	Borax	B-06A	B06A	B-20
Carbonates	Strontianite	C-01A	C01A	B-24
	Witherite	C-02A	C02A	B-26
	Calcite	C-03A	C03A	B-28
	Calcite	C-03D	C03D	B-30
	Calcite	C-03E	C03E	B-32
	Trona	C-04A	C04A	B-34
	Dolomite	C-05A	C05A	B-36
	Dolomite	C-05C	C05C	B-38
	Magnesite	C-06A	C06A	B-40
	Malachite	C-07A	C07A	B-42
	Rhodochrosite	C-08A	C08A	B-44
	Siderite	C-09A	C09A	B-46
	Cerussite	C-10A	C10A	B-48
	Smithsonite	C-11A	C11A	B-50
	Azurite	C-12A	C12A	B-52
Elements	Graphite	E-01A	E01A	B-56
	Sulphur	E-02A	E02A	B-58
Halides	Cryolite	H-01A	H01A	B-62
	Fluorite	H-02A	H02A	B-64
	Fluorite	H-02B	H02B	B-66
	Halite	H-03A	H03A	B-68
	Atacamite	H-04A	H04A	B-70
Hydroxides	Brucite	OH-01A	OH01A	B-74
	Goethite	OH-02A	OH02A	B-76
	Gibbsite	OH-03A	OH03A	B-78
Oxides	Hematite	O-01A	O01A	B-82
	Hematite	O-01B	O01B	B-84
	Rutile	O-02A	O02A	B-86
	Cassiterite	O-03A	O03A	B-88
	Magnetite	O-04A	O04A	B-90
	Pyrolusite	O-06A	O06A	B-92
	Columbite	O-07A	O07A	B-94

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	Magnesiochromite	O-08A	O08A	B-96
	Gahnite	O-11A	O11A	B-98
	Anatase	O-12A	O12A	B-100
	Zincite	O-13A	O13A	B-102
	Periclase	O-14A	O14A	B-104
	Corundum	O-15A	O15A	B-106
Phosphates	Apatite	P-01A	P01A	B-110
	Montebrasite	P-02A	P02A	B-112
	Amblygonite	P-03A	P03A	B-114
	Lithiophilite	P-04A	P04A	B-116
Sulphates	Anhydrite	SO-01A	SO01A	B-120
	Gypsum	SO-02B	SO02B	B-122
	Barite	SO-03A	SO03A	B-124
	Alunite	SO-04A	SO04A	B-126
	Celestite	SO-05A	SO05A	B-128
	Tschermigite	SO-06A	SO06A	B-130
	Jarosite	SO-07A	SO07A	B-132
	Plumbojarosite	SO-07B	SO07B	B-134
	Natrojarosite	SO-07C	SO07C	B-136
	Glauberite	SO-08A	SO08A	B-138
	Aphthitalite	SO-09A	SO09A	B-140
	Anglesite	SO-10A	SO10A	B-142
	Antlerite	SO-11A	SO11A	B-144
Sulphides	Sphalerite	S-01A	S01A	B-148
	Pyrite	S-02A	S02A	B-150
	Realgar	S-03A	S03A	B-152
	Chalcopyrite	S-04A	S04A	B-154
	Arsenopyrite	S-05A	S05A	B-156
	Stibnite	S-06A	S06A	B-158
	Galena	S-07A	S07A	B-160
	Chalcocite	S-08A	S08A	B-162
	Bornite	S-09A	S09A	B-164
	Marcasite	S-10A	S10A	B-166
	Molybdenite	S-11A	S11A	B-168
	Pyrrhotite	S-12A	S12A	B-170
Tungstates	Scheelite	T-01A	T01A	B-174
Cyclosilicates	Tourmaline	CS-01A	CS01A	B-178
	Beryl	CS-02A	CS02A	B-180
	Cordierite	CS-03A	CS03A	B-182
	Ferroaxinite	CS-04A	CS04A	B-184
Inosilicates	Rhodonite	IN-01A	IN01A	B-188
	Wollastonite	IN-02A	IN02A	B-190
	Glaucophane	IN-03A	IN03A	B-192
	Actinolite	IN-04A	IN04A	B-194
	Tremolite	IN-05A	IN05A	B-196
	Cummingtonite	IN-06A	IN06A	B-198
	Riebeckite	IN-07A	IN07A	B-200

	Anthophyllite	IN-08A	IN08A	B-202
	Diopside	IN-09B	IN09B	B-204
	Enstatite	IN-10B	IN10B	B-206
	Johannsenite	IN-12A	IN12A	B-208
	Spodumene	IN-13A	IN13A	B-210
	Hypersthene	IN-14A	IN14A	B-212
	Augite	IN-15A	IN15A	B-214
Nesosilicates	Fayalite	NS-01A	NS01A	B-218
	Forsterite	NS-02A	NS02A	B-220
	Grossular Garnet	NS-03B	NS03B	B-222
	Almandine Garnet	NS-04A	NS04A	B-224
	Topaz	NS-06A	NS06A	B-226
	Titanite	NS-07A	NS07A	B-228
	Sillimanite	NS-08A	NS08A	B-230
	Zircon	NS-09A	NS09A	B-232
Phyllosilicates	Kaolinite	PS-01A	PS01A	B-236
	Kaolinite	PS-01B	PS01B	B-238
	Montmorillonite	PS-02B	PS02B	B-240
	Montmorillonite	PS-02D	PS02D	B-242
	Dickite	PS-03A	PS03A	B-244
	Palygorskite	PS-04A	PS04A	B-246
	Sepiolite	PS-05A	PS05A	B-248
	Nontronite	PS-06A	PS06A	B-250
	Nontronite	PS-06B	PS06B	B-252
	Nontronite	PS-06D	PS06D	B-254
	Pyrophyllite	PS-07A	PS07A	B-256
	Cookeite	PS-09A	PS09A	B-258
	Corrensite	PS-10A	PS10A	B-260
	Illite	PS-11A	PS11A	B-262
	Chlorite	PS-12A	PS12A	B-264
	Chlorite	PS-12C	PS12C	B-266
	Chlorite	PS-12E	PS12E	B-268
	Chlorite	PS-12F	PS12F	B-270
	Lepidiolite	PS-13A	PS13A	B-272
	Lepidiolite	PS-13B	PS13B	B-274
	Talc	PS-14A	PS14A	B-276
	Muscovite	PS-16A	PS16A	B-278
	Vermiculite	PS-18A	PS18A	B-280
	Vermiculite	PS-18B	PS18B	B-282
	Glauconite	PS-19A	PS19A	B-284
	Serpentine	PS-20A	PS20A	B-286
	Prehnite	PS-21A	PS21A	B-288
	Hydroxyapophyllite	PS-22A	PS22A	B-290
	Biotite	PS-23A	PS23A	B-292
	Saponite	PS-24A	PS24A	B-294
Sorosilicate	Epidote	SS-01A	SS01A	B-298
	Epidote	SS-01C	SS01C	B-300

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	Hemimorphite	SS-02A	SS02A	B-302
	Vesuvianite	SS-03A	SS03A	B-304
	Clinozoisite	SS-04A	SS04A	B-306
Tectosilcates	Quartz	TS-01A	TS01A	B-310
	Quartz	TS-01B	TS01B	B-312
	Quartz	TS-01C	TS01C	B-314
	Quartz	TS-01D	TS01D	B-316
	Quartz	TS-01E	TS01E	B-318
	Labradorite	TS-02A	TS02A	B-320
	Labradorite	TS-02B	TS02B	B-322
	Olgioclase	TS-03A	TS03A	B-324
	Andesine	TS-04A	TS04A	B-326
	Anorthite	TS-05A	TS05A	B-328
	Albite	TS-06A	TS06A	B-330
	Cristobalite	TS-07A	TS07A	B-332
	Natrolite	TS-08A	TS08A	B-334
	Stilbite	TS-09A	TS09A	B-336
	Sodalite	TS-10A	TS10A	B-338
	Buddingtonite	TS-11A	TS11A	B-340
	Orthoclase	TS-12A	TS12A	B-342
	Bytownite	TS-13A	TS13A	B-344
	Sanidine	TS-14A	TS14A	B-346
	Chabazite	TS-15A	TS15A	B-348
	Nepheline	TS-16A	TS16A	B-350
	Microcline	TS-17A	TS17A	B-352
	Analcime	TS-18A	TS18A	B-354

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ALPHABETICAL INDEX

Mineral Name	Sample Number	Digital File name	Page No.
Actinolite	IN-04A	IN04A	B-194
Albite	TS-06A	TS06A	B-330
Almandine Garnet	NS-04A	NS04A	B-224
Alunite	SO-04A	SO04A	B-126
Amblygonite	P-03A	P03A	B-114
Analcime	TS-18A	TS18A	B-354
Anatase	O-12A	O12A	B-100
Andesine	TS-04A	TS04A	B-326
Anglesite	SO-10A	SO10A	B-142
Anhydrite	SO-01A	SO01A	B-120
Anorthite	TS-05A	TS05A	B-328
Anthophyllite	IN-08A	IN08A	B-202
Antlerite	SO-11A	SO11A	B-144
Apatite	P-01A	P01A	B-110
Aphthitalite	SO-09A	SO09A	B-140
Arsenopyrite	S-05A	S05A	B-156
Atacamite	H-04A	H04A	B-70
Augite	IN-15A	IN15A	B-214
Azurite	C-12A	C12A	B-52
Barite	SO-03A	SO03A	B-124
Beryl	CS-02A	CS02A	B-180
Biotite	PS-23A	PS23A	B-292
Borax	B-06A	B06A	B-20
Bornite	S-09A	S09A	B-164
Brucite	OH-01A	OH01A	B-74
Buddingtonite	TS-11A	TS11A	B-340
Bytownite	TS-13A	TS13A	B-344
Calcite	C-03A	C03A	B-28
Calcite	C-03D	C03D	B-30
Calcite	C-03E	C03E	B-32
Cassiterite	O-03A	O03A	B-88
Celestite	SO-05A	SO05A	B-128
Cerussite	C-10A	C10A	B-48
Chabazite	TS-15A	TS15A	B-348
Chalcocite	S-08A	S08A	B-162
Chalcopyrite	S-04A	S04A	B-154
Chlorite	PS-12A	PS12A	B-264
Chlorite	PS-12C	PS12C	B-266
Chlorite	PS-12E	PS12E	B-268
Chlorite	PS-12F	PS12F	B-270

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Clinozoisite	SS-04A	SS04A	B-306
Colemanite	B-01A	B01A	B-10
Columbite	O-07A	O07A	B-94
Cookeite	PS-09A	PS09A	B-258
Cordierite	CS-03A	CS03A	B-182
Corrensite	PS-10A	PS10A	B-260
Corundum	O-15A	O15A	B-106
Cristobalite	TS-07A	TS07A	B-332
Cryolite	H-01A	H01A	B-62
Cummingtonite	IN-06A	IN06A	B-198
Dickite	PS-03A	PS03A	B-244
Diopside	IN-09B	IN09B	B-204
Dolomite	C-05A	C05A	B-36
Dolomite	C-05C	C05C	B-38
Enstatite	IN-10B	IN10B	B-206
Epidote	SS-01A	SS01A	B-298
Epidote	SS-01C	SS01C	B-300
Fayalite	NS-01A	NS01A	B-218
Ferroaxinite	CS-04A	CS04A	B-184
Fluorite	H-02A	H02A	B-64
Fluorite	H-02B	H02B	B-66
Forsterite	NS-02A	NS02A	B-220
Gahnite	O-11A	O11A	B-98
Galena	S-07A	S07A	B-160
Gibbsite	OH-03A	OH03A	B-78
Glauberite	SO-08A	S008A	B-138
Glauconite	PS-19A	PS19A	B-284
Glaucophane	IN-03A	IN03A	B-192
Goethite	OH-02A	OH02A	B-76
Graphite	E-01A	E01A	B-56
Grossular Garnet	NS-03B	NS03B	B-222
Gypsum	SO-02B	SO02B	B-122
Halite	H-03A	H03A	B-68
Hematite	O-01A	O01A	B-82
Hematite	O-01B	O01B	B-84
Hemimorphite	SS-02A	SS02A	B-302
Howlite	B-05A	B05A	B-18
Hydroxyapophyllite	PS-22A	PS22A	B-290
Hypersthene	IN-14A	IN14A	B-212
Illite	PS-11A	PS11A	B-262
Jarosite	SO-07A	SO07A	B-132
Johannsenite	IN-12A	IN12A	B-208
Kaolinite	PS-01A	PS01A	B-236
Kaolinite	PS-01B	PS01B	B-238
Kernite	B-02A	B02A	B-12
Labradorite	TS-02A	TS02A	B-320
Labradorite	TS-02B	TS02B	B-322

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Lepidiolite	PS-13A	PS13A	B-272
Lepidiolite	PS-13B	PS13B	B-274
Lithiophilite	PS-04A	PS04A	B-116
Magnesiochromite	O-08A	O08A	B-96
Magnesite	C-06A	C06A	B-40
Magnetite	O-04A	O04A	B-90
Malachite	C-07A	C07A	B-42
Marcasite	S-10A	S10A	B-166
Microcline	TS-17A	TS17A	B-352
Mimetite	A-01A	A01A	B-4
Molybdenite	S-11A	S11A	B-168
Montebrasite	P-02A	P02A	B-112
Montmorillonite	PS-02B	PS02B	B-240
Montmorillonite	PS-02D	PS02D	B-242
Muscovite	PS-16A	PS16A	B-278
Natrojarosite	SO-07C	SO07C	B-136
Natrolite	TS-08A	TS08A	B-334
Nepheline	TS-16A	TS16A	B-350
Nontronite	PS-06A	PS06A	B-250
Nontronite	PS-06B	PS06B	B-252
Nontronite	PS-06D	PS06D	B-254
Olgioclase	TS-03A	TS03A	B-324
Orthoclase	TS-12A	TS12A	B-342
Palygorskite	PS-04A	PS04A	B-246
Periclase	O-14A	O14A	B-104
Plumbojarosite	SO-07B	SO07B	B-134
Prehnite	PS-21A	PS21A	B-288
Pyrite	S-02A	S02A	B-150
Pyrolusite	O-06A	O06A	B-92
Pyrophyllite	PS-07A	PS07A	B-256
Pyrrhotite	S-12A	S12A	B-170
Quartz	TS-01A	TS01A	B-310
Quartz	TS-01B	TS01B	B-312
Quartz	TS-01C	TS01C	B-314
Quartz	TS-01D	TS01D	B-316
Quartz	TS-01E	TS01E	B-318
Realgar	S-03A	S03A	B-152
Rhodochrosite	C-08A	C08A	B-44
Rhodonite	IN-01A	IN01A	B-188
Riebeckite	IN-07A	IN07A	B-200
Rutile	O-02A	O02A	B-86
Sanidine	TS-14A	TS14A	B-346
Saponite	PS-24A	PS24A	B-294
Scheelite	T-01A	T01A	B-174
Scorodite	A-02A	A02A	B-6
Sepiolite	PS-05A	PS05A	B-248
Serpentine	PS-20A	PS20A	B-286

Siderite	C-09A	C09A	B-46
Sillimanite	NS-08A	NS08A	B-230
Smithsonite	C-11A	C11A	B-50
Sodalite	TS-10A	TS10A	B-338
Sphalerite	S-01A	S01A	B-148
Spodumene	IN-13A	IN13A	B-210
Stibnite	S-06A	S06A	B-158
Stilbite	TS-09A	TS09A	B-336
Strontianite	C-01A	C01A	B-24
Sulphur	E-02A	E02A	B-58
Talc	PS-14A	PS14A	B-276
Tincalconite	B-04A	B04A	B-16
Titanite	NS-07A	NS07A	B-228
Topaz	NS-06A	NS06A	B-226
Tourmaline	CS-01A	CS01A	B-178
Tremolite	IN-05A	IN05A	B-196
Trona	C-04A	C04A	B-34
Tschermigite	SO-06A	SO06A	B-130
Ulexite	B-03A	B03A	B-14
Vermiculite	PS-18A	PS18A	B-280
Vermiculite	PS-18B	PS18B	B-282
Vesuvianite	SS-03A	SS03A	B-304
Witherite	C-02A	C02A	B-26
Wollastonite	IN-02A	IN02A	B-190
Zincite	O-13A	O13A	B-102
Zircon	NS-09A	NS09A	B-232

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APPENDIX B
MINERAL SPECTRA AND ANCILLARY INFORMATION

LEGEND

————————	< 45 µm
- - - - - - - - - - -	45 - 125 µm
— · — · — · — · — ·	125 - 500 µm

(A)	=	Abundant
(M)	=	Minor
(T)	=	Trace
(?)	=	Questionable

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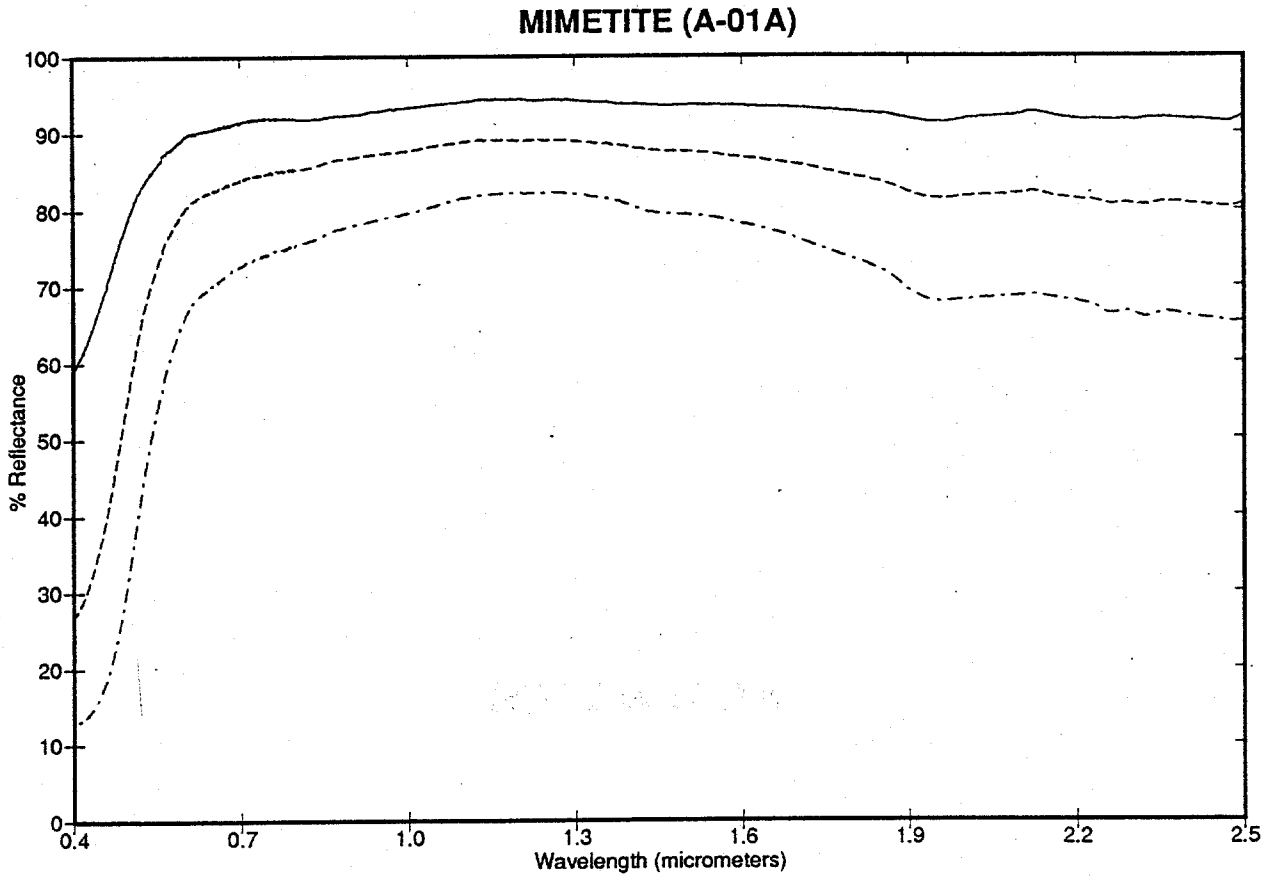
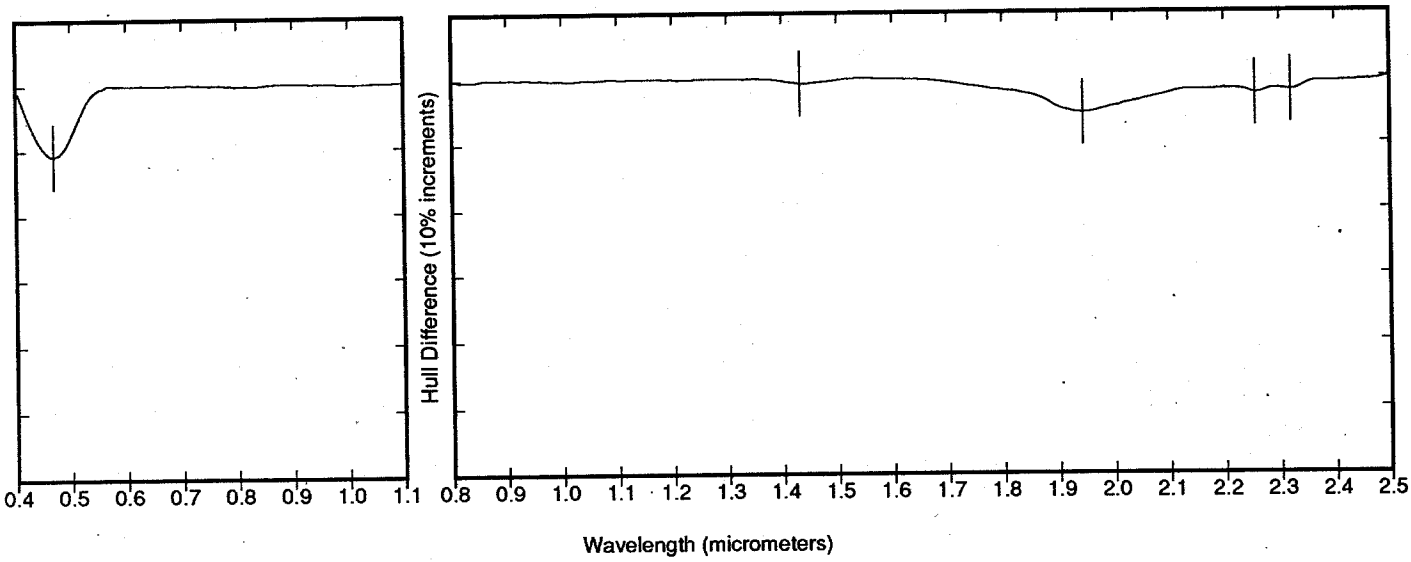
ARSENATES



DESCRIPTION: MIMETITE
SAMPLE_NUM: A-01A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: CHIHUAHUA
GEOGRAPHICAL_REGION: INGLA TIERRA MINE
SITE: INGLA TIERRA MINE
COLLECTOR: JPL
MINERALOGY: MIMETITE(A)
CHEMICAL FORMULA: $Pb_5(AsO_4)_3$ Cl

MIMETITE (A-01A)

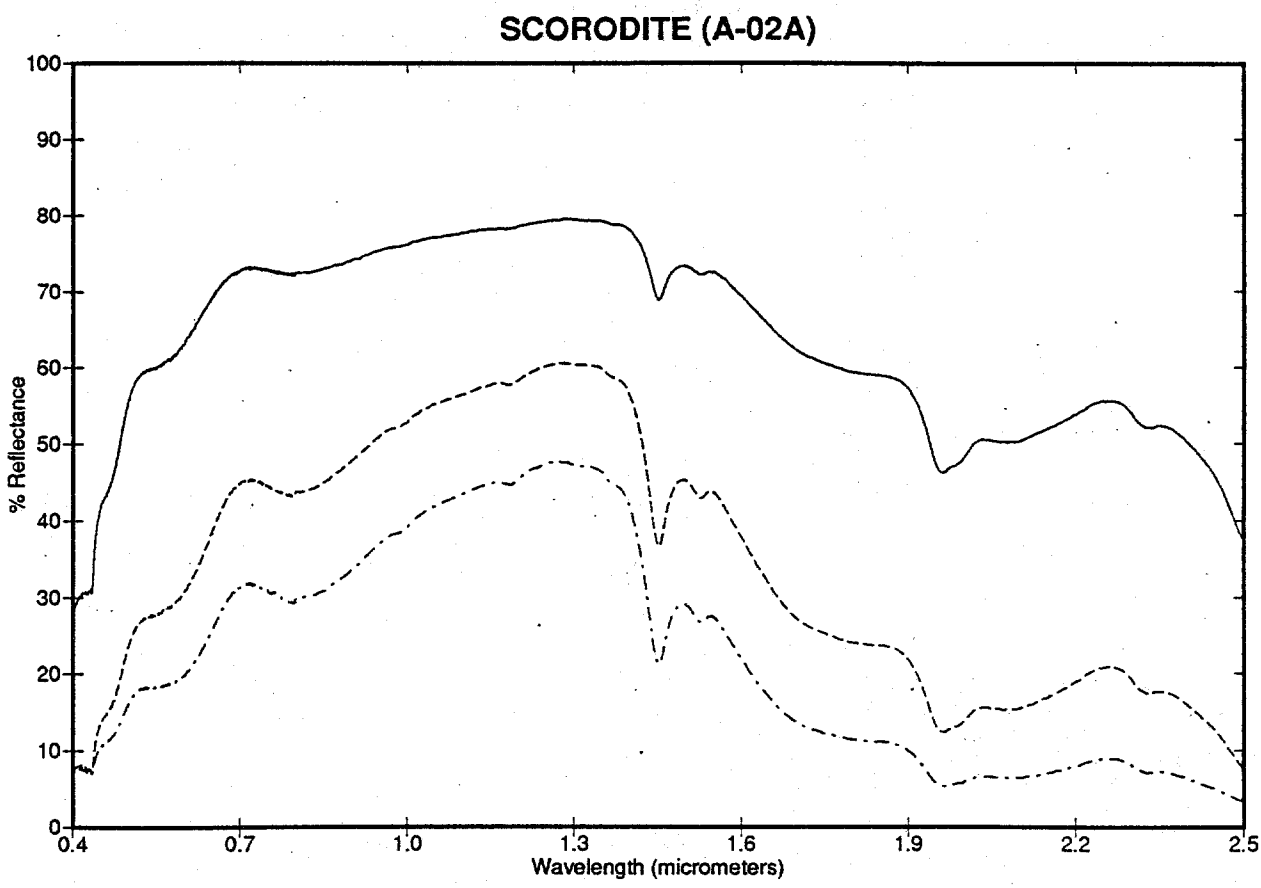


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4680	10.7877	0.9484	0.9335

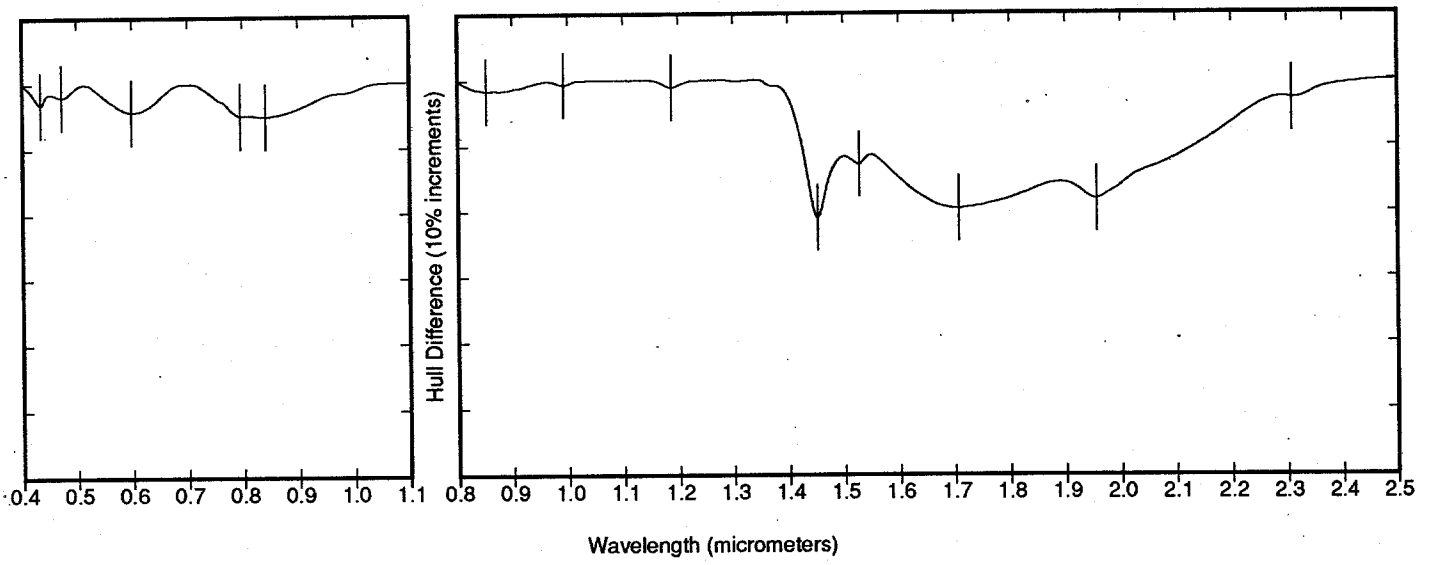
SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9440	5.4115	1.5534	0.7741
2.2560	2.5187	0.1553	0.8014
2.3200	2.0872	0.1961	0.3169
1.4320	0.7610	0.0752	0.7267



DESCRIPTION: SCORODITE
SAMPLE_NUM: A-02A
COUNTRY: USA
POLITICAL_SUBDIVISION: UTAH
GEOGRAPHICAL_REGION: TOOELE COUNTY
SITE: GOLD HILL
COLLECTOR: WARD'S
MINERALOGY: SCORODITE(A)
CHEMICAL FORMULA: $Fe^{3+}AsO_4 \bullet 2H_2O$

SCORODITE (A-02A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.8400	5.0662	0.7225	0.3743
0.7950	4.9629	0.2220	8.0983
0.5990	4.2804	0.4102	0.9174
0.4330	3.1380	0.0873	1.0999
0.4720	1.9464	0.0714	0.8600

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 6.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4520	21.0207	1.4258	0.8291
1.7080	19.6638	5.9147	0.7982
1.9560	18.1756	4.5307	0.3116
1.5280	12.8592	0.5382	1.2223
2.3080	2.9169	0.2345	0.1687
0.8520	1.6097	0.1677	0.4504
1.1880	1.1112	0.0440	0.9355
0.9920	0.6520	0.0255	0.7217

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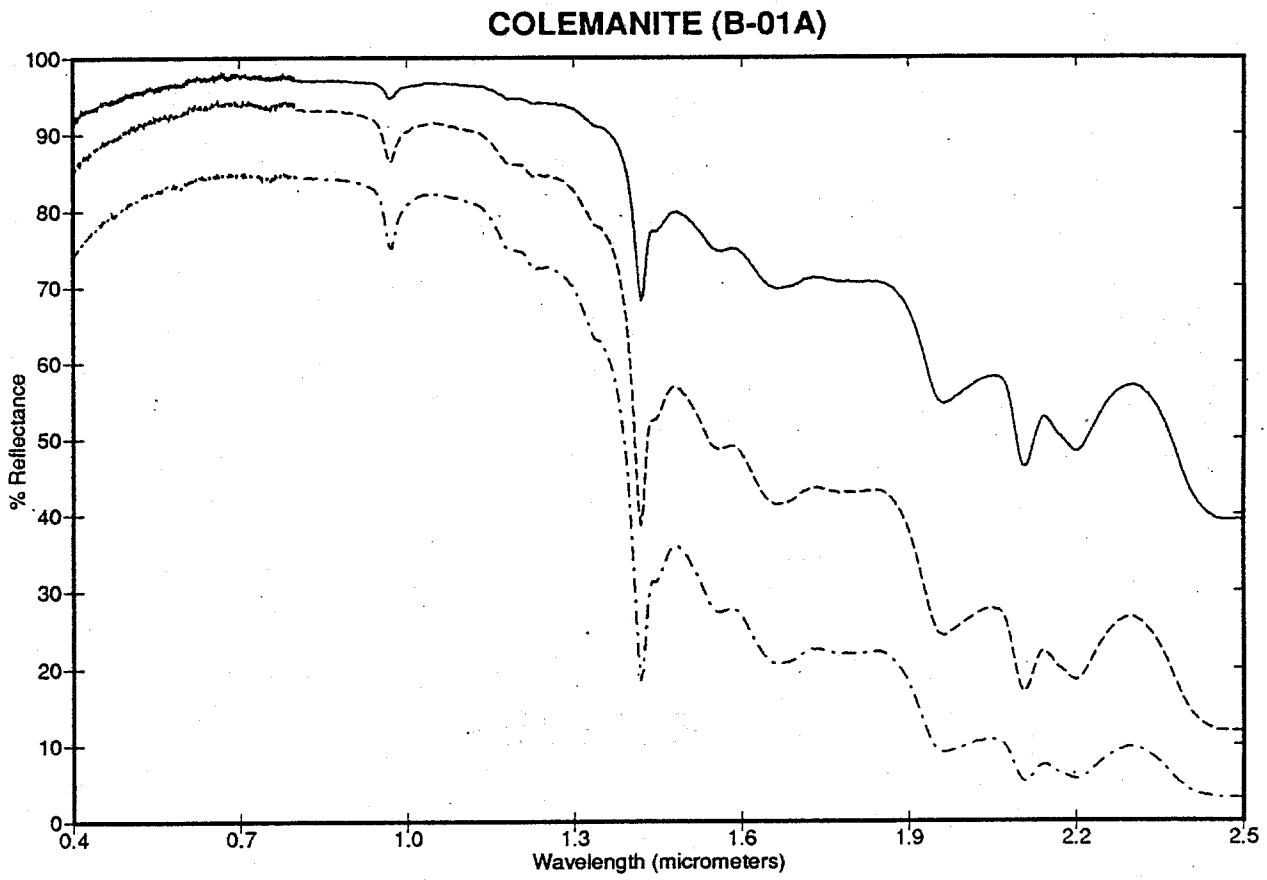
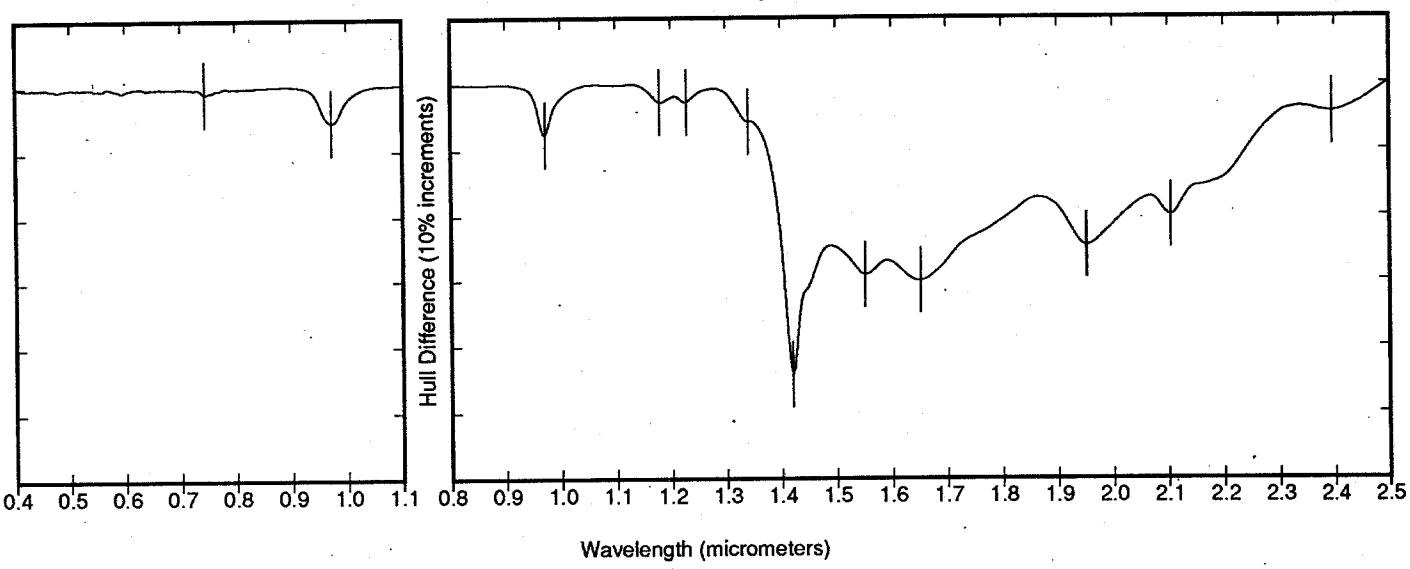
BORATES



DESCRIPTION: COLEMANITE
SAMPLE_NUM: B-01A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: KERN COUNTY
SITE: BORON
COLLECTOR: BURMINCO
MINERALOGY: COLEMANITE(A)
CHEMICAL FORMULA: $Ca_2B_6O_{11} \bullet 5H_2O$

COLEMANITE (B-01A)

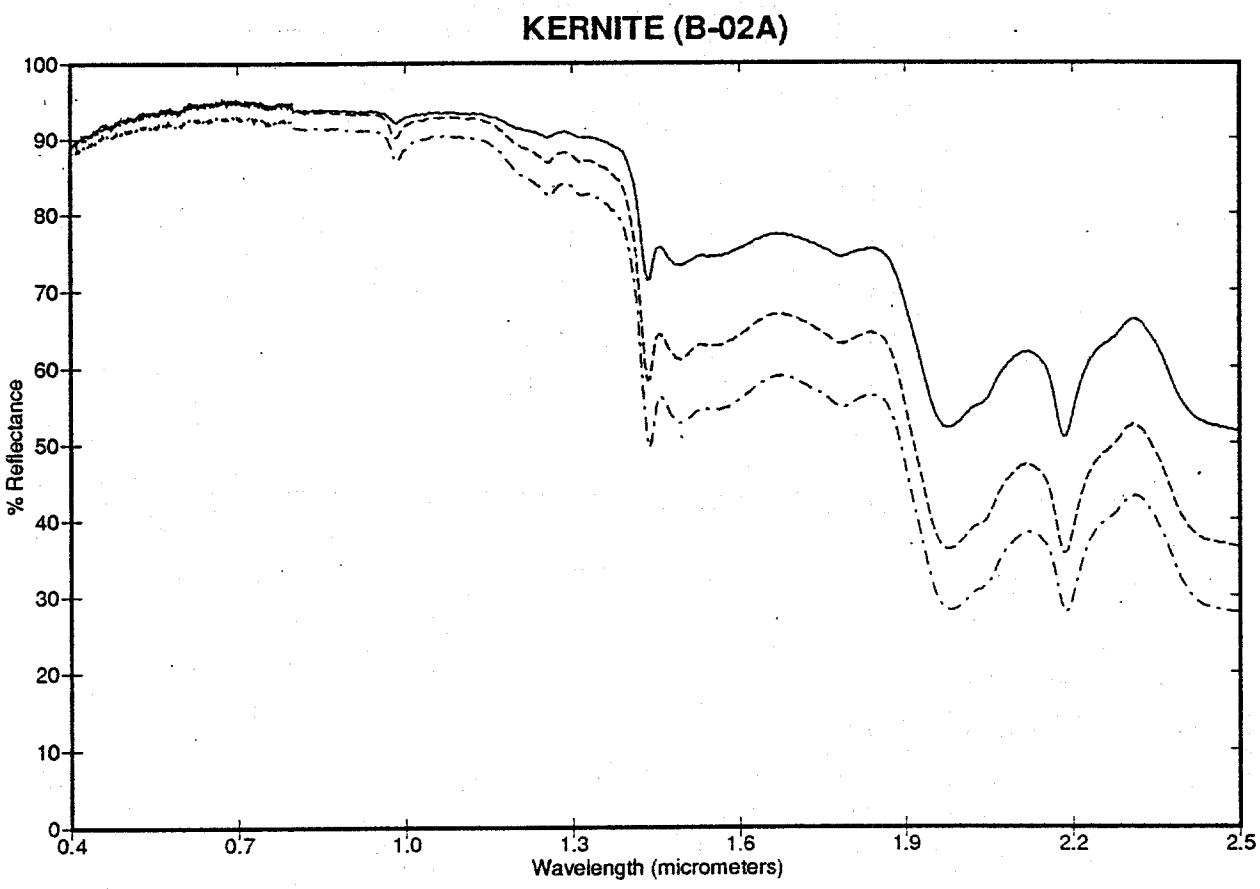


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9720	5.5317	0.2899	0.7996
0.7440	1.0815	0.0176	0.9905

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4200	44.2245	3.5139	0.5963
1.6520	29.9963	6.7403	0.3714
1.5520	29.0708	2.6127	1.5818
1.9520	24.6162	4.1872	0.7415
2.1040	19.9943	3.3317	0.2507
0.9720	7.5966	0.2951	0.8400
1.3400	5.7007	0.1903	7.3922
2.3960	4.3681	0.4749	0.8021
1.2280	2.7561	0.1138	0.6899
1.1800	2.7266	0.1175	0.8454



DESCRIPTION: KERNITE
SAMPLE_NUM: B-02A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: KERN COUNTY
SITE: BORON
COLLECTOR: JPL
MINERALOGY: KERNITE(A)
CHEMICAL FORMULA: $Na_2B_4O_6(OH)_2 \bullet 3H_2O$

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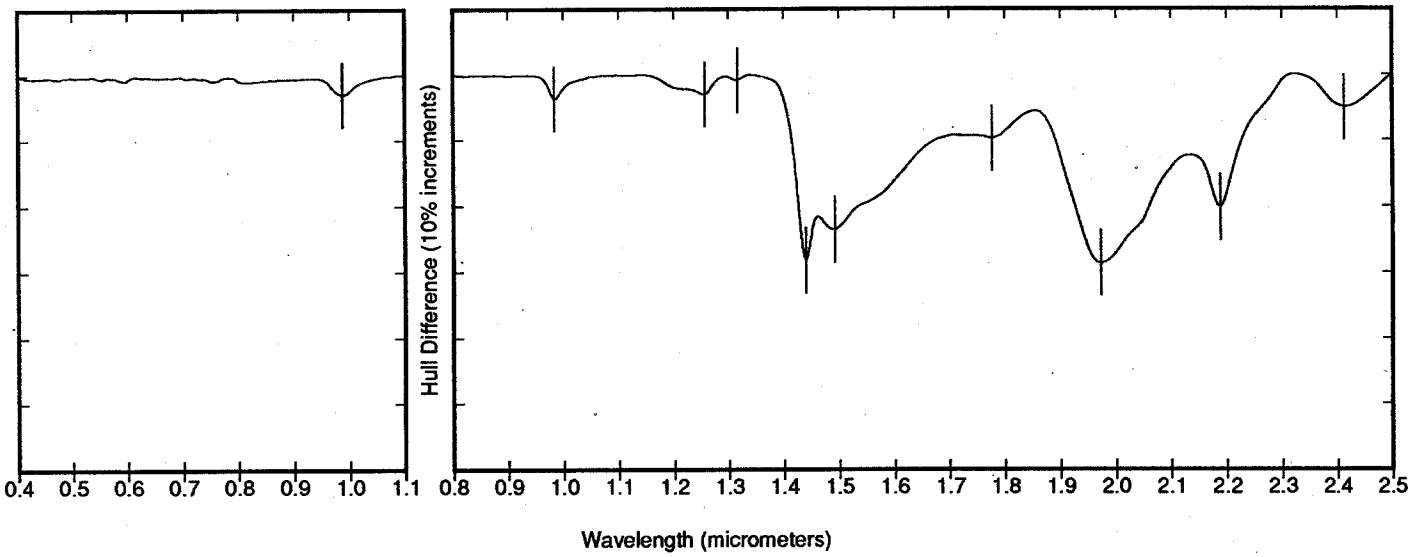
KERNITE (B-02A)



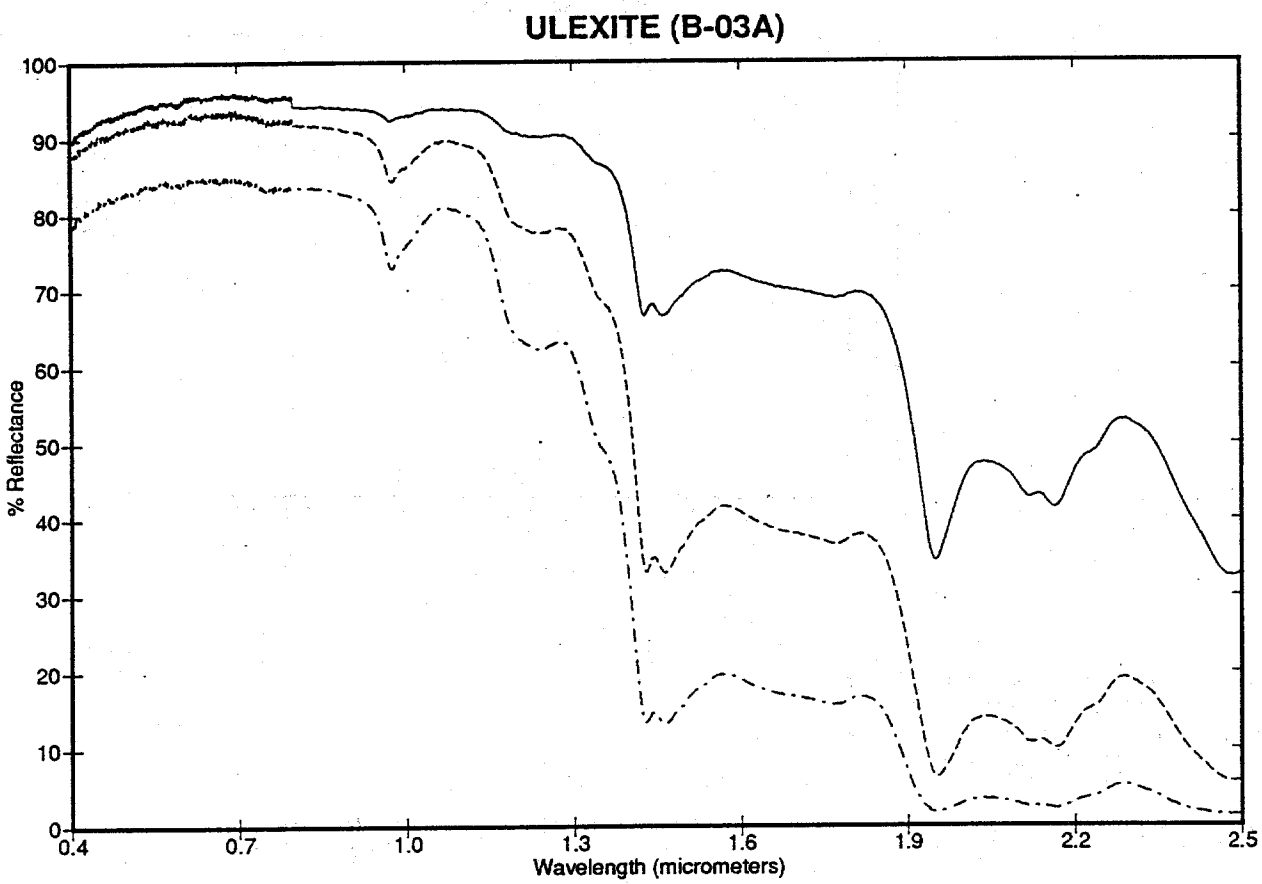
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9880	2.8944	0.2160	1.3369

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 8.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9720	28.6240	5.3295	0.5881
1.4400	28.2099	1.2352	1.1360
1.4920	23.5671	4.4399	0.1683
2.1880	20.2098	1.7896	0.8085
1.7760	9.8141	0.8554	0.4586
2.4120	5.0339	0.4611	0.7645
0.9840	3.7467	0.1531	0.4900
1.2560	3.0469	0.2302	3.1914
1.3160	0.8551	0.0206	1.4832

50



DESCRIPTION: ULEXITE
SAMPLE_NUM: B-03A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: KERN COUNTY
SITE: BORON
COLLECTOR: JPL
MINERALOGY: ULEXITE(A)
CHEMICAL FORMULA: $NaCaB_5O_6(OH)_6 \bullet 5H_2O$

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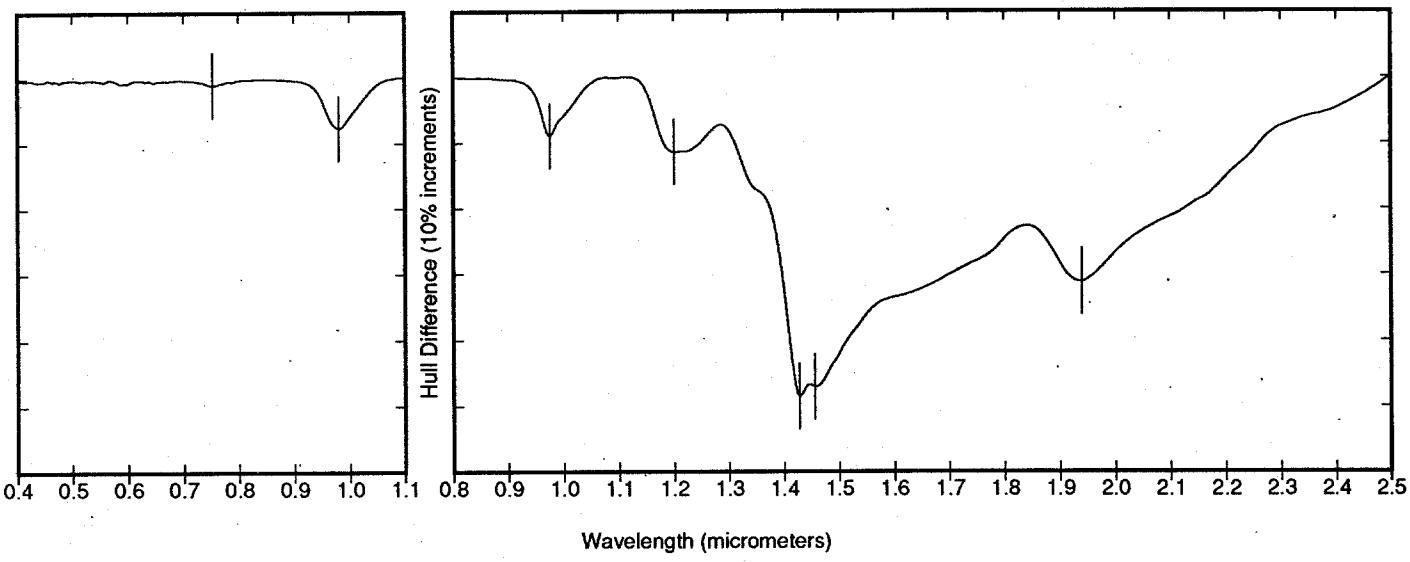
ULEXITE (B-03A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9800	7.6396	0.5603	0.7880
0.7530	1.0350	0.0149	0.2561

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4280	48.5410	3.9861	3.1981
1.4560	47.0229	12.9320	0.0299
1.9400	31.1163	10.6737	0.3376
1.2000	11.4003	1.2434	0.4908
0.9760	8.9437	0.5676	0.6228

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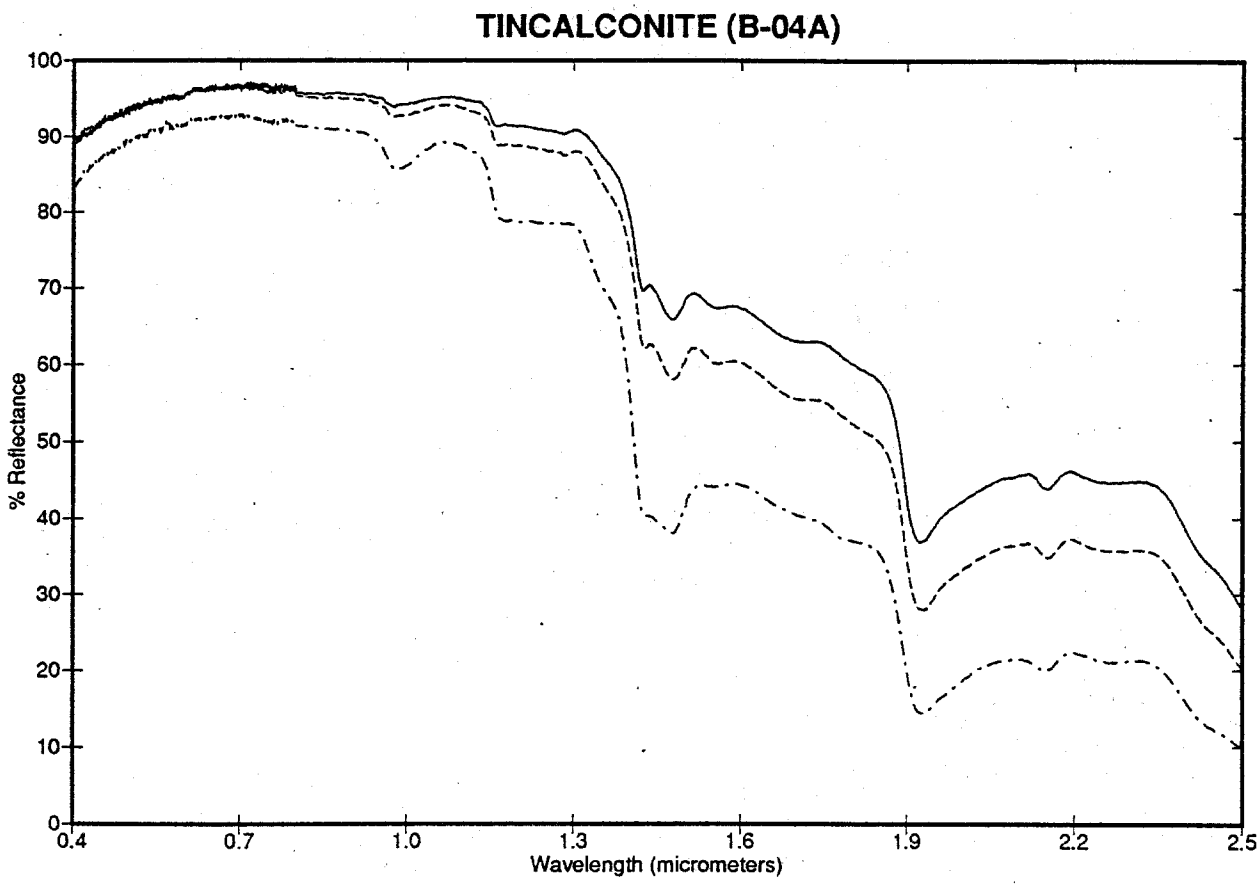

DESCRIPTION: TINCALCONITE
SAMPLE_NUM: B-04A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: KERN COUNTY
SITE: BORON
COLLECTOR: BURMINCO
MINERALOGY: TINCALCONITE(A),BORAX(A)
CHEMICAL FORMULA: $Na_2B_4O_5(OH)_4 \bullet 3H_2O$

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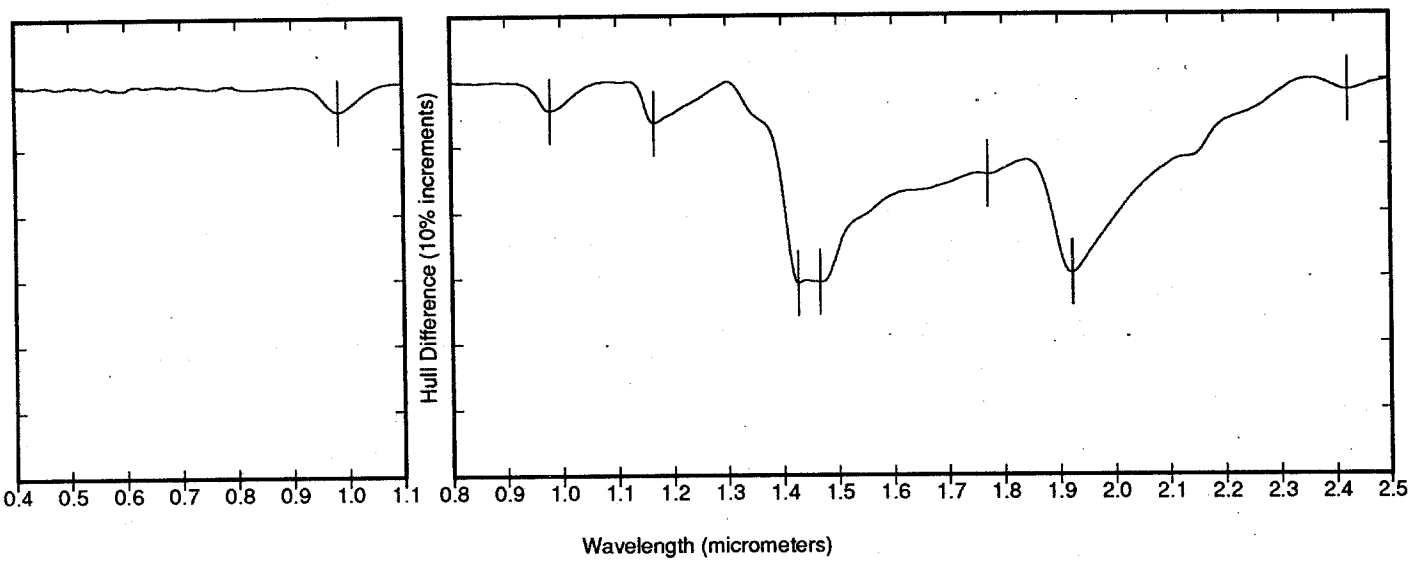
TINCALCONITE (B-04A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9840	4.3200	0.3429	0.9333

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4280	30.8414	1.8585	2.0450
1.4680	30.6712	6.1528	0.1102
1.9240	29.3966	6.7389	0.3239
1.7720	14.4426	1.0838	0.1891
1.1680	6.4028	0.5593	0.2863
0.9800	4.4629	0.3053	0.6043
2.4240	1.6863	0.1199	0.8305

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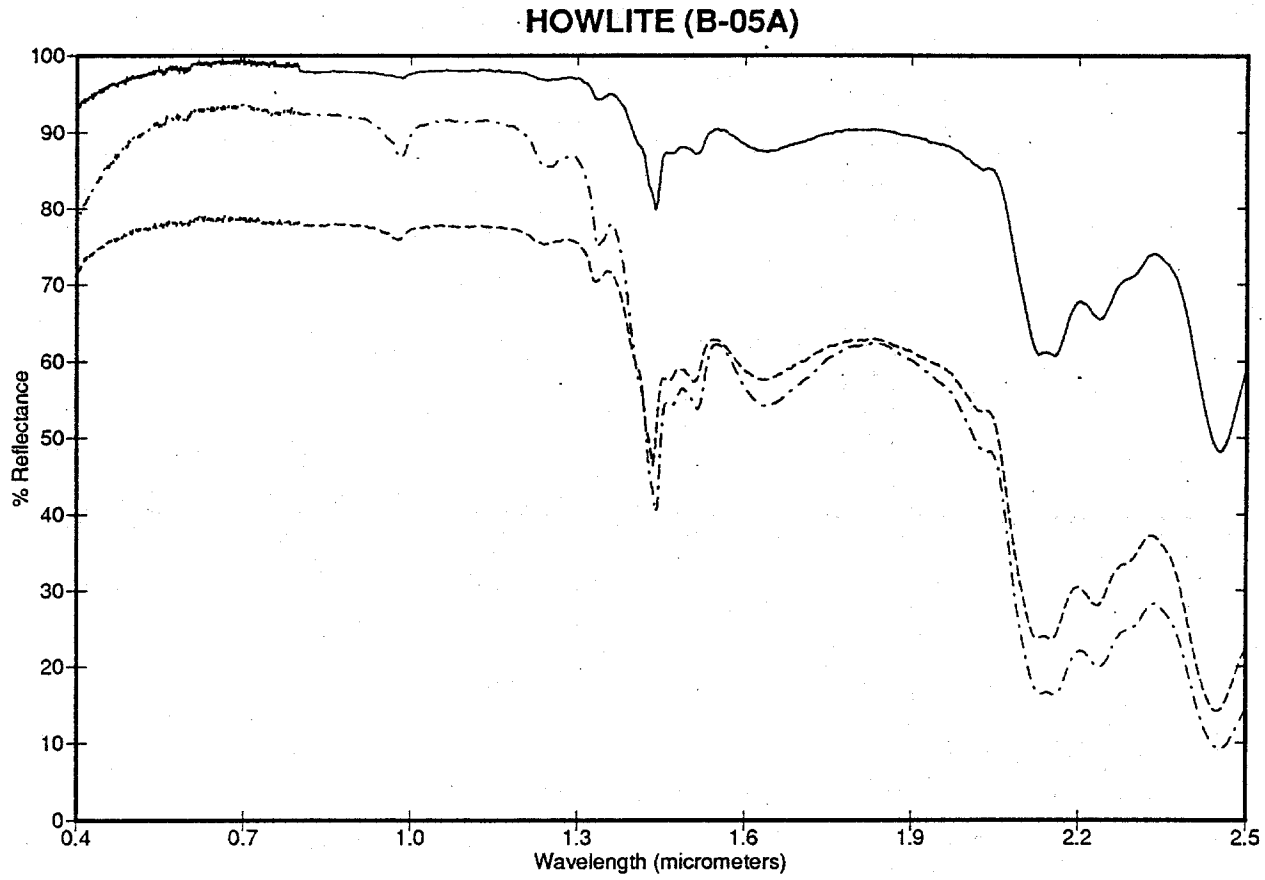

DESCRIPTION: HOWLITE
SAMPLE_NUM: B-05A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: SAN GABRIEL MOUNTAINS
SITE: TICK CANYON
COLLECTOR: BURMINCO
MINERALOGY: HOWLITE(A)
CHEMICAL FORMULA: $Ca_2B_5SiO_9(OH)_5$

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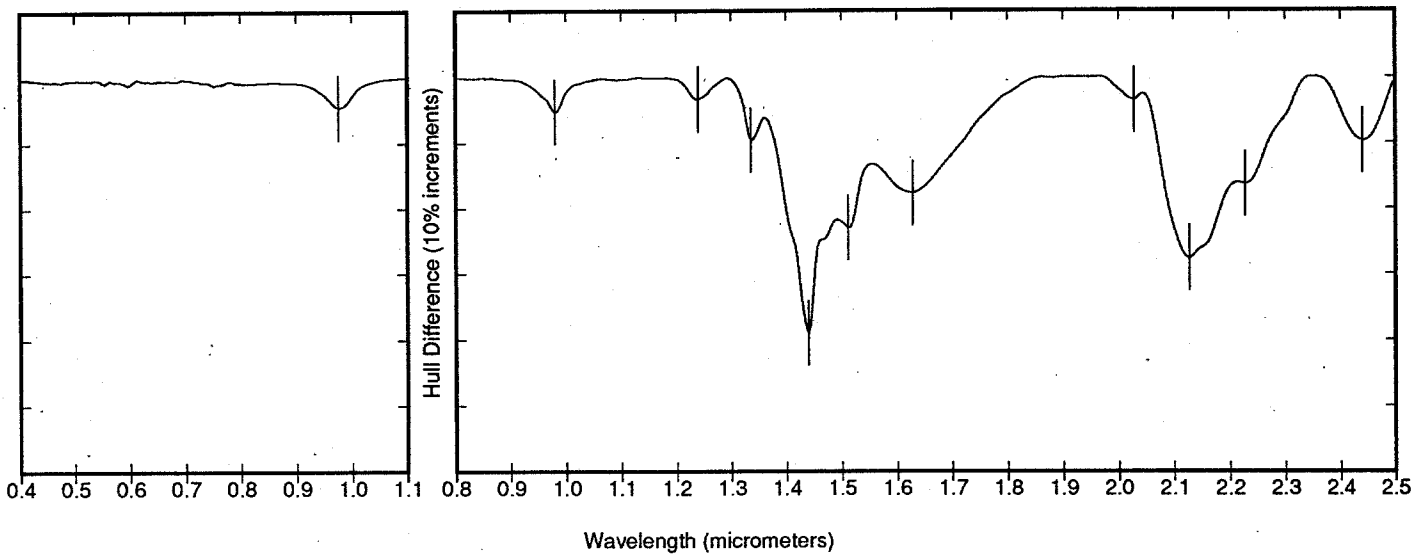
HOWLITE (B-05A)

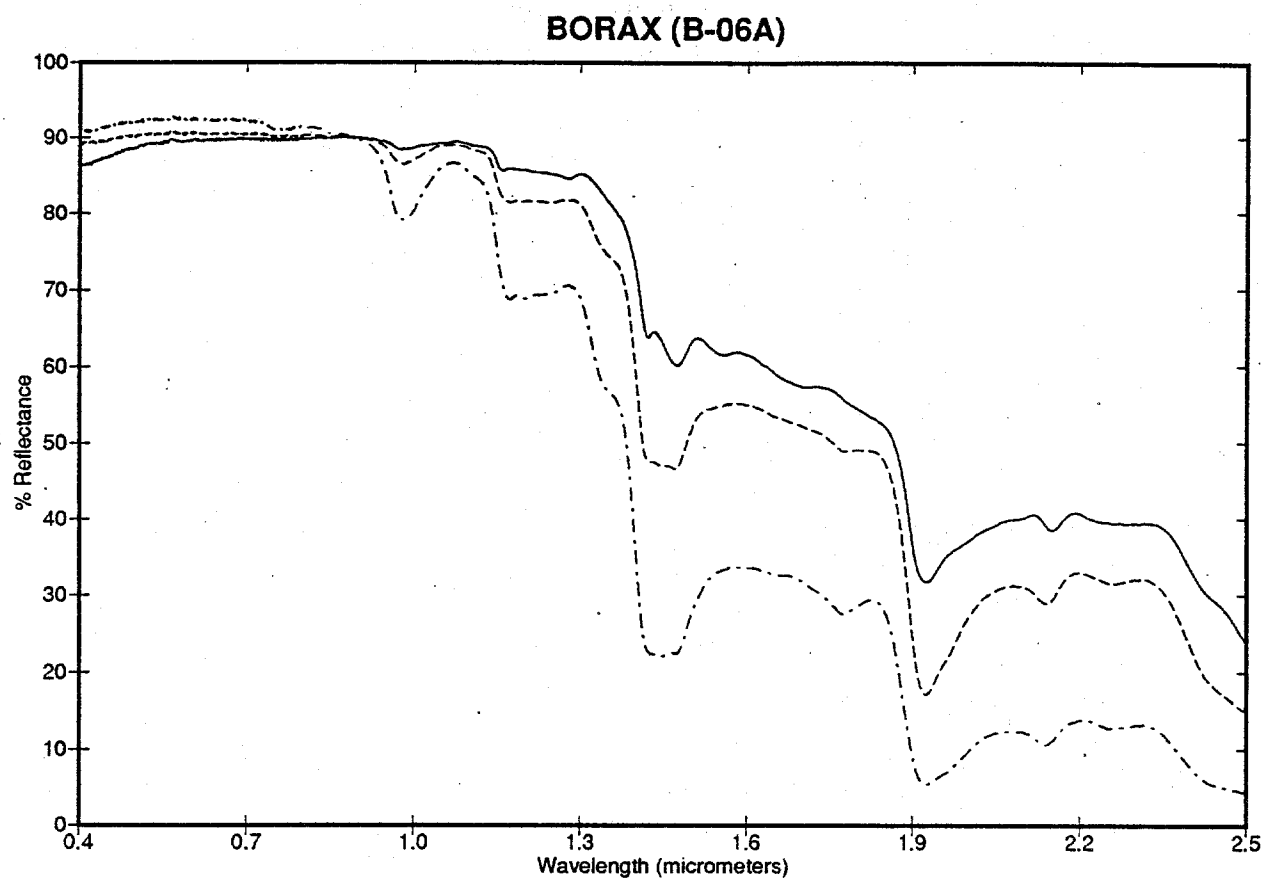


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9760	4.3477	0.3572	1.4487

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4400	38.9457	3.0047	1.1651
2.1280	27.6486	3.3259	0.7055
1.5120	23.0025	1.2073	0.5859
1.6280	17.6634	2.9648	0.6196
2.2280	16.3177	1.1223	0.2102
2.4400	9.7036	0.7529	1.0564
1.3360	9.5826	0.3327	0.7233
0.9800	5.2085	0.2902	1.2003
2.0280	3.4695	0.1504	2.1248
1.2400	3.3106	0.1602	0.8410



DESCRIPTION: BORAX
SAMPLE_NUM: B-06A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: KERN COUNTY
SITE: BORON
COLLECTOR: BURMINCO
MINERALOGY: BORAX(A),TINCALCONITE(T)
CHEMICAL FORMULA: $Na_2B_4O_5(OH)_4 \bullet 8H_2O$

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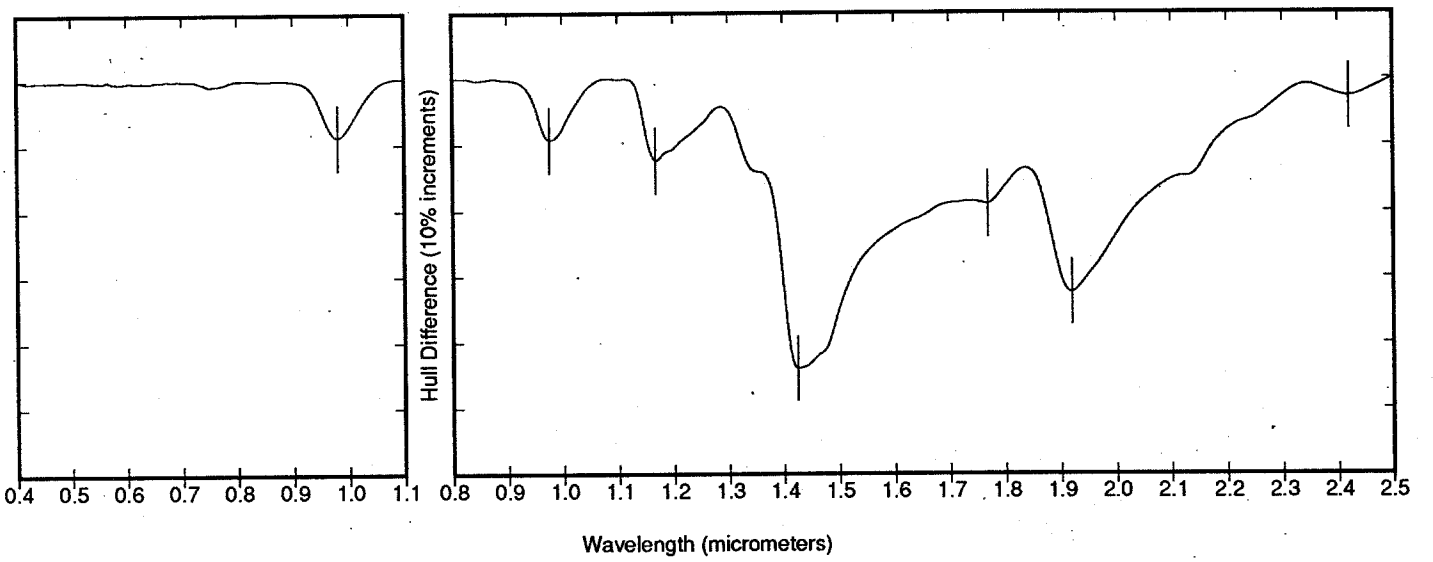
BORAX (B-06A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9800	8.8131	0.6753	0.8133

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = .5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4240	43.9005	11.1251	0.2848
1.9200	32.2958	7.9055	0.3115
1.7680	18.9663	1.6254	0.4772
1.1680	12.4188	1.2730	0.2824
0.9760	9.3029	0.6704	0.6313
2.4200	2.8032	0.2721	1.1232

CARBONATES

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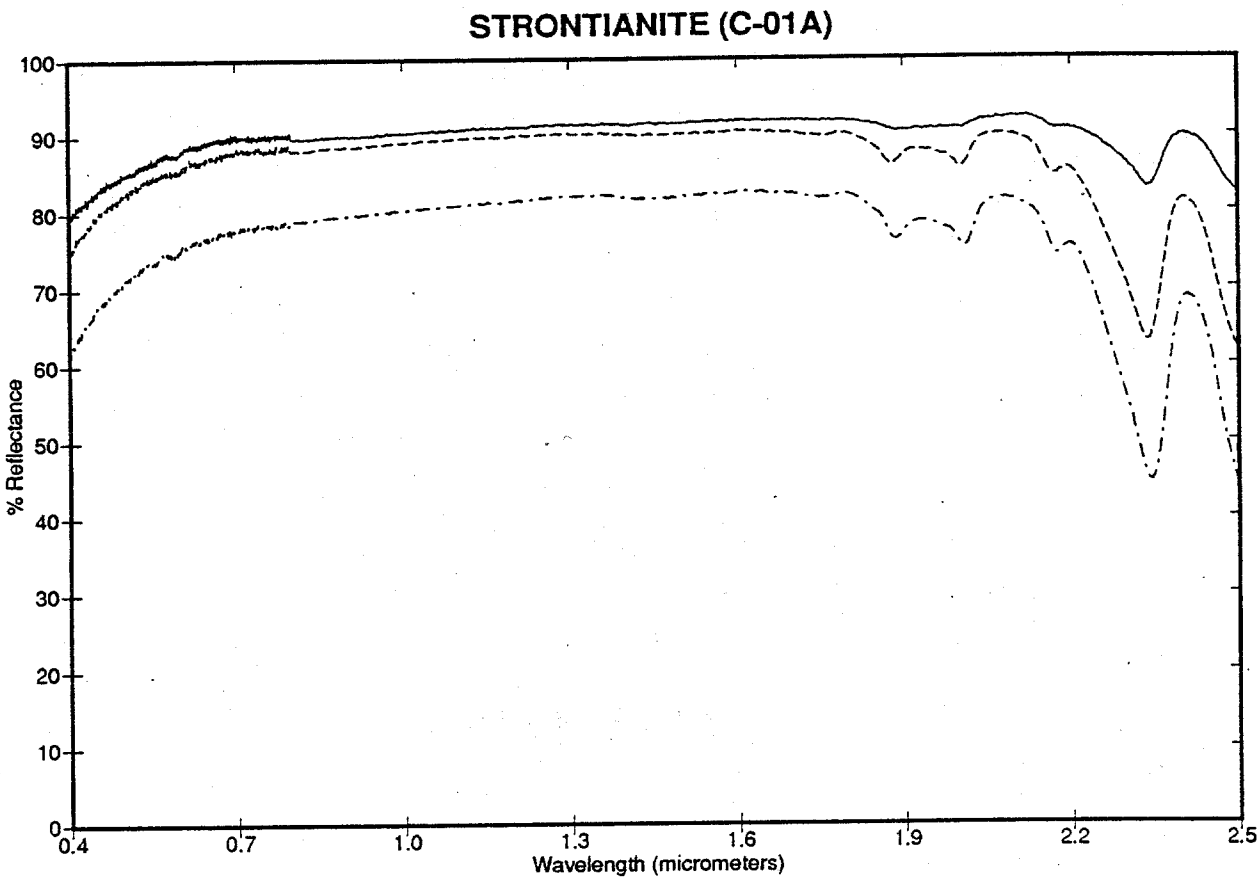

DESCRIPTION: STRONTIANITE
SAMPLE_NUM: C-01A
COUNTRY: GERMANY
POLITICAL_SUBDIVISION: WESTPHALIA
GEOGRAPHICAL_REGION: HAMM
SITE: HAMM
COLLECTOR: WARD'S
MINERALOGY: STRONTIANITE(A)
CHEMICAL FORMULA: $SrCO_3$

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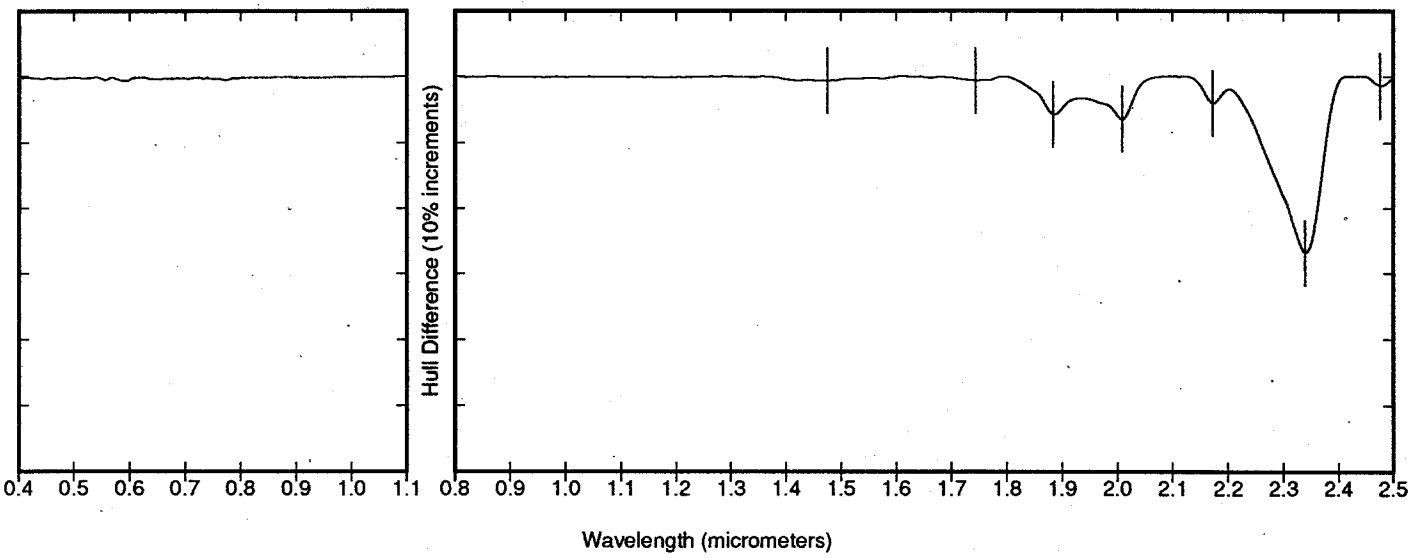
STRONTIANITE (C-01A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 14.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3400	26.8317	2.6542	2.0318
2.0080	6.4641	0.4966	2.0981
1.8840	5.7518	0.3787	0.9304
2.1720	4.0450	0.1608	0.8713
2.4760	1.3916	0.0396	0.8361
1.4760	0.6965	0.1093	1.0712
1.7440	0.6607	0.0467	1.0737

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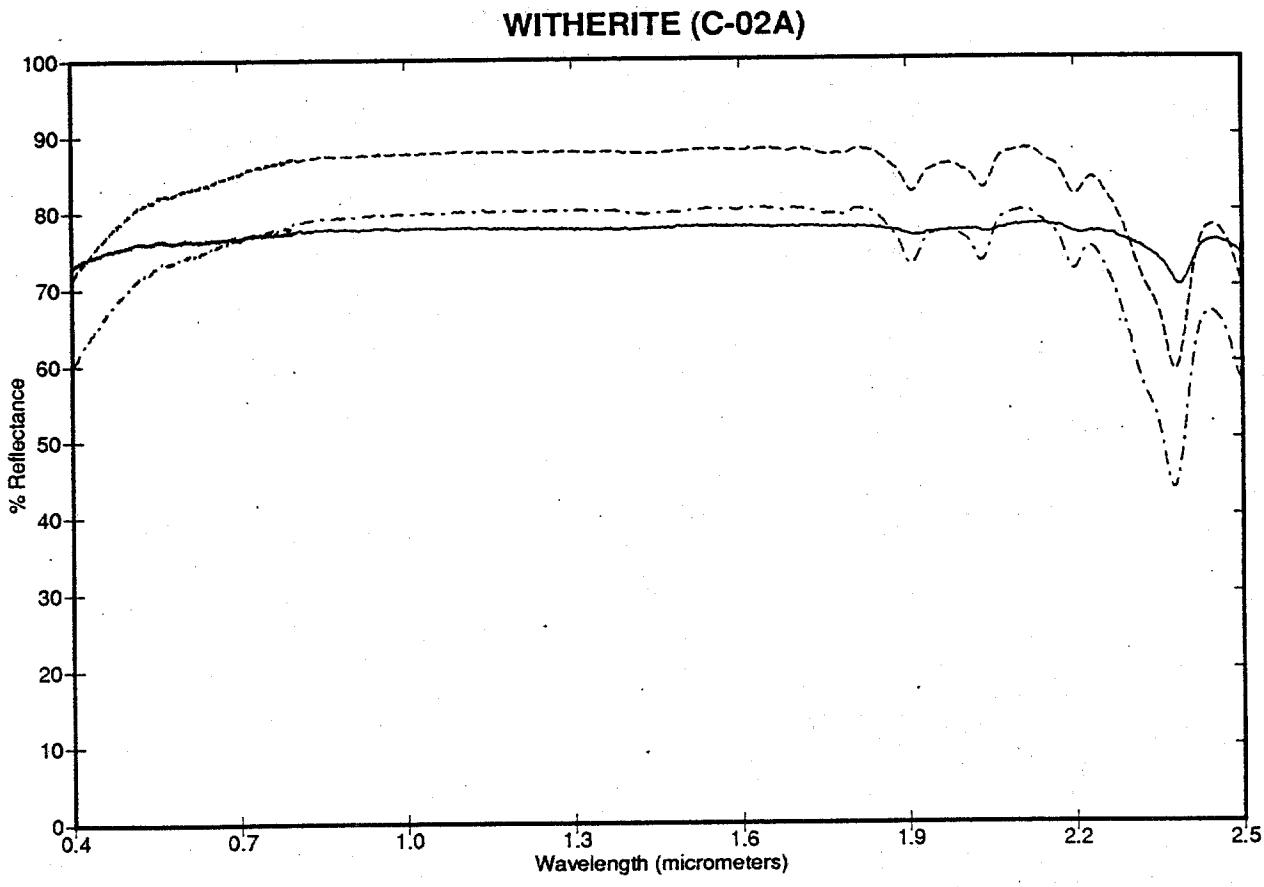

DESCRIPTION: WITHERITE
SAMPLE_NUM: C-02A
COUNTRY: UNITED KINGDOM
POLITICAL_SUBDIVISION: ENGLAND
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: GRIEGER'S INC
MINERALOGY: WITHERITE(A)
CHEMICAL FORMULA: $BaCO_3$

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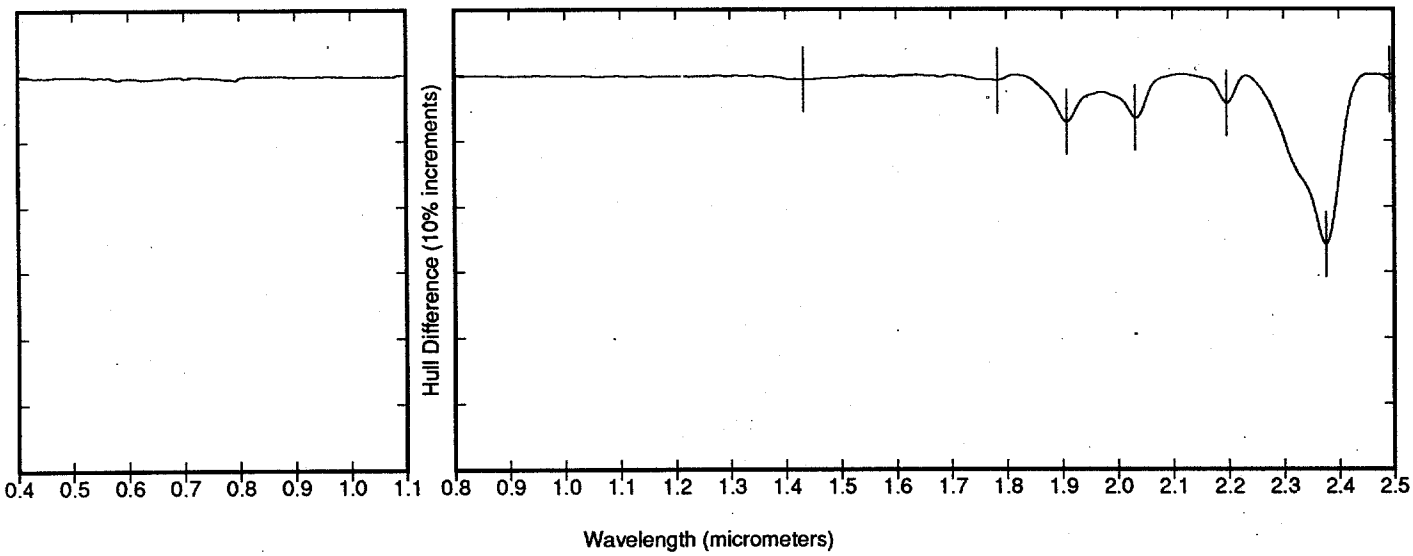
WITHERITE (C-02A)

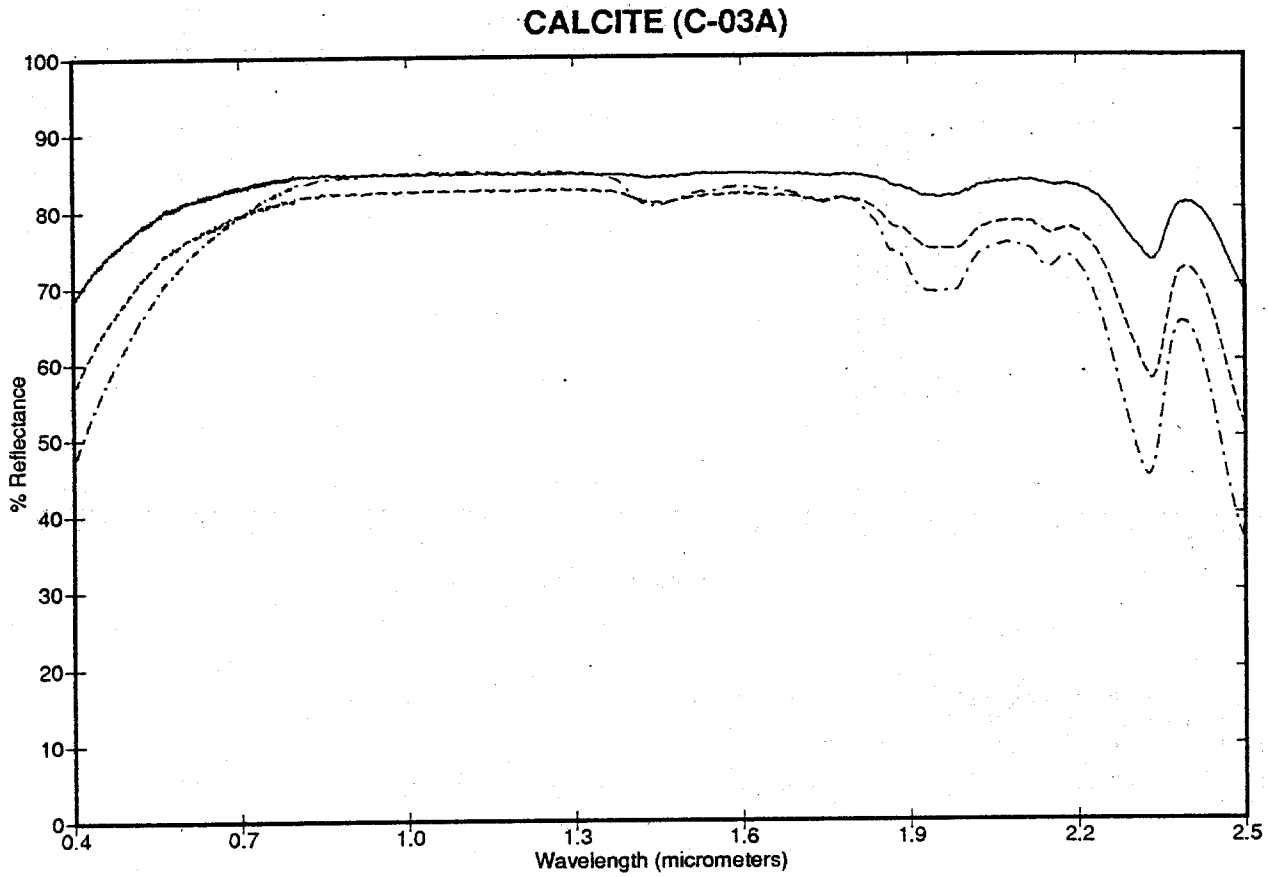


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 16.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3760	25.8250	2.3256	2.1046
1.9080	7.2595	0.5210	0.8421
2.0320	6.6567	0.3979	1.4034
2.1960	4.3960	0.1721	1.1602
1.7840	0.9490	0.0610	3.5728
2.4920	0.7600	0.0092	2.5147
1.4320	0.7391	0.1727	1.9059

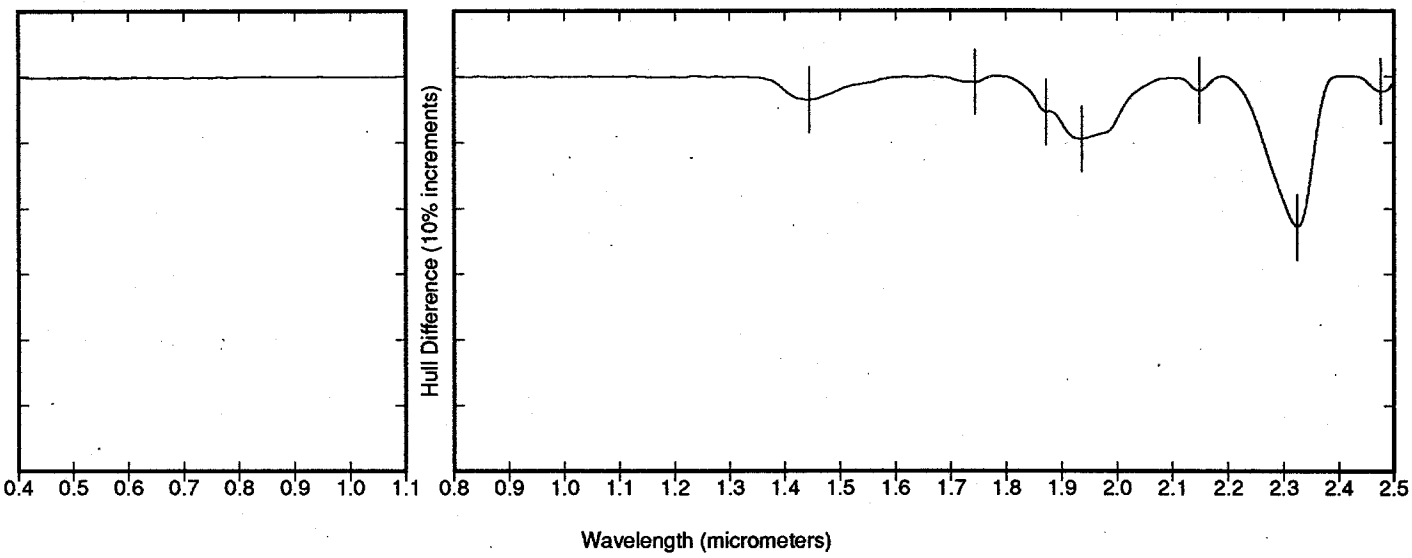
63



DESCRIPTION: CALCITE,TRAVERTINE
SAMPLE_NUM: C-03A
COUNTRY: ITALY
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: CALCITE(A)
CHEMICAL FORMULA: $CaCO_3$

64

CALCITE (C-03A)

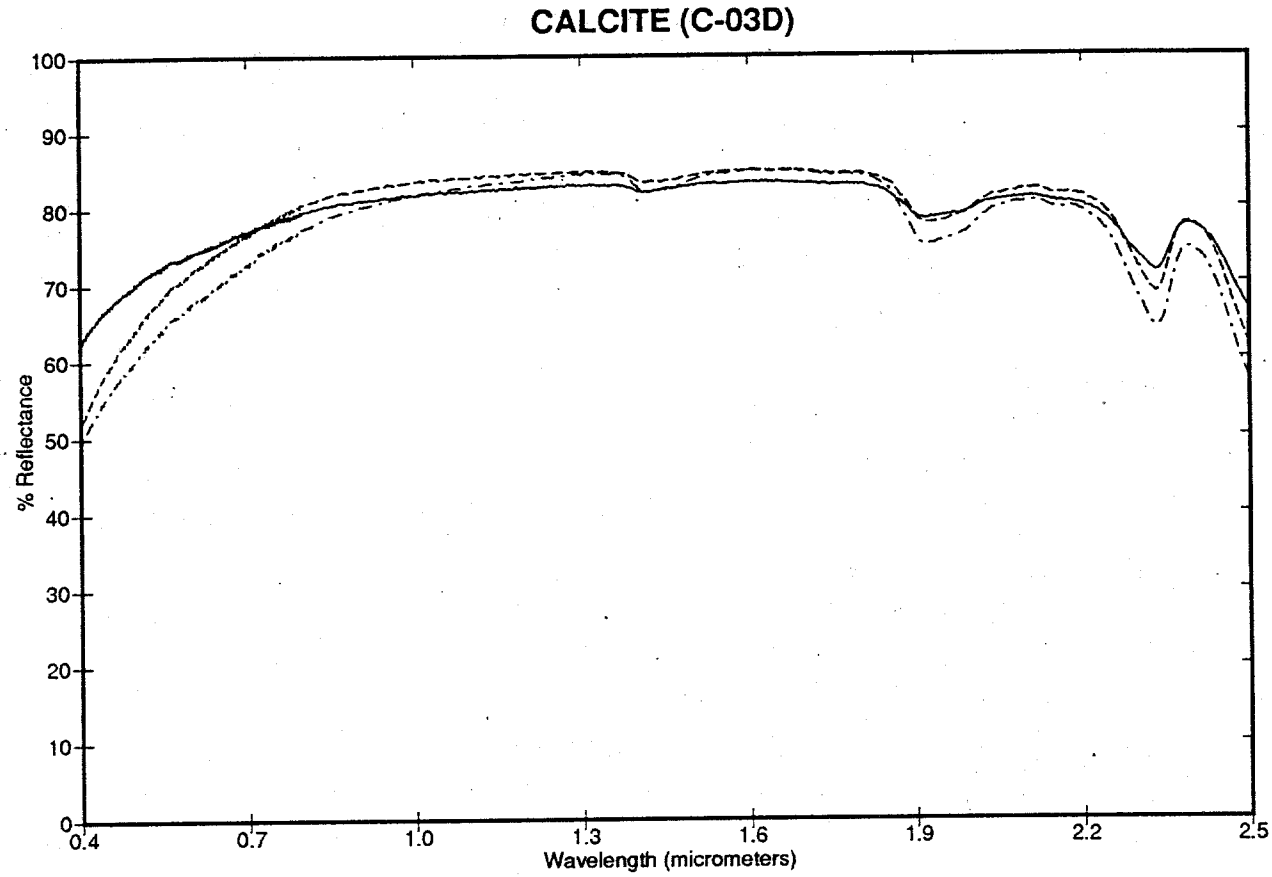


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3240	22.8297	2.0179	1.7971
1.9360	9.5011	1.2213	0.6015
1.8720	5.4482	0.1828	7.4307
1.4440	3.6077	0.4482	0.6800
2.4760	2.2847	0.0907	1.2415
2.1480	2.1732	0.0861	1.0672
1.7440	0.9326	0.0557	2.4947

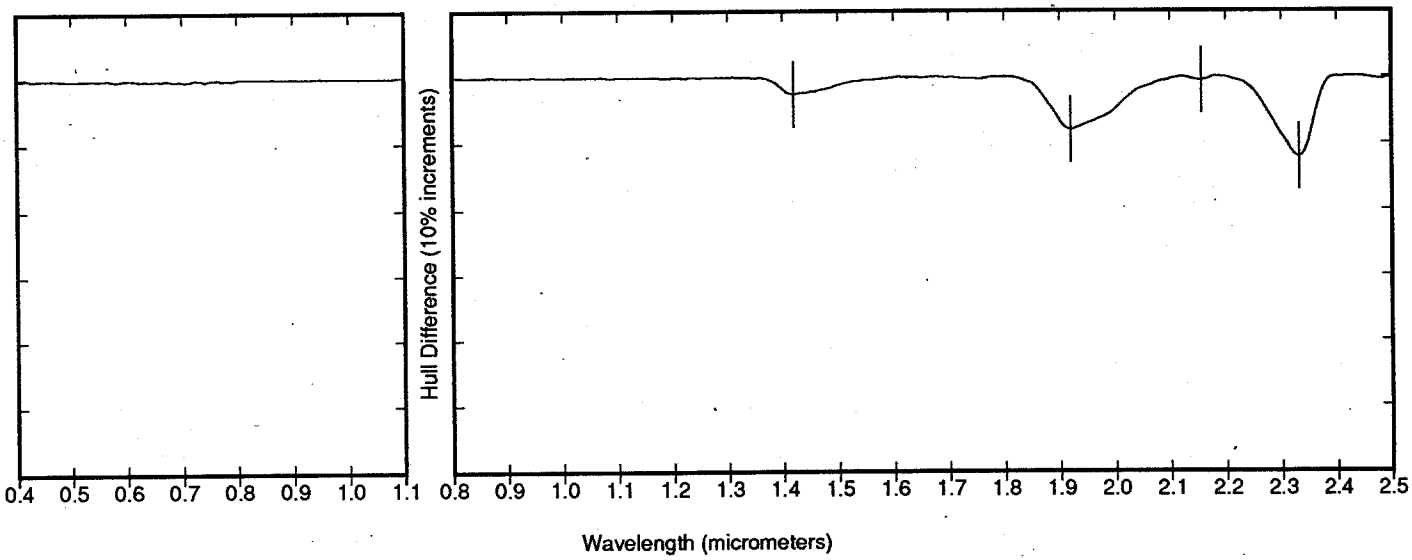
65



DESCRIPTION: CALCITE
SAMPLE_NUM: C-03D
COUNTRY: UNITED KINGDOM
POLITICAL_SUBDIVISION: ENGLAND
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: CALCITE(A)
CHEMICAL FORMULA: $CaCO_3$

66

CALCITE (C-03D)

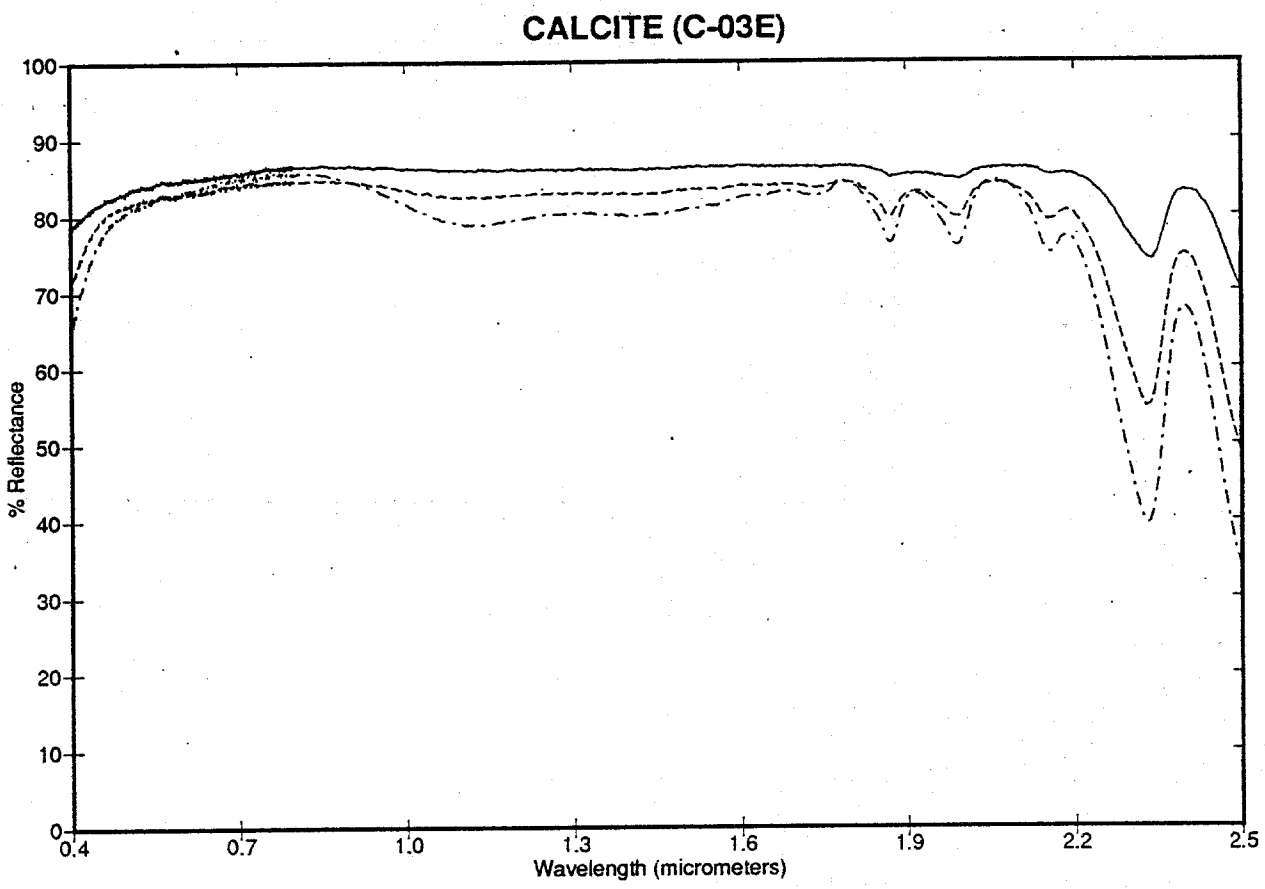


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3320	12.1119	1.0103	1.8931
1.9200	8.0348	1.1069	0.4655
1.4200	2.6284	0.2901	0.3808
2.1560	0.6231	0.0222	1.5990

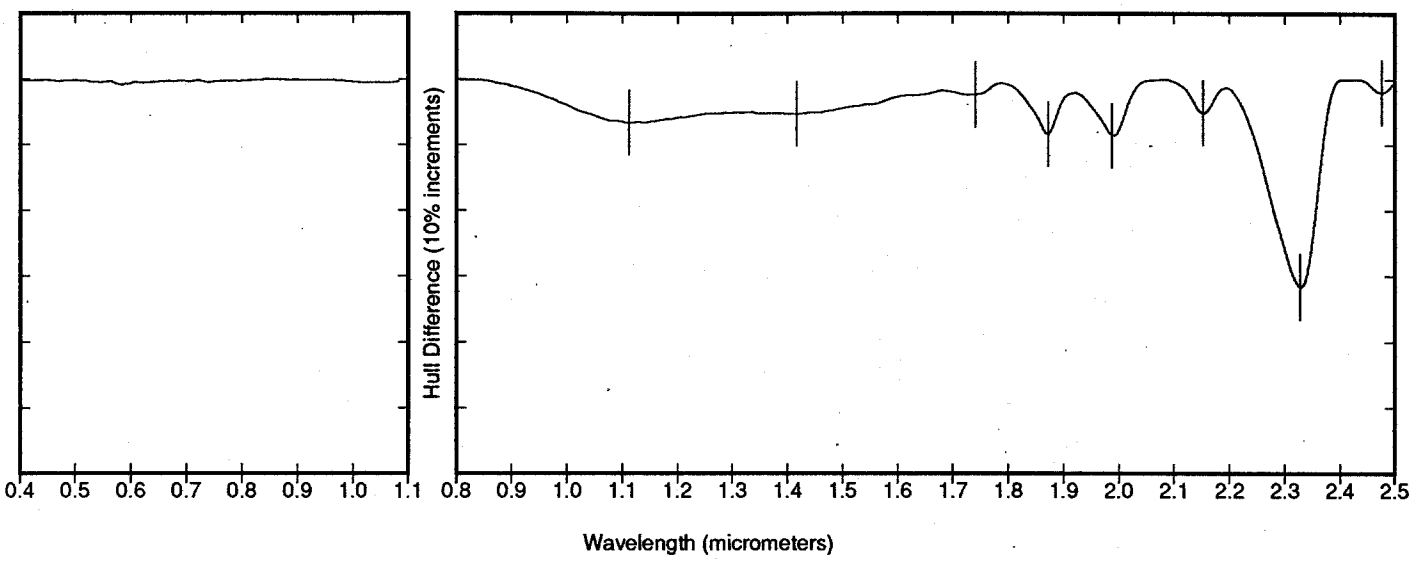
67



DESCRIPTION: CALCITE
SAMPLE_NUM: C-03E
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: CALCITE(A)
CHEMICAL FORMULA: $CaCO_3$

68

CALCITE (C-03E)

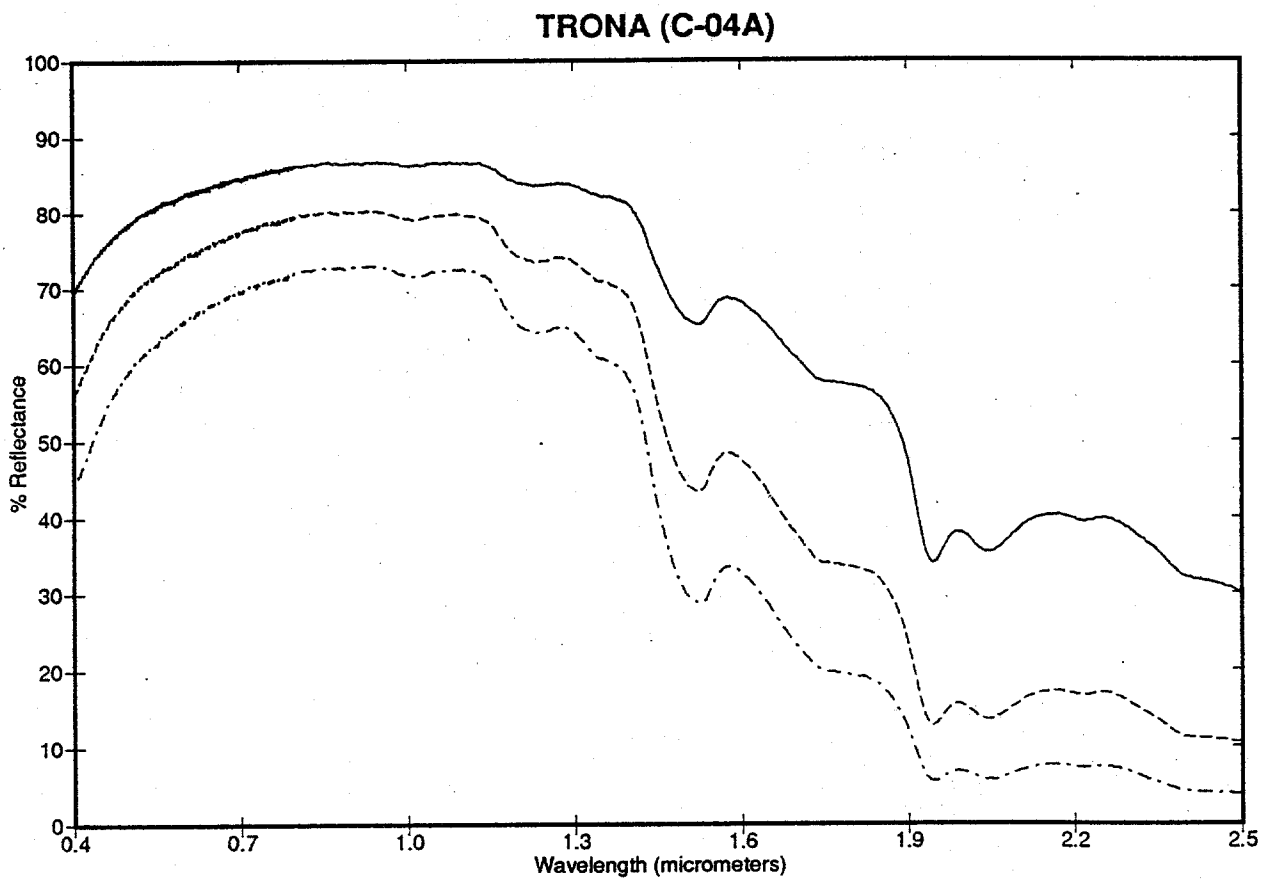


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 19.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3280	31.6080	3.0799	1.8626
1.9880	8.6137	0.5882	1.3810
1.8720	8.3593	0.4973	1.5582
1.1120	6.6429	2.1697	0.7045
1.4160	5.2915	1.4352	0.4064
2.1520	5.1008	0.2562	1.0412
1.7400	2.3657	0.1416	1.0701
2.4760	1.9593	0.0695	1.2758

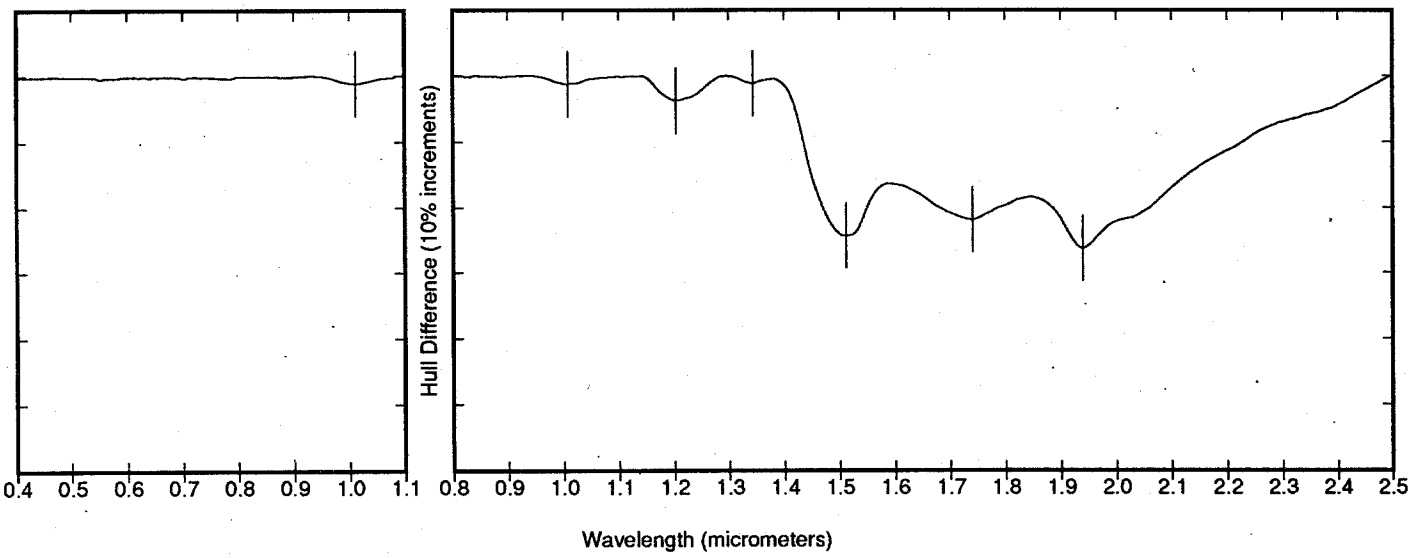
69



DESCRIPTION: TRONA
SAMPLE_NUM: C-04A
COUNTRY: USA
POLITICAL_SUBDIVISION: WYOMING
GEOGRAPHICAL_REGION: SWEETWATER COUNTY
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: TRONA(A)
CHEMICAL FORMULA: $Na_3(CO_3)(HCO_3) \bullet 2H_2O$

70

TRONA (C-04A)



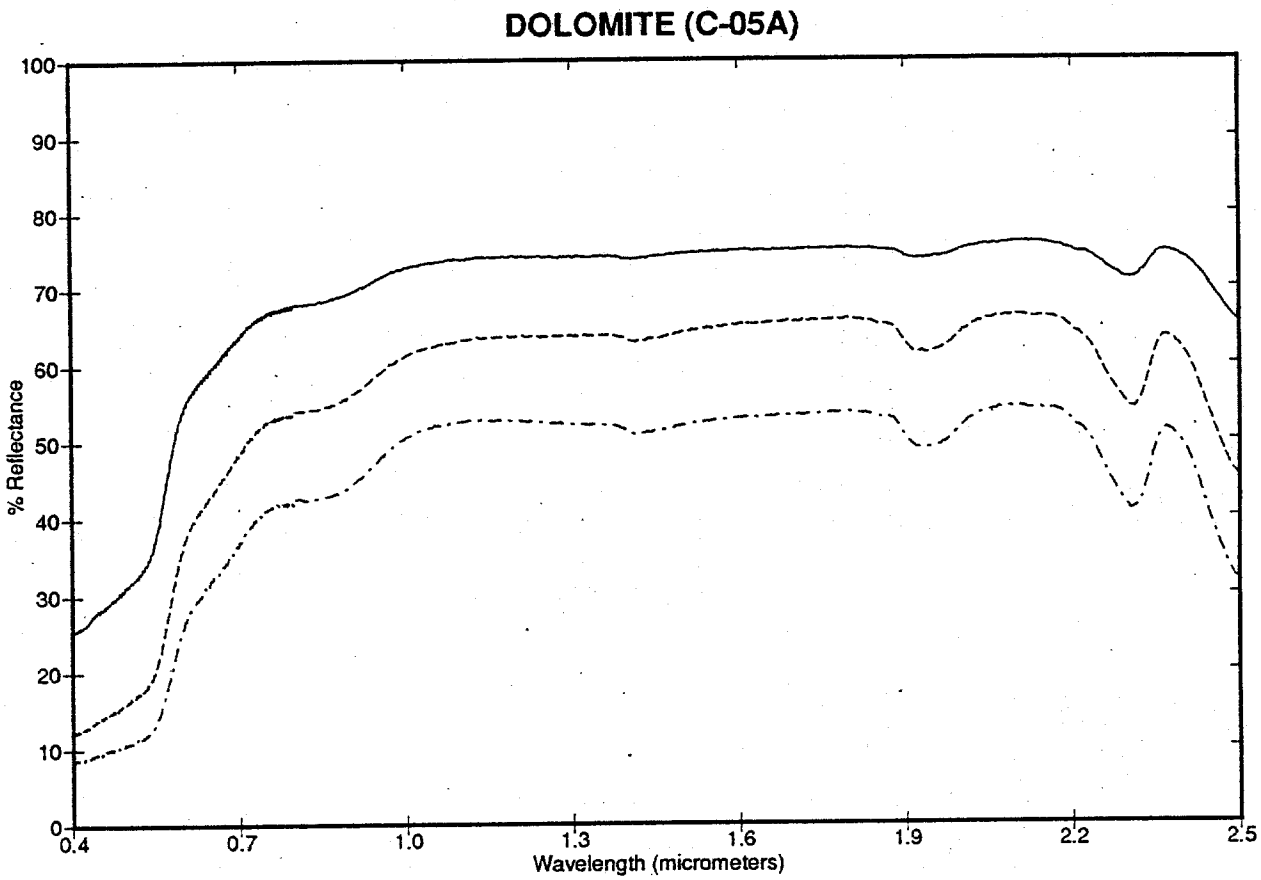
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.0120	1.1574	0.0868	0.9701

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9400	26.2175	8.6334	0.3154
1.5120	24.3342	3.3007	1.0508
1.7400	21.8570	4.9130	1.3602
1.2040	3.8155	0.3169	0.6876
1.0080	1.2276	0.0937	0.7591
1.3440	1.1810	0.0539	0.9986

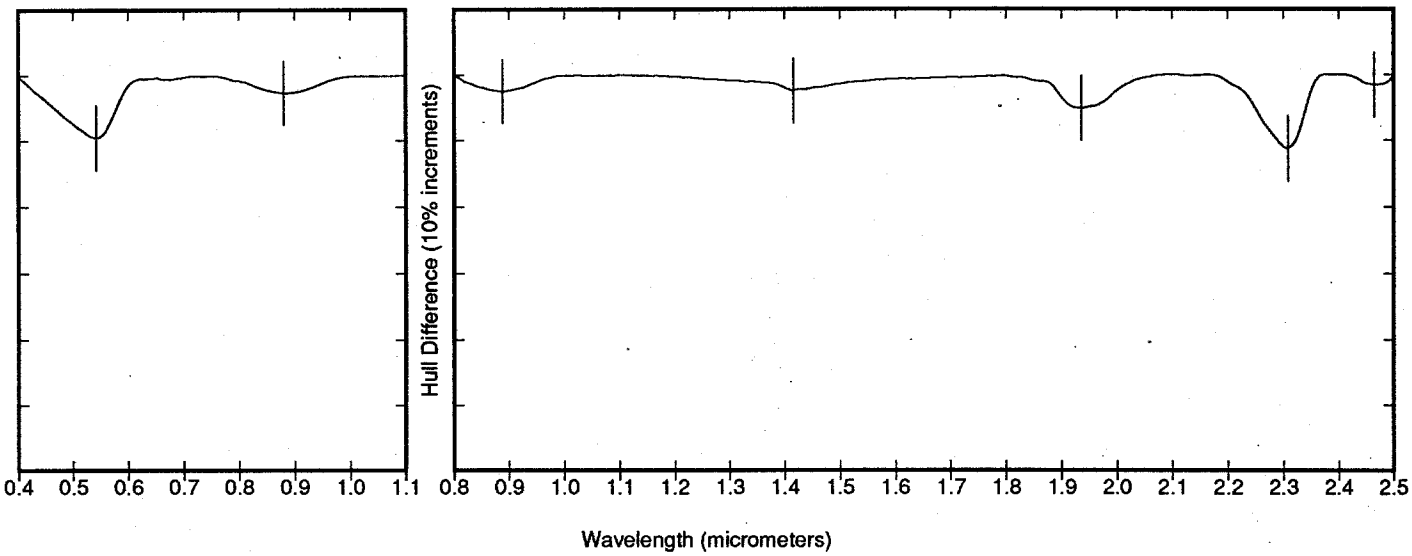
71



DESCRIPTION: DOLOMITE,RED BANDED
SAMPLE_NUM: C-05A
COUNTRY: USA
POLITICAL_SUBDIVISION: COLORADO
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: DOLOMITE(A),QUARTZ(M)
CHEMICAL FORMULA: $CaMg(CO_3)_2$

72

DOLOMITE (C-05A)



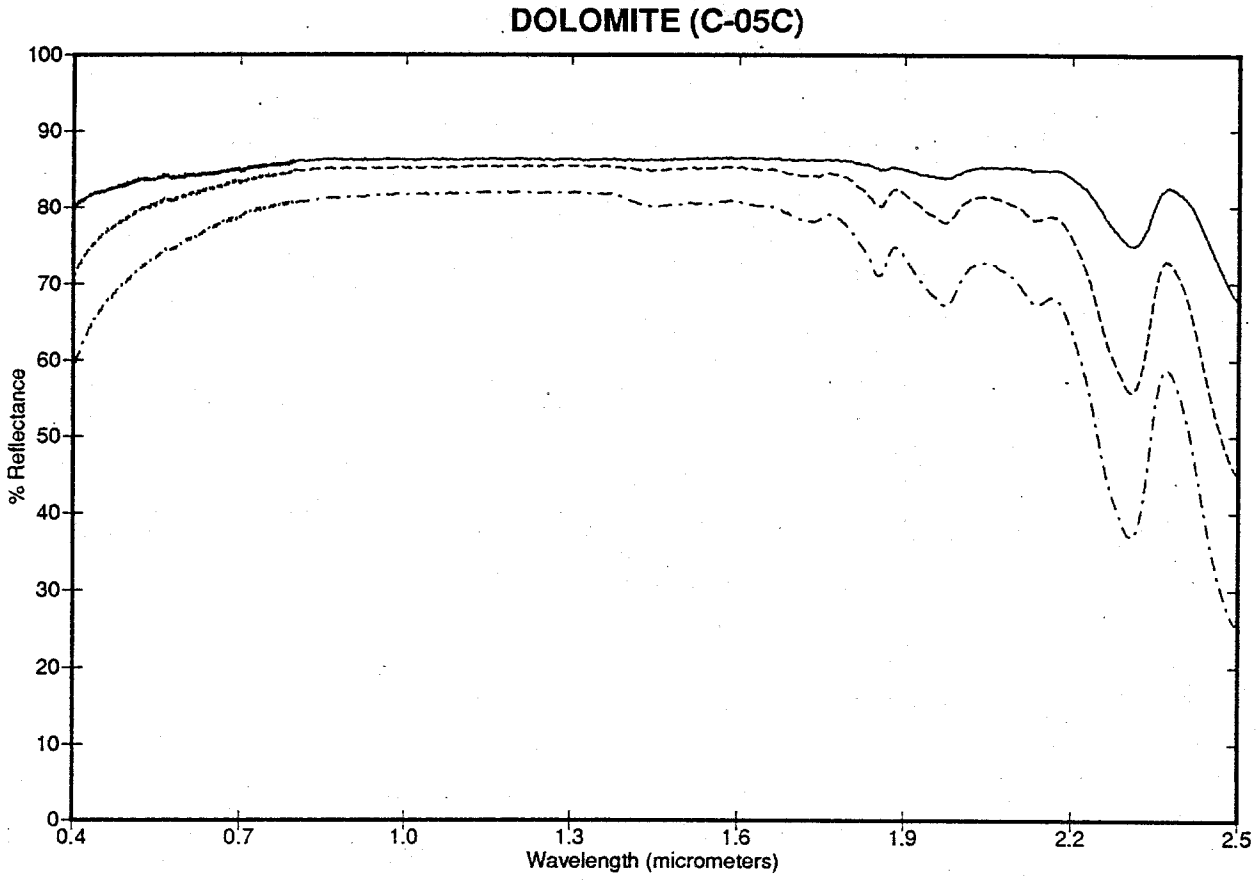
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5420	9.5204	1.1083	1.9869
0.8800	2.6315	0.3244	0.8395

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 8.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3080	11.2774	1.0168	1.8802
1.9360	5.1841	0.6129	0.7668
0.8880	2.4969	0.2805	0.9770
1.4160	2.4037	0.5280	0.6338
2.4640	1.5781	0.0863	1.0278

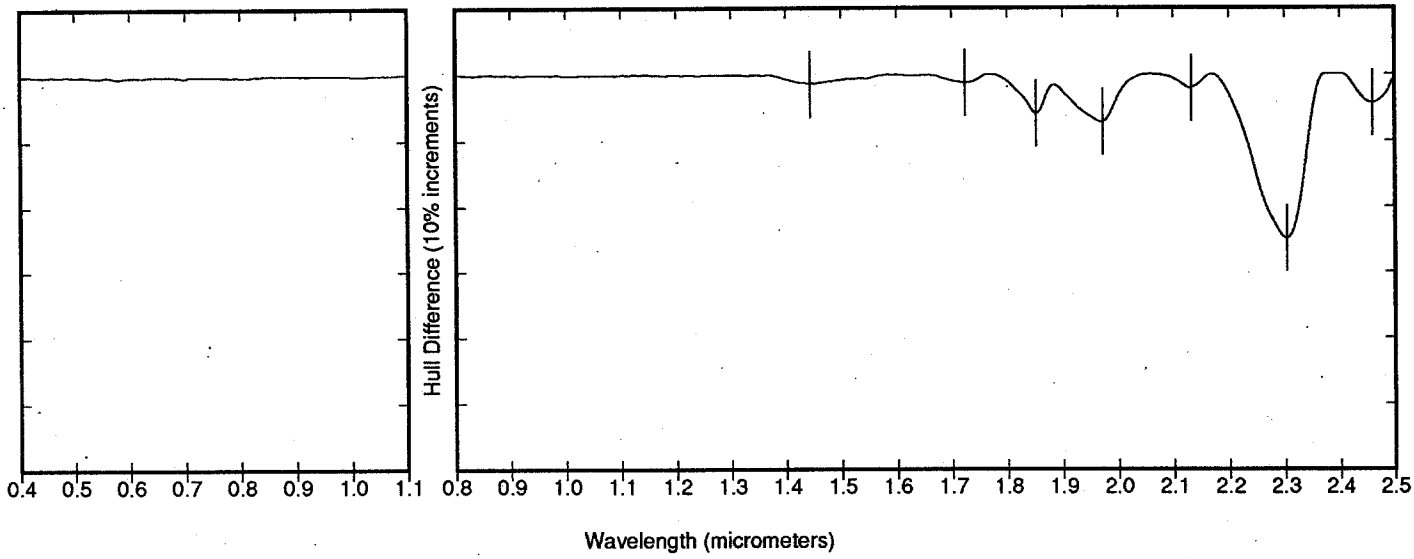
73



DESCRIPTION: DOLOMITE
SAMPLE_NUM: C-05C
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: LOS ANGELES COUNTY
SITE: PALOS VERDES
COLLECTOR: BURMINCO
MINERALOGY: DOLOMITE(A)
CHEMICAL FORMULA: $CaMg(CO_3)_2$

74

DOLOMITE (C-05C)

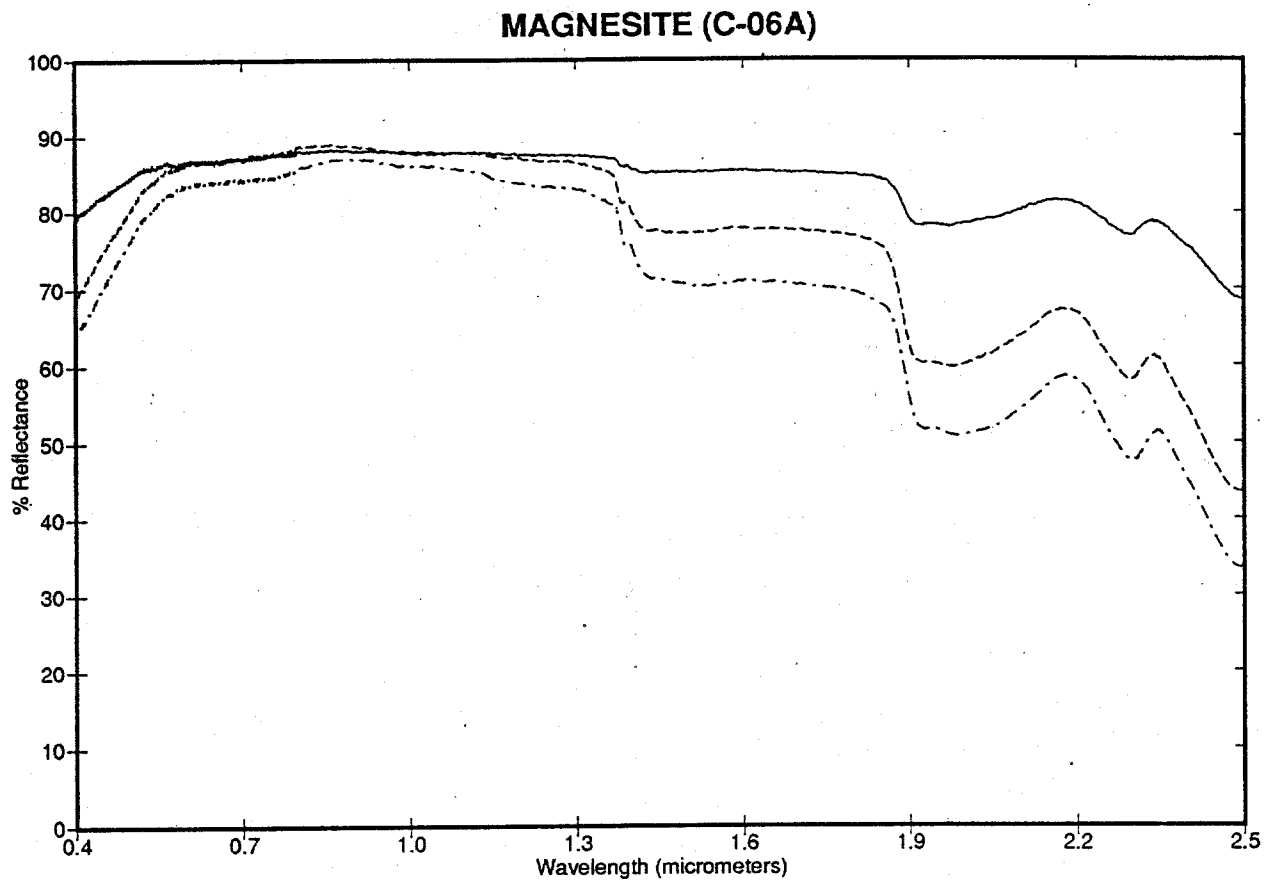


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 15.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3040	24.9050	2.4845	1.8819
1.9720	7.1777	0.6333	1.9237
1.8520	5.9290	0.3084	1.5582
2.4600	4.3408	0.2499	1.1551
2.1320	2.1214	0.0961	1.4091
1.4440	1.4307	0.1749	0.5488
1.7240	1.2791	0.0881	1.7889

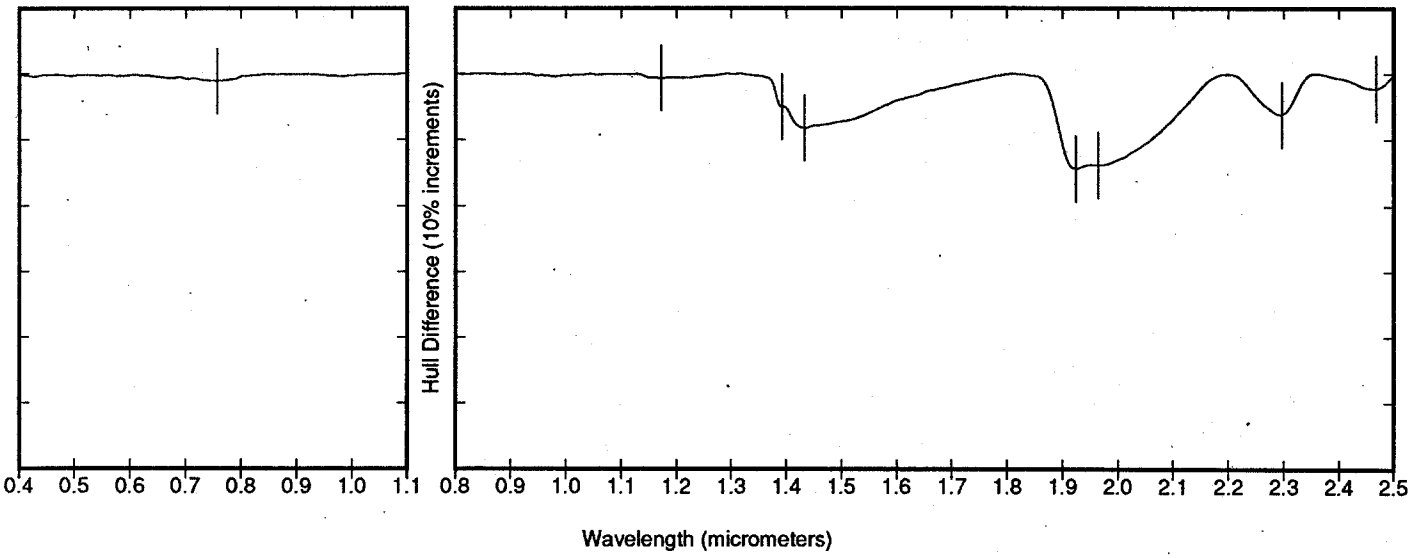
75



DESCRIPTION: MAGNESITE
SAMPLE_NUM: C-06A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: RIVERSIDE COUNTY
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: MAGNESITE(A)
CHEMICAL FORMULA: $MgCo_3$

76

MAGNESITE (C-06A)



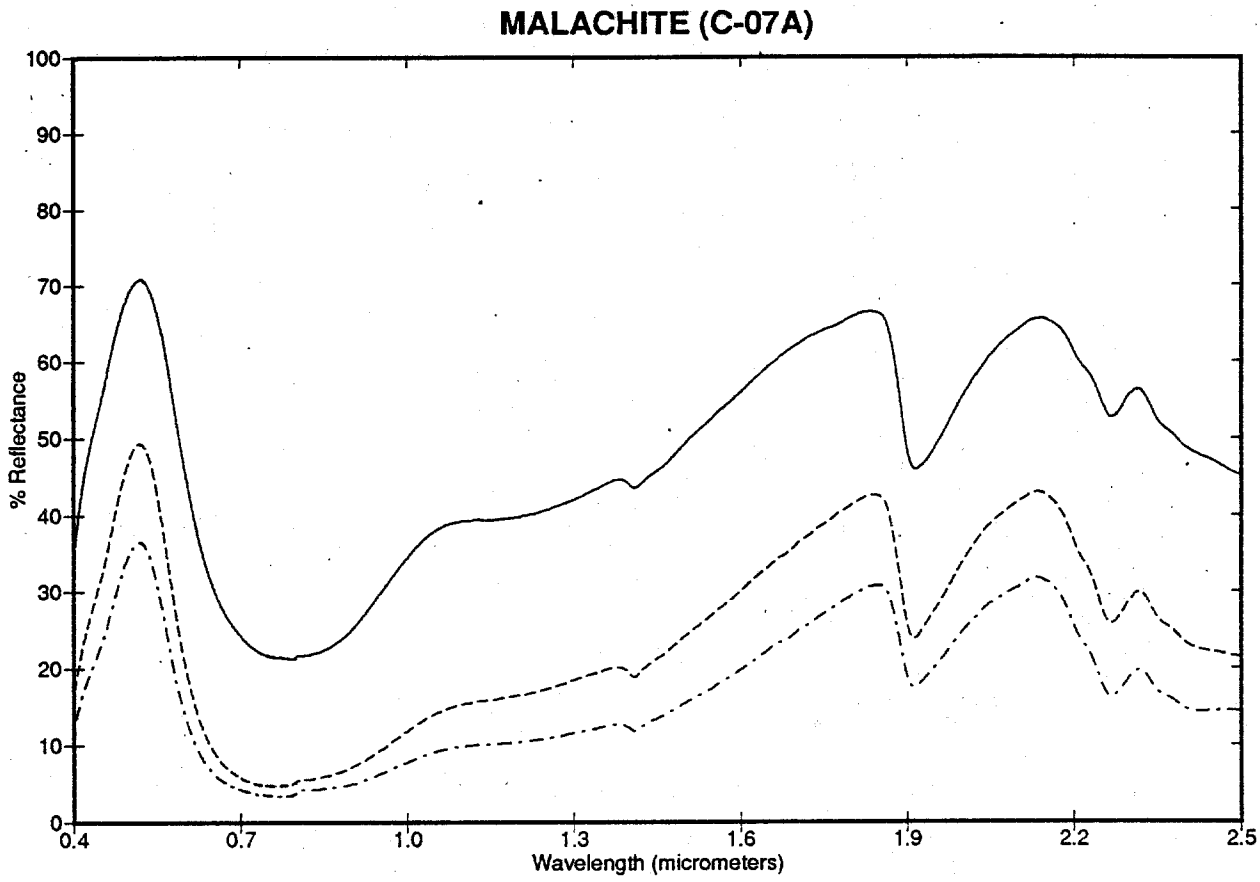
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 25.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7560	1.0823	0.0874	0.8216

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9240	14.3819	0.9055	1.3032
1.9640	13.8390	1.9496	0.0930
1.4320	8.3032	1.7579	0.1674
2.2960	6.1983	0.4712	1.8172
1.3920	5.0825	0.1000	3.9634
2.4680	2.2767	0.1650	2.6813
1.1720	0.6793	0.0816	0.4845

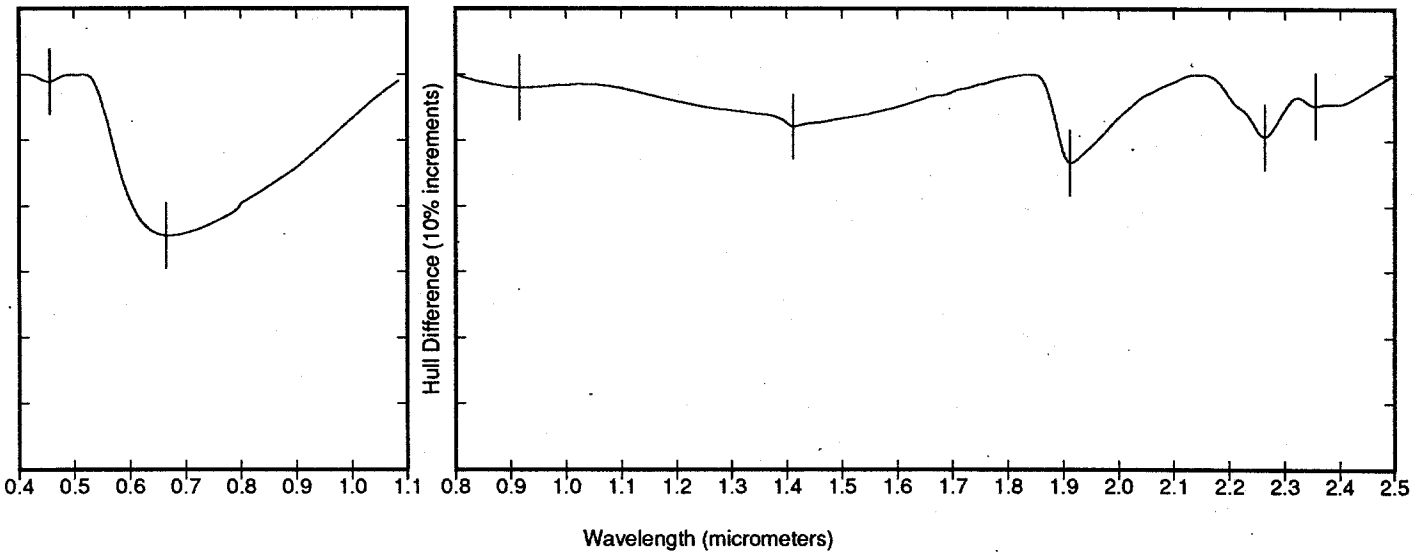
77



DESCRIPTION: MALACHITE
SAMPLE_NUM: C-07A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: SAN BERNADINO COUNTY
SITE: NEAR VALLEY WELLS
COLLECTOR: BURMINCO
MINERALOGY: MALACHITE(A),POSSIBLE CHRYSOCOLLA(M)
CHEMICAL FORMULA: $Cu_2(CO_3)(OH)_2$

78

MALACHITE (C-07A)



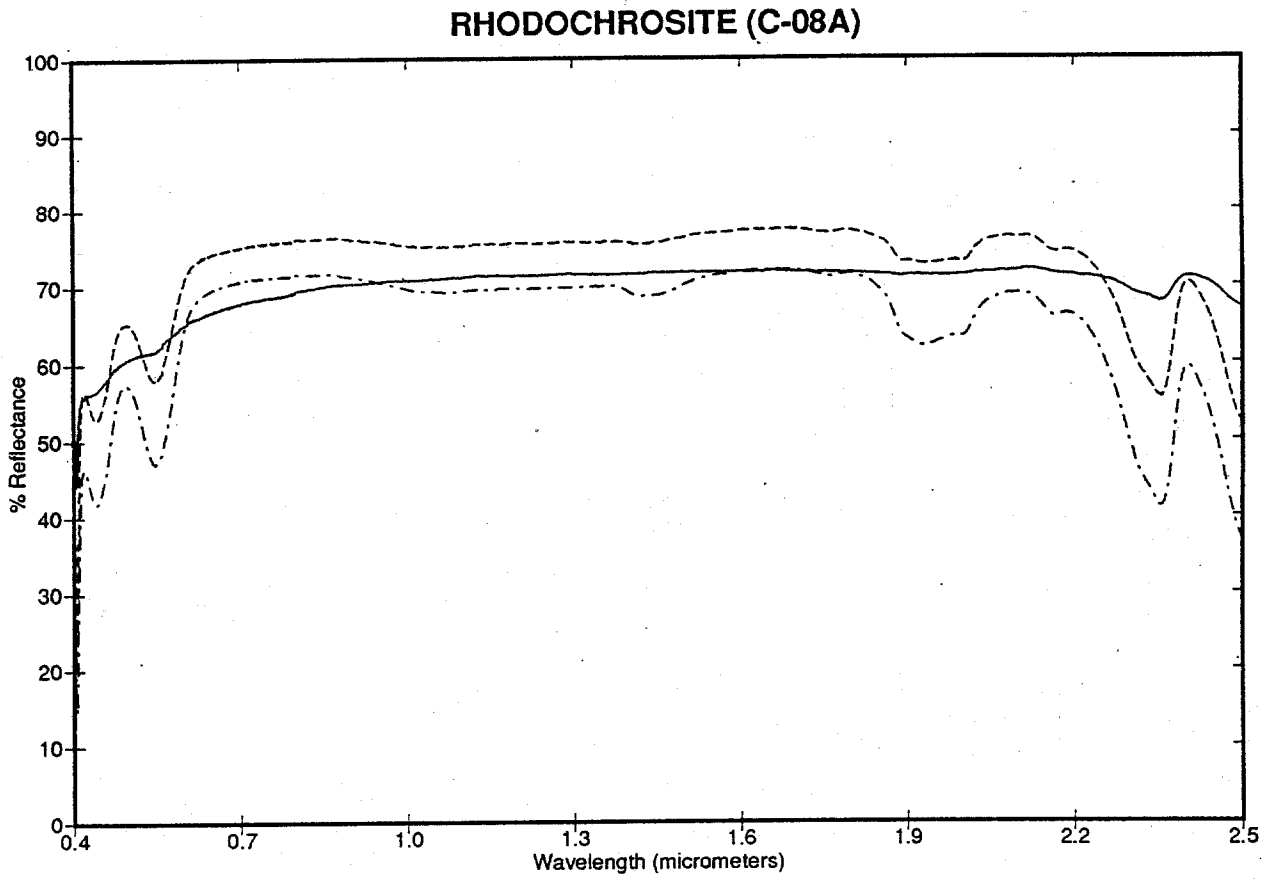
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6650	24.4598	8.2810	0.3480
0.4560	1.0556	0.0381	1.2529

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 6.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9120	13.4237	1.6361	0.2953
2.2640	9.4268	0.8387	1.2306
1.4120	7.9421	3.3631	0.9250
2.3560	4.7208	0.5672	0.3051
0.9160	1.9362	0.3188	0.7801

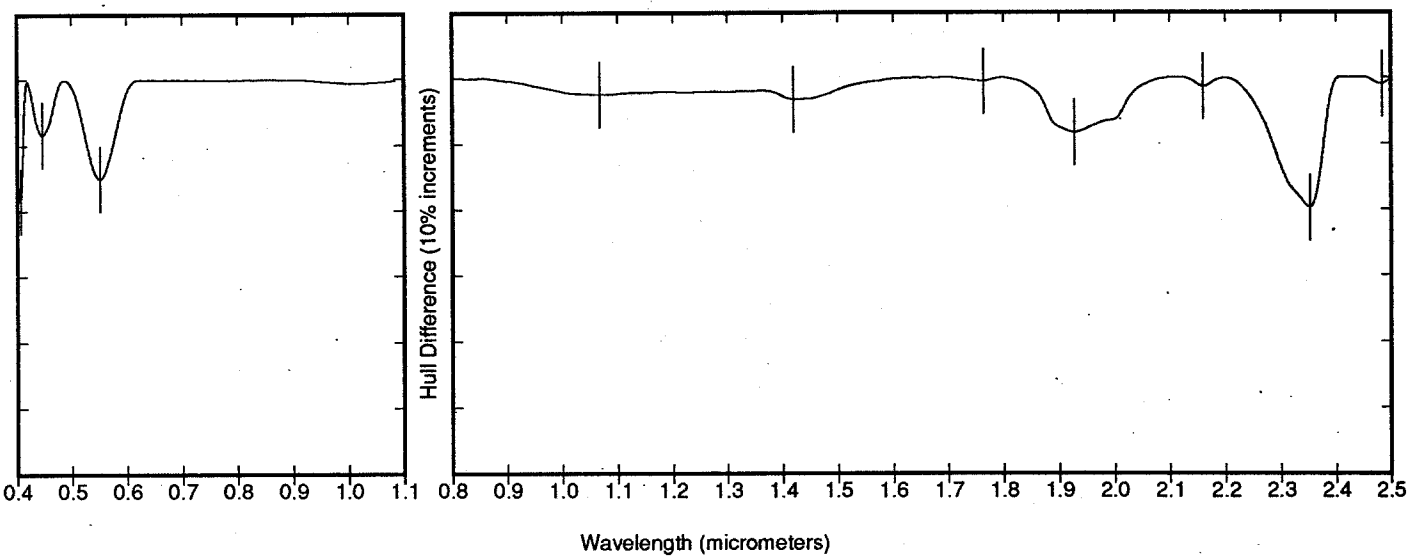
79



DESCRIPTION: RHODOCHROSITE
SAMPLE_NUM: C-08A
COUNTRY: USA
POLITICAL_SUBDIVISION: MONTANA
GEOGRAPHICAL_REGION: SILVER BOW COUNTY
SITE: BUTTE
COLLECTOR: WARD'S
MINERALOGY: RHODOCHROSITE(A),QUARTZ(M)
CHEMICAL FORMULA: $MnCo_3$

80

RHODOCHROSITE (C-08A)



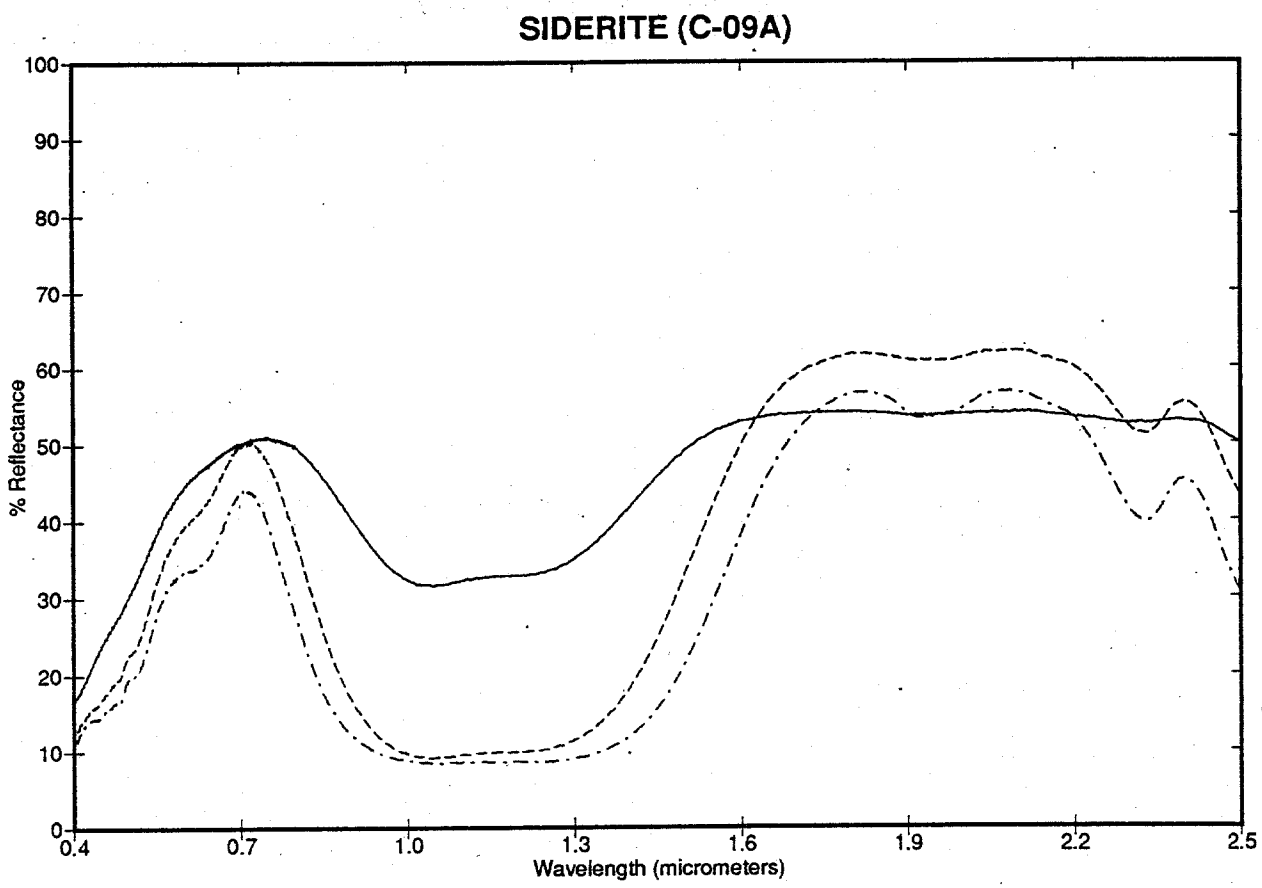
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4060	18.4520	0.1366	0.3532
0.5510	15.0542	0.9150	0.9611
0.4460	8.3302	0.3008	0.7889

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3520	19.8161	1.8833	2.6645
1.9280	8.3401	1.2127	0.6557
1.4200	3.3548	0.8941	1.7036
1.0680	2.5832	0.5385	1.2724
2.1600	1.4135	0.0502	0.9097
2.4840	1.0033	0.0275	1.9395
1.7640	0.5869	0.0290	2.0863

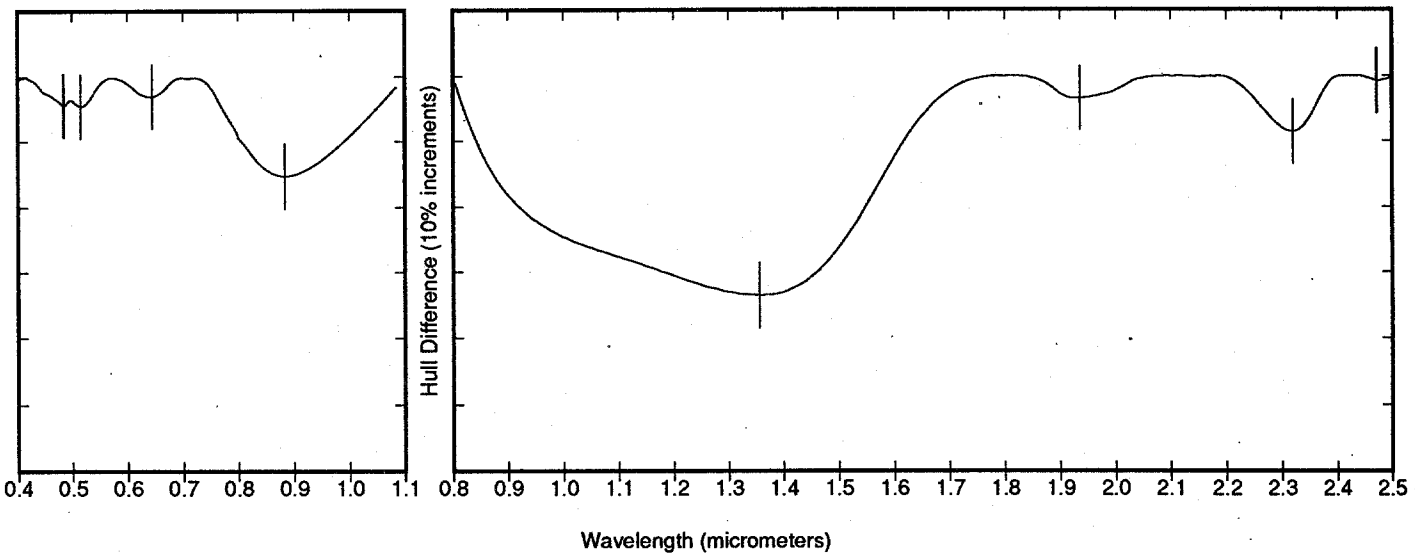
81



DESCRIPTION: SIDERITE
SAMPLE_NUM: C-09A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: SIDERITE(A),QUARTZ(M)
CHEMICAL FORMULA: $Fe^{2+}CO_3$

82

SIDERITE (C-09A)



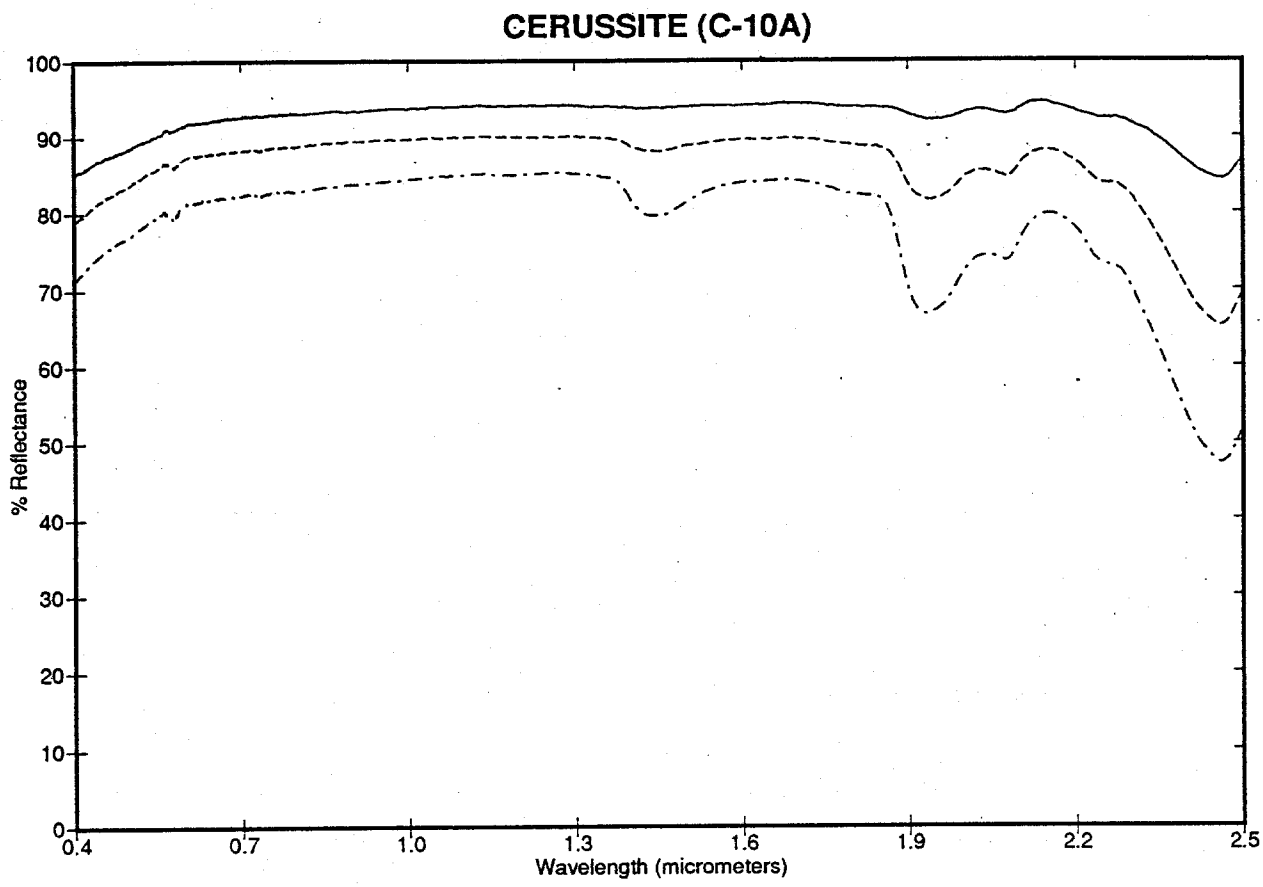
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.8840	15.1958	3.3411	0.7078
0.5150	4.4780	0.1882	0.6168
0.4840	4.3695	0.1972	2.8589
0.6440	2.9823	0.1865	1.3838

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3560	33.4484	21.0099	1.9252
2.3200	8.6049	0.9177	1.4791
1.9360	3.4668	0.4452	0.7266
2.4720	0.7683	0.0264	0.7563

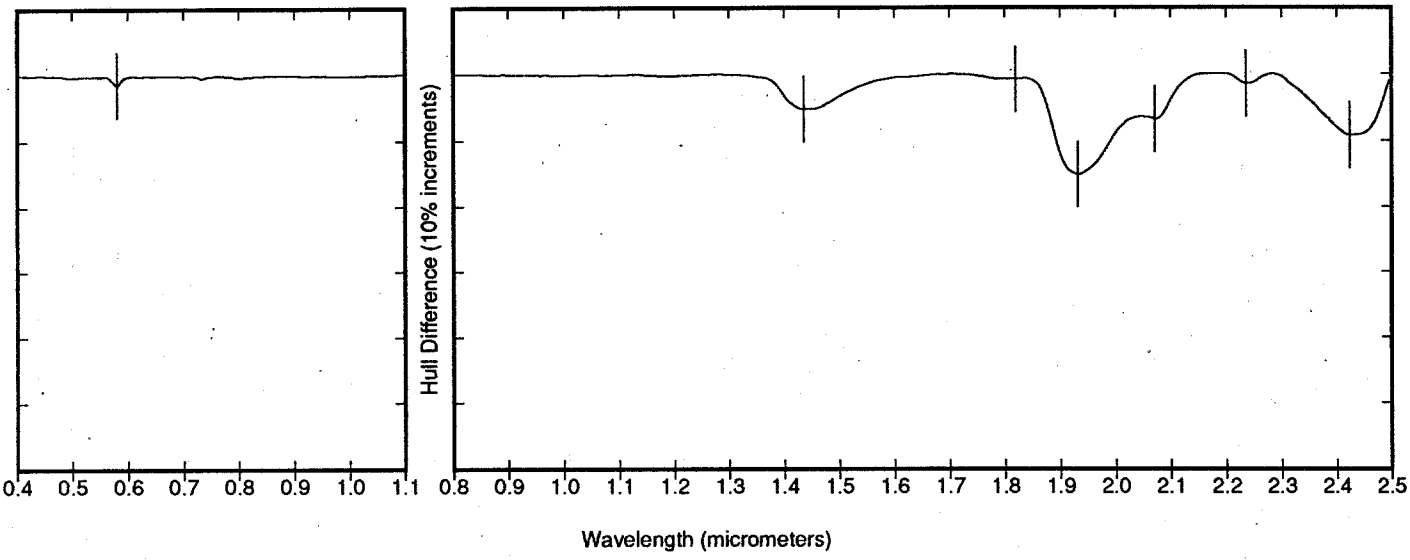
83



DESCRIPTION: CERUSSITE
SAMPLE_NUM: C-10A
COUNTRY: USA
POLITICAL_SUBDIVISION: ARIZONA
GEOGRAPHICAL_REGION: FLUX MINE
SITE: FLUX MINE
COLLECTOR: JPL
MINERALOGY: CERUSSITE(A)
CHEMICAL FORMULA: $PbCO_3$

94

CERUSSITE (C-10A)



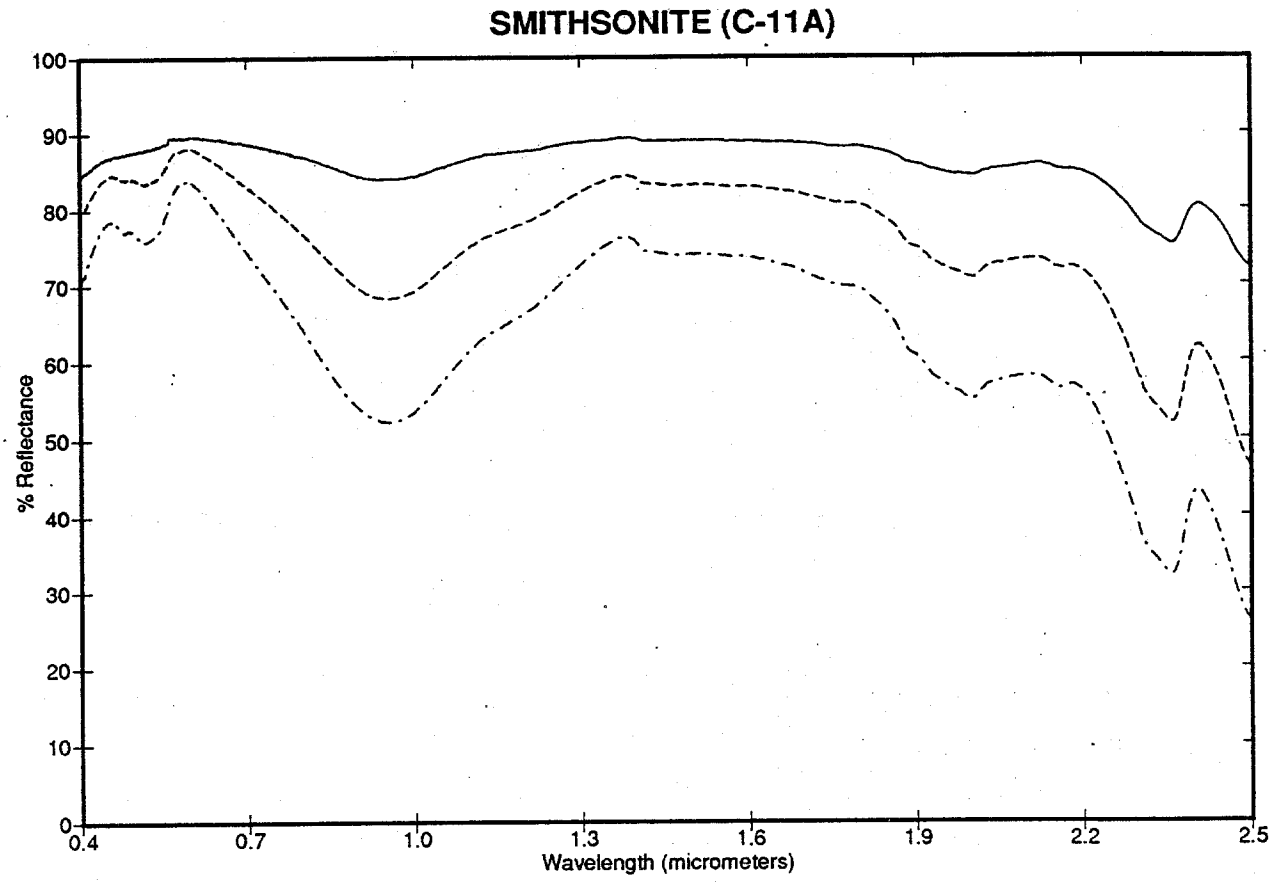
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5800	1.4412	0.0298	1.0016

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9320	15.1617	1.9459	0.5947
2.4240	9.2572	1.1338	1.2028
2.0720	6.8072	0.3905	0.6809
1.4360	5.3049	0.7169	0.5053
2.2360	1.4946	0.0643	0.6980
1.8200	0.8366	0.0670	4.3350

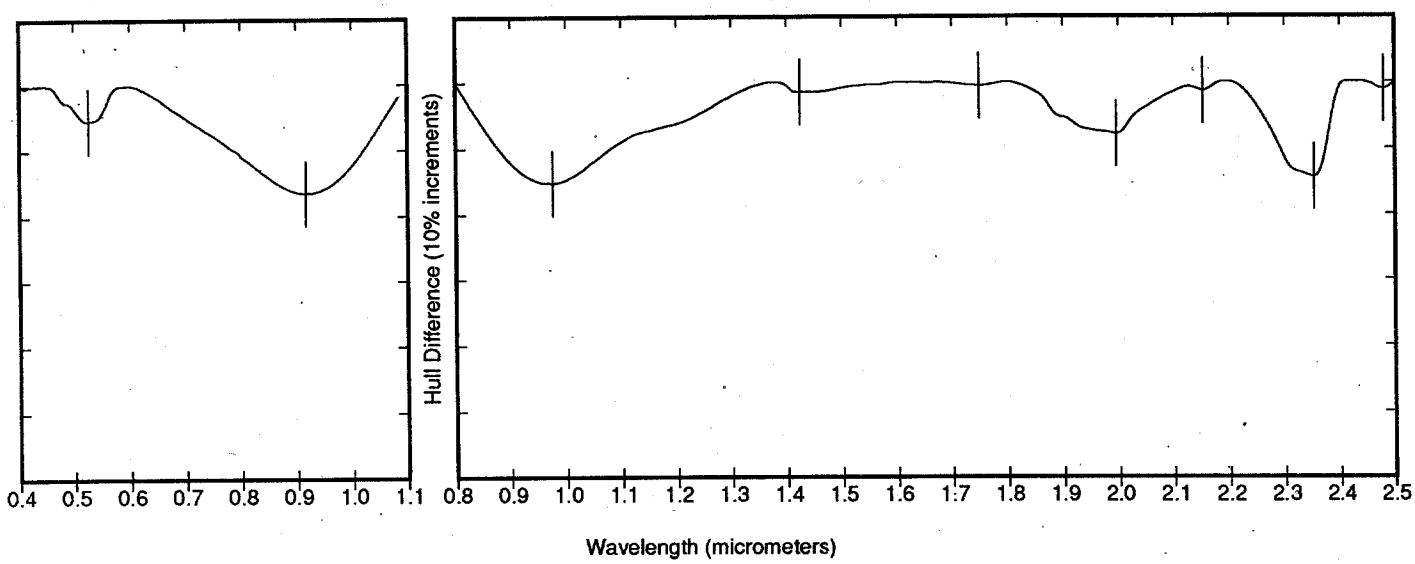
85



DESCRIPTION: SMITHSONITE
SAMPLE_NUM: C-11A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: SMITHSONITE(A)
CHEMICAL FORMULA: $ZnCO_3$

86

SMITHSONITE (C-11A)



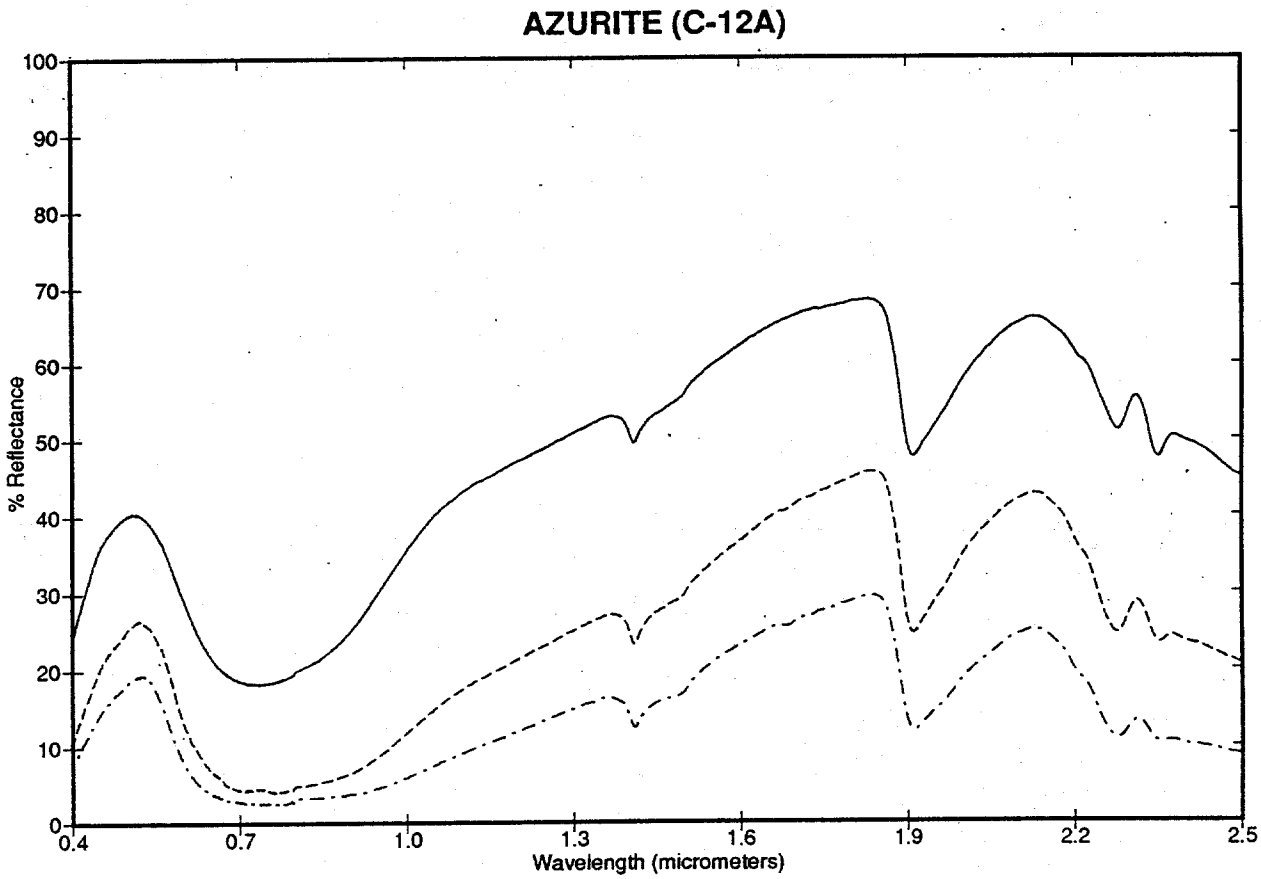
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9160	16.4611	4.5183	1.4151
0.5250	5.4152	0.3817	1.1657

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9760	15.2411	4.5126	0.6238
2.3520	14.4109	1.5631	2.7871
1.9960	7.8629	1.3595	1.8496
1.4240	1.4933	0.1780	0.2254
2.1520	1.3674	0.0517	1.0218
2.4800	1.1219	0.0361	1.6449
1.7480	0.5983	0.0381	1.4593

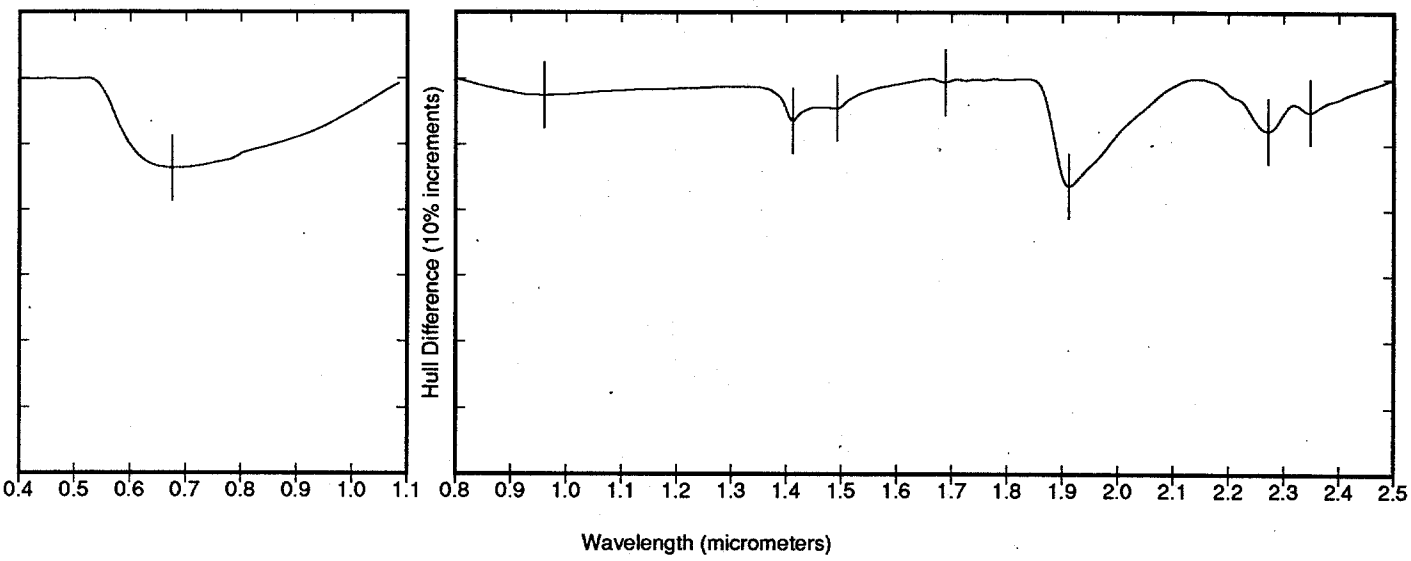
87



DESCRIPTION: AZURITE
SAMPLE_NUM: C-12A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: SAN BERNADINO COUNTY
SITE: NEAR VALLEY WELLS
COLLECTOR: BURMINCO
MINERALOGY: MALACHITE(A),AZURITE(M),POSSIBLE CHRYSOCOLLA(M)
CHEMICAL FORMULA: $Cu_3(CO_3)_2(OH)_2$

88

AZURITE (C-12A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

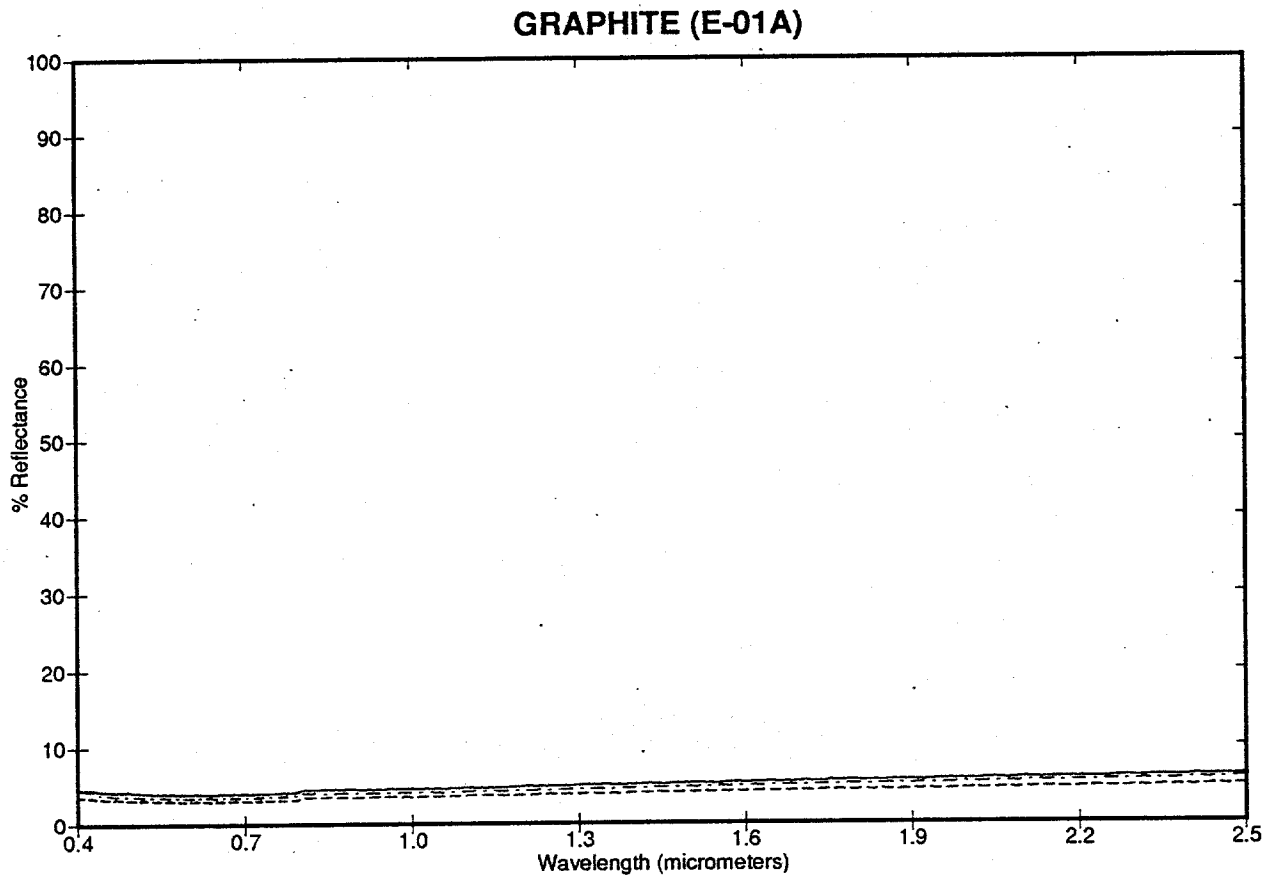
WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6760	13.6547	4.8429	0.3566

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9120	16.3200	2.0675	0.3152
2.2720	7.8916	0.6717	1.4285
1.4120	6.4214	0.5161	0.7822
2.3480	5.0065	0.4766	0.3573
1.4920	4.5158	0.3529	0.3384
0.9600	2.5153	0.8865	0.3918
1.6880	0.5603	0.0147	0.9591

ELEMENTS

90



DESCRIPTION: GRAPHITE
SAMPLE_NUM: E-01A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: SONORA
GEOGRAPHICAL_REGION: MORELOS
SITE: SAN JOSE MINE
COLLECTOR: BURMINCO
MINERALOGY: GRAPHITE(A)
CHEMICAL FORMULA: C

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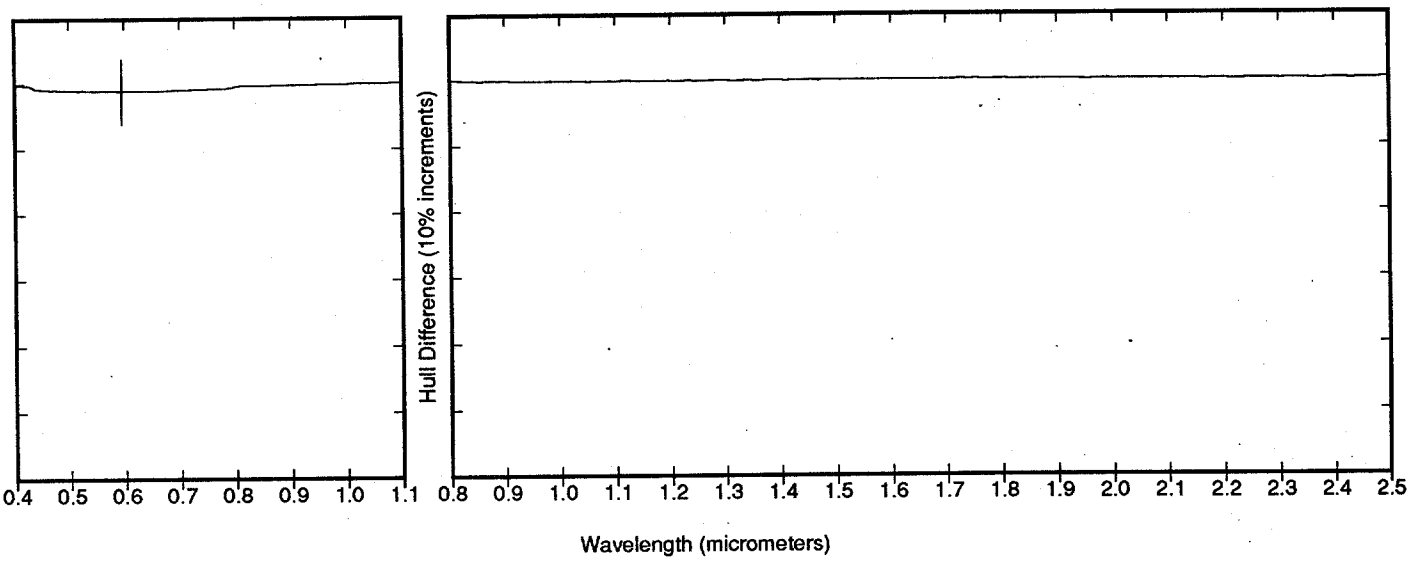
GRAPHITE (E-01A)

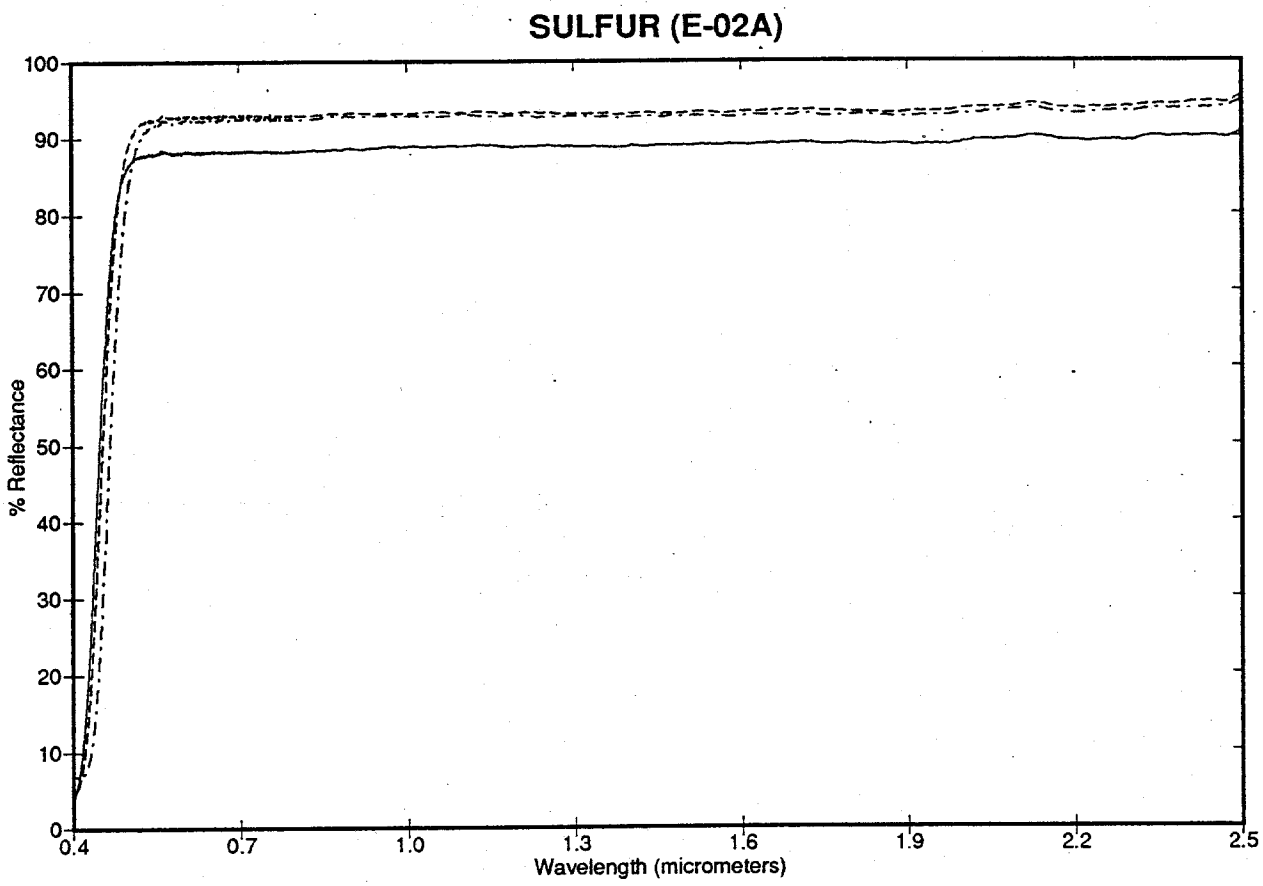


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5950	1.0980	0.4032	0.6561

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

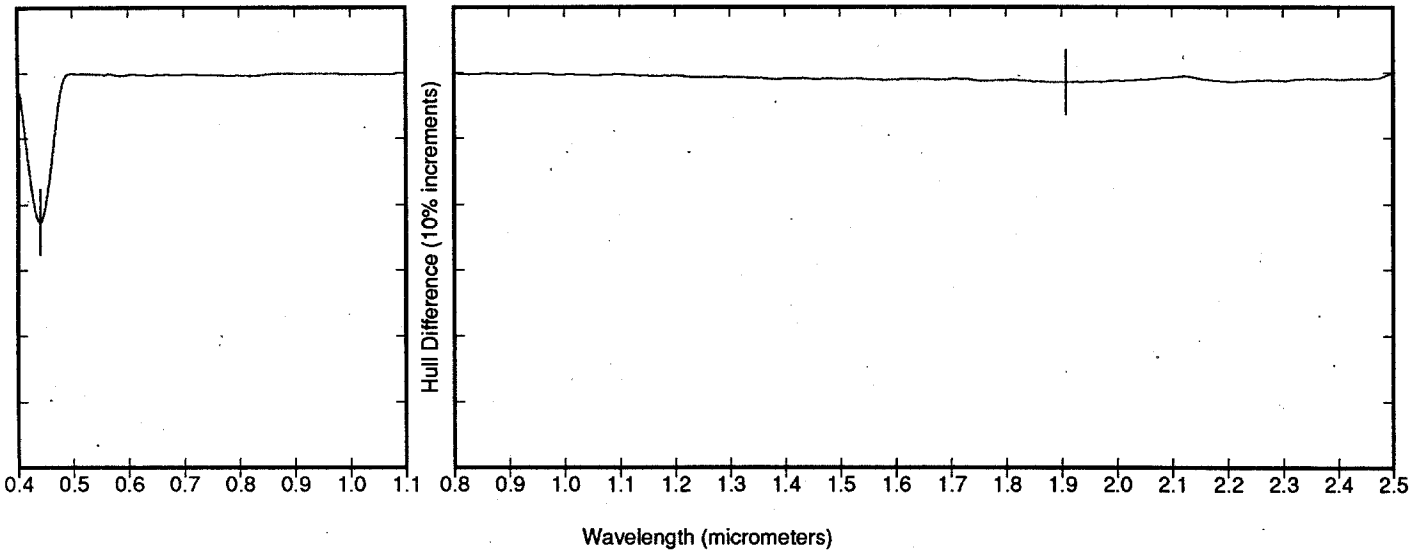
92



DESCRIPTION: SULFUR
SAMPLE_NUM: E-02A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: SULFUR(A)
CHEMICAL_FORMULA: S

93

SULFUR (E-02A)



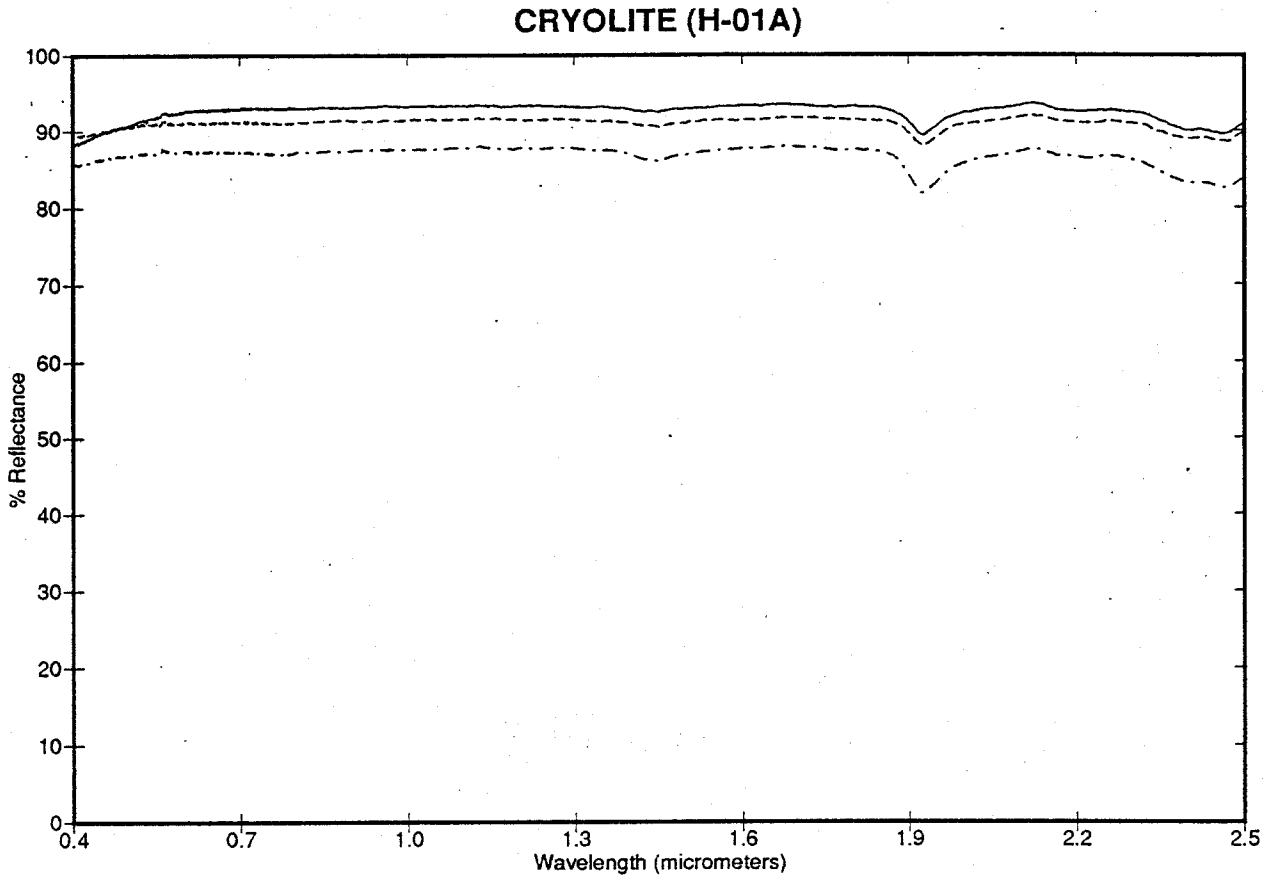
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4400	22.6451	1.0954	0.9920

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 21.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9080	1.4609	1.3503	1.1888

HALIDES



DESCRIPTION: CRYOLITE
SAMPLE_NUM: H-01A
COUNTRY: DENMARK
POLITICAL_SUBDIVISION: GREENLAND
GEOGRAPHICAL_REGION: IVIGTUT
SITE: IVIGTUT
COLLECTOR: WARD'S
MINERALOGY: CRYOLITE(A)
CHEMICAL_FORMULA: $Na_3Al\ F_6$

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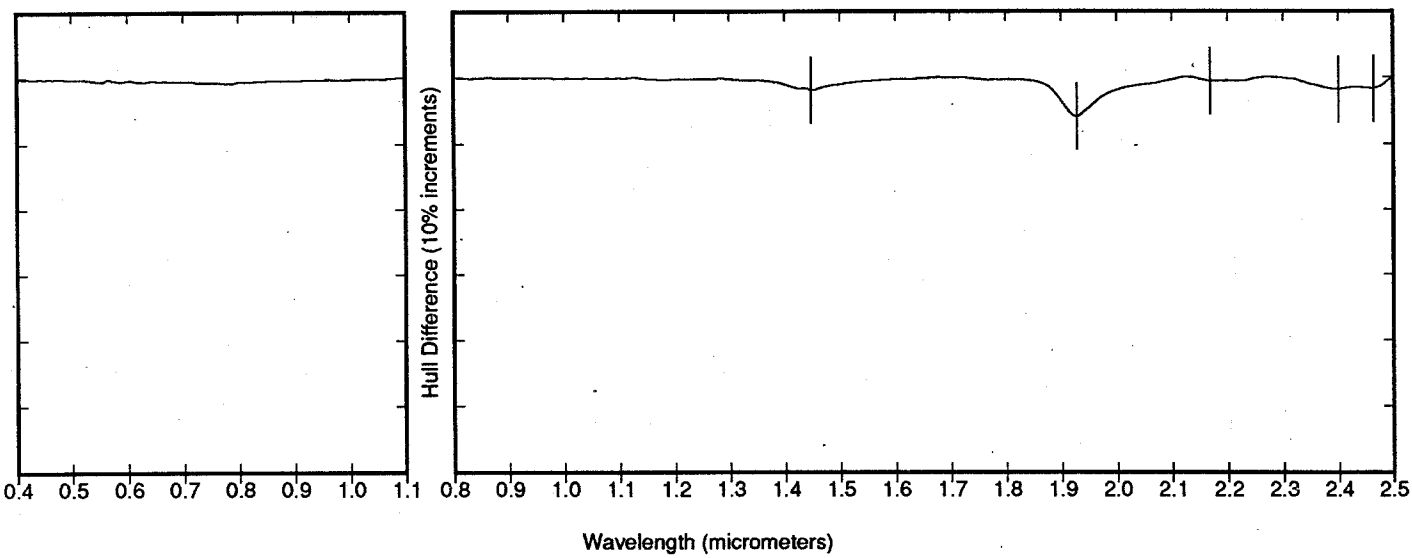
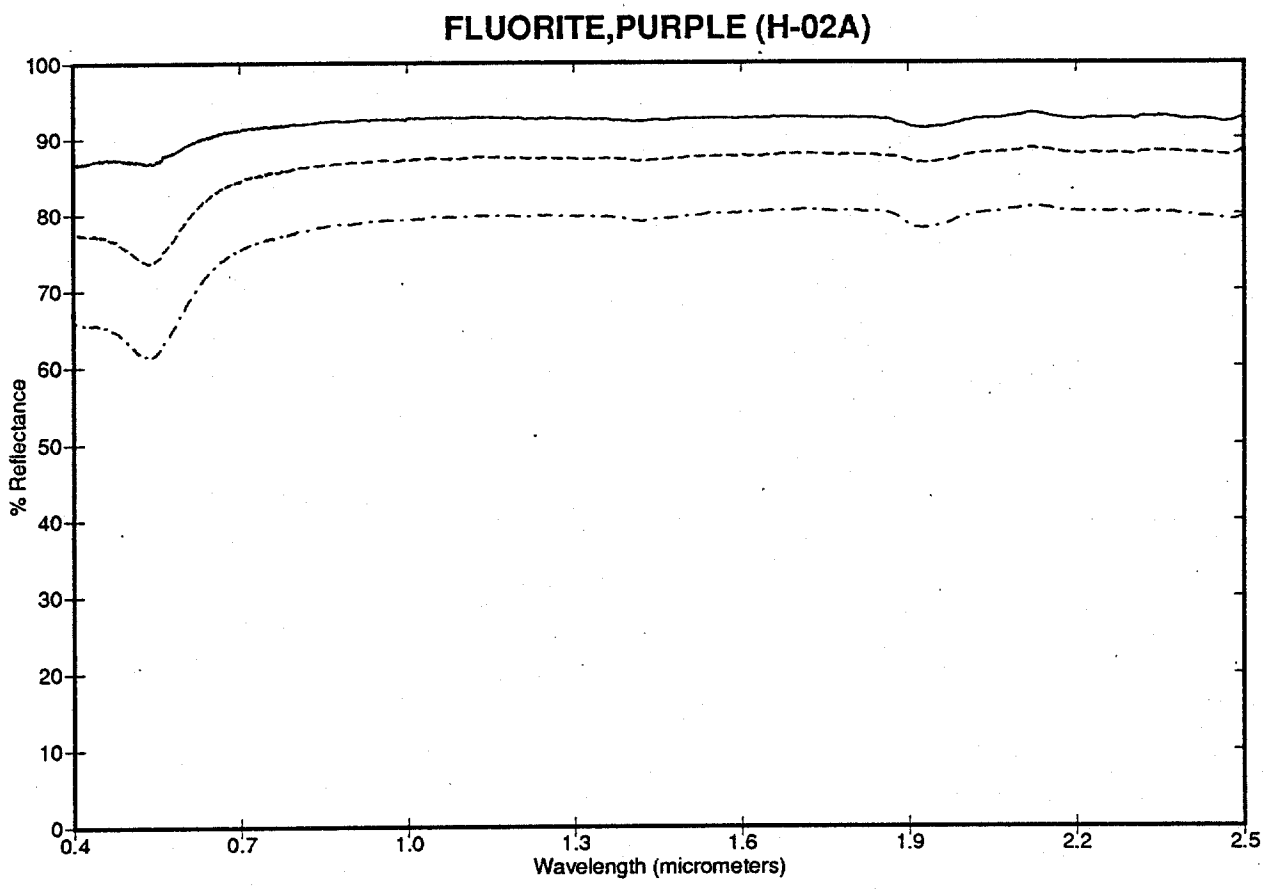
CRYOLITE (H-01A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9280	5.9087	0.6870	0.7871
1.4480	1.9621	0.3030	1.4885
2.4000	1.8735	0.1712	1.5845
2.4640	1.7082	0.0753	1.1259
2.1680	0.6187	0.0549	0.2386



DESCRIPTION: FLUORITE,PURPLE
SAMPLE_NUM: H-02A
COUNTRY: USA
POLITICAL_SUBDIVISION: ILLINOIS
GEOGRAPHICAL_REGION: HARDIN COUNTY
SITE: ROSICLARE
COLLECTOR: WARD'S
MINERALOGY: FLUORITE(A)
CHEMICAL FORMULA: CaF_2

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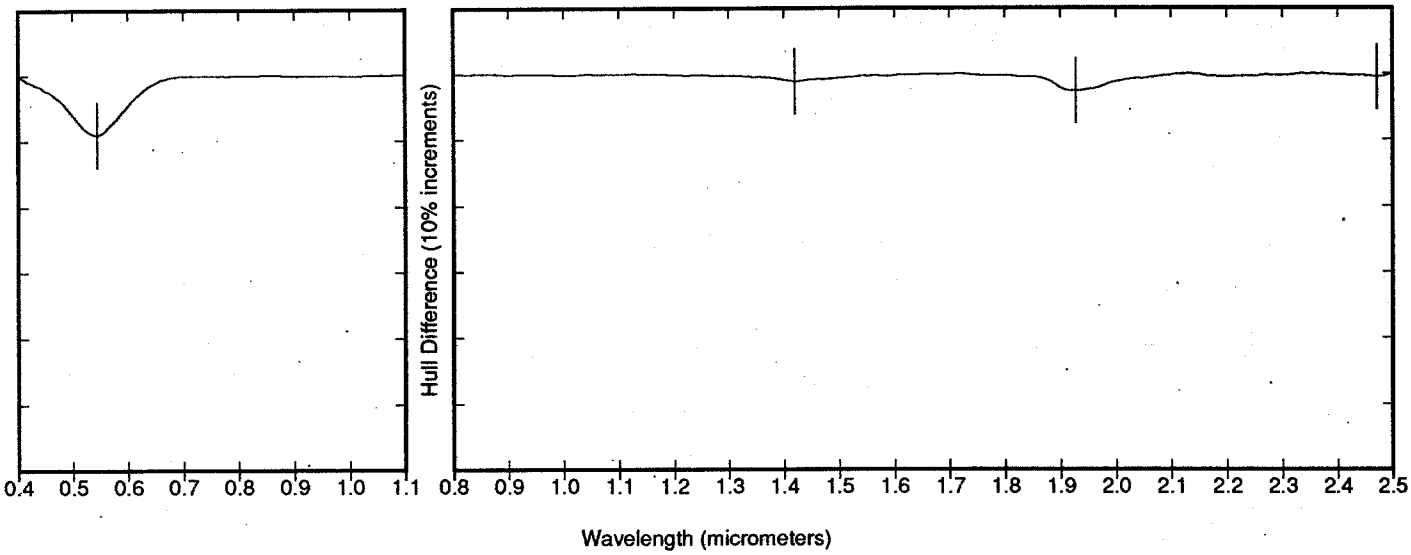
FLUORITE,PURPLE (H-02A)

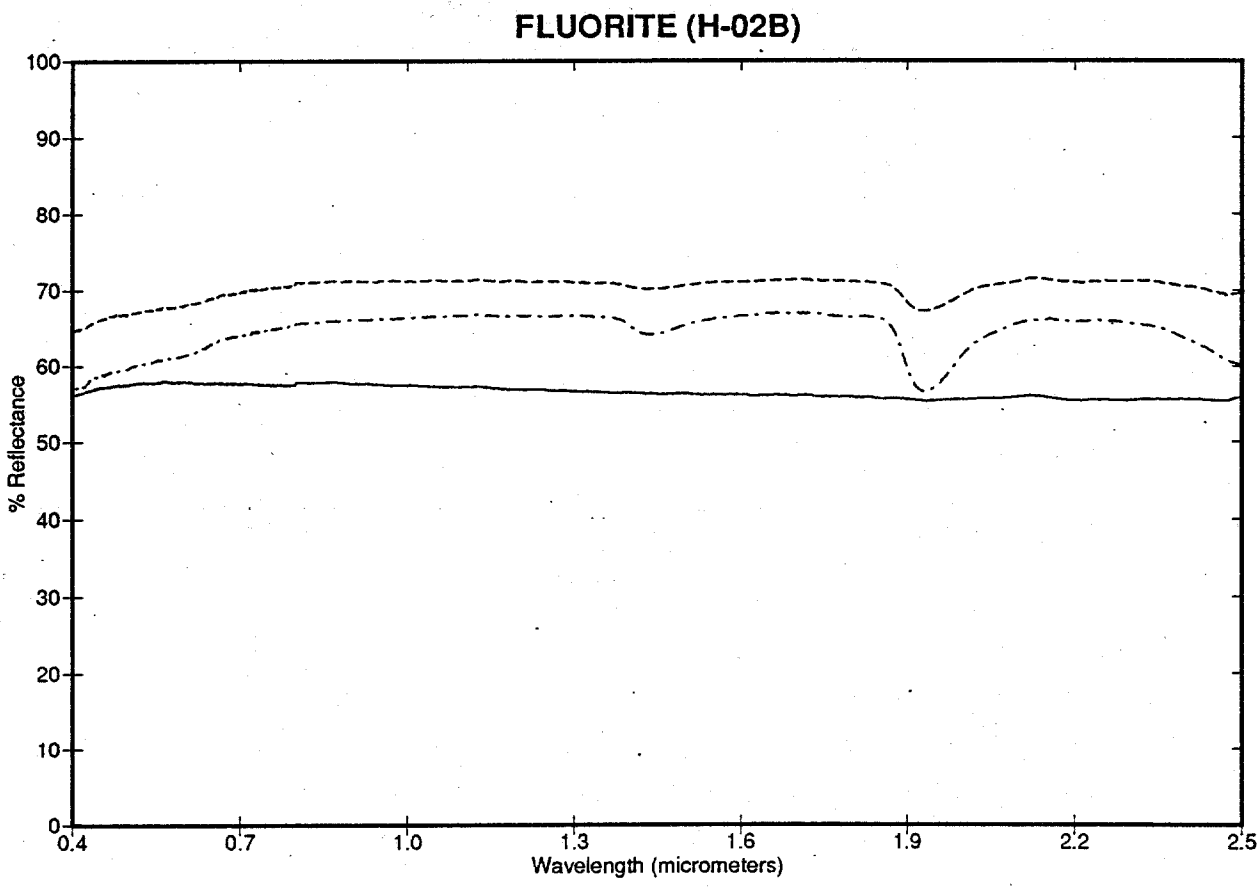


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5440	9.0399	1.1561	1.0881

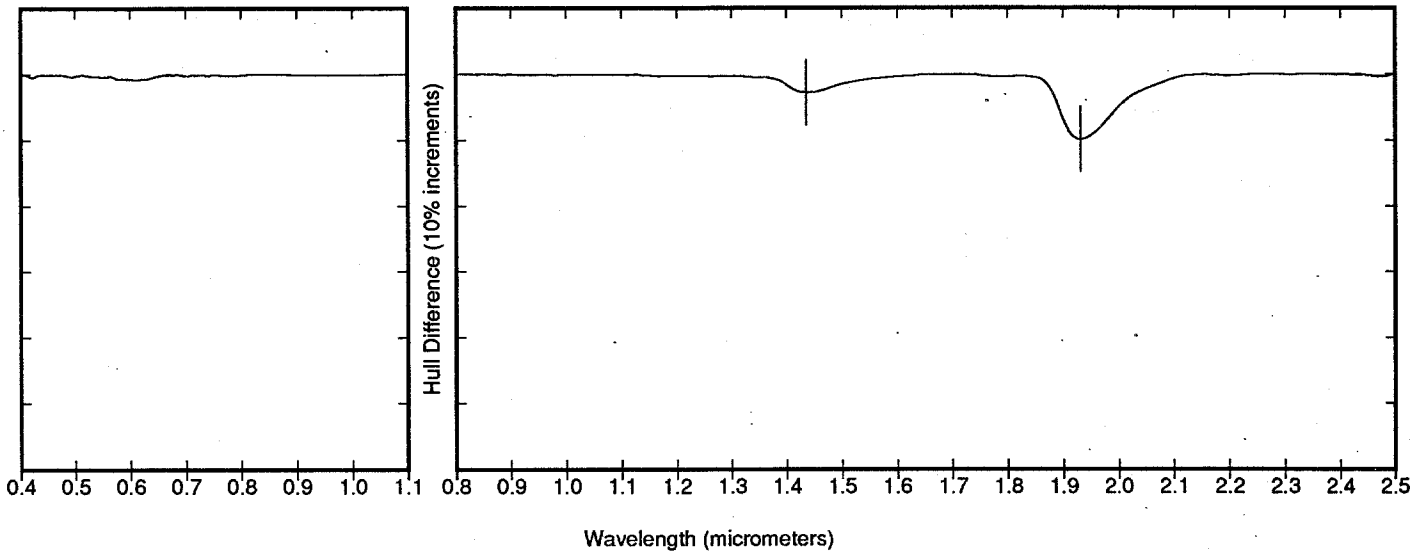
SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 11.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9280	2.6586	0.4054	0.8173
1.4200	1.1683	0.2030	0.7859
2.4720	0.5533	0.0408	3.1590



DESCRIPTION: FLUORITE
SAMPLE_NUM: H-02B
COUNTRY: UNITED KINGDOM
POLITICAL_SUBDIVISION: ENGLAND
GEOGRAPHICAL_REGION: DURHAM COUNTY
SITE: WEARDALE
COLLECTOR: WARD'S
MINERALOGY: FLUORITE(A)
CHEMICAL FORMULA: CaF_2

FLUORITE (H-02B)

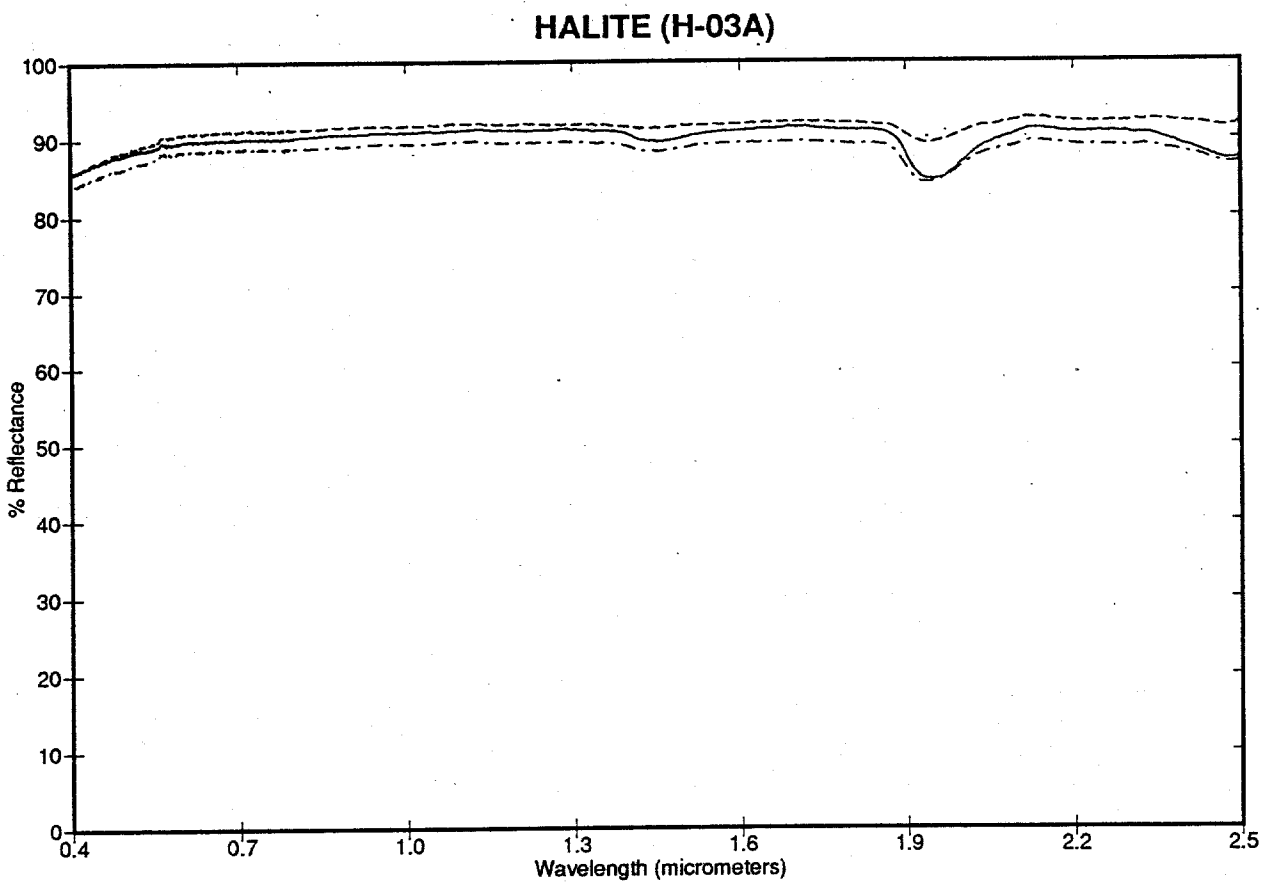


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9320	9.9334	1.2225	0.5390
1.4360	2.7955	0.3914	0.6204

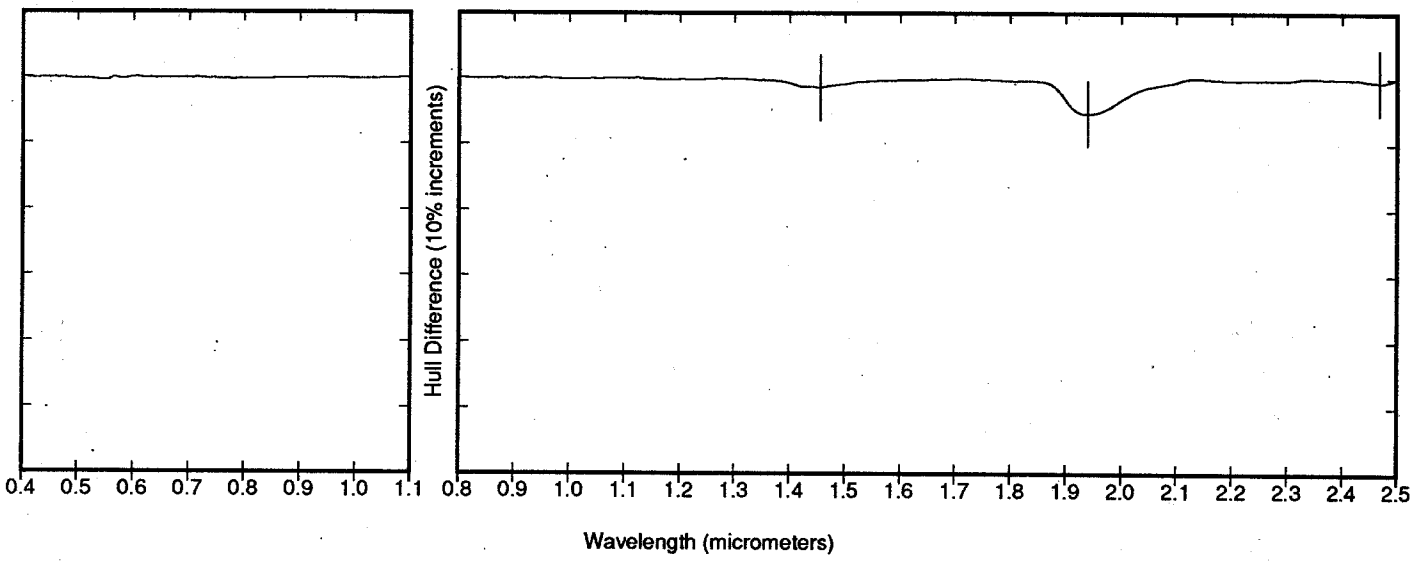
101



DESCRIPTION: HALITE
SAMPLE_NUM: H-03A
COUNTRY: USA
POLITICAL_SUBDIVISION: MICHIGAN
GEOGRAPHICAL_REGION: WAYNE COUNTY
SITE: DETROIT
COLLECTOR: WARD'S
MINERALOGY: HALITE(A)
CHEMICAL FORMULA: NaCl

102

HALITE (H-03A)

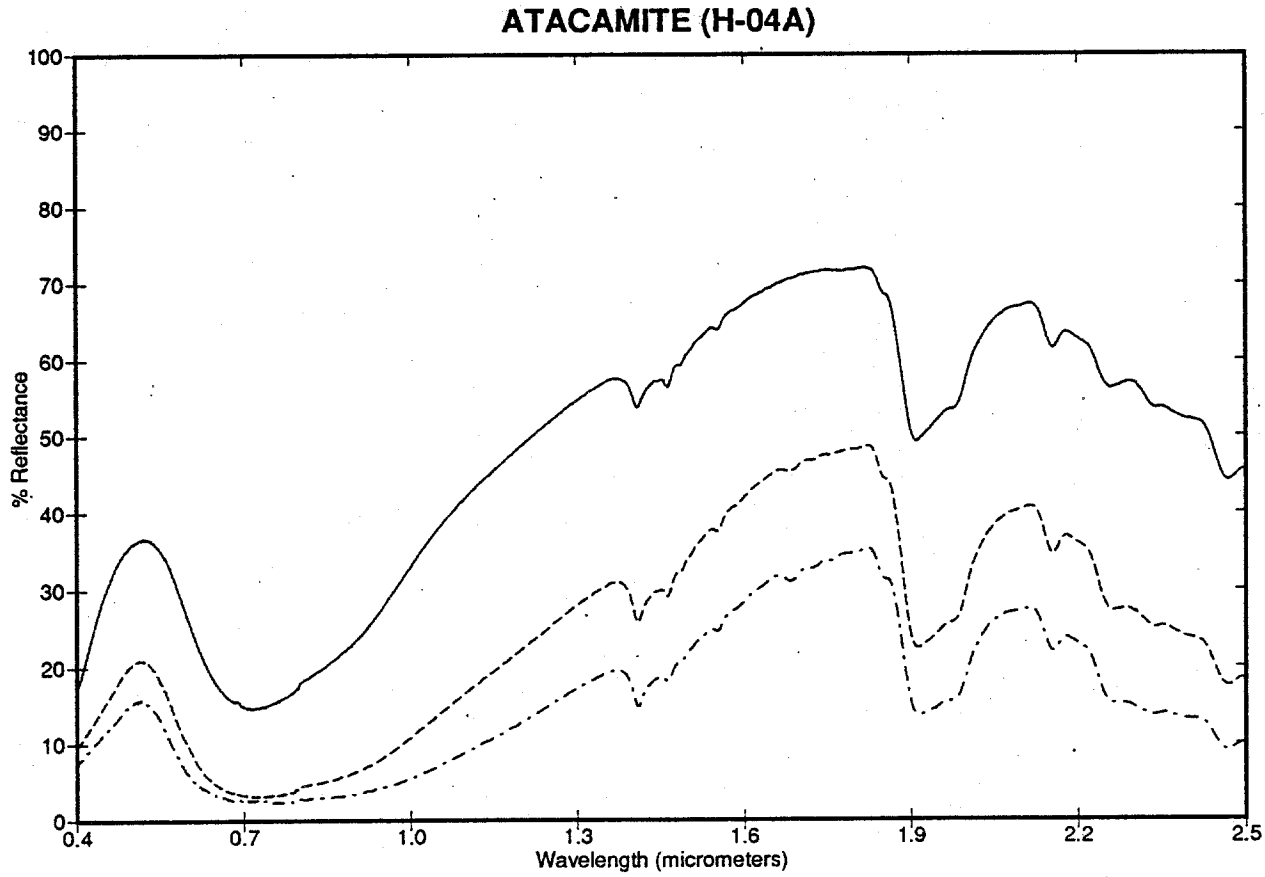


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

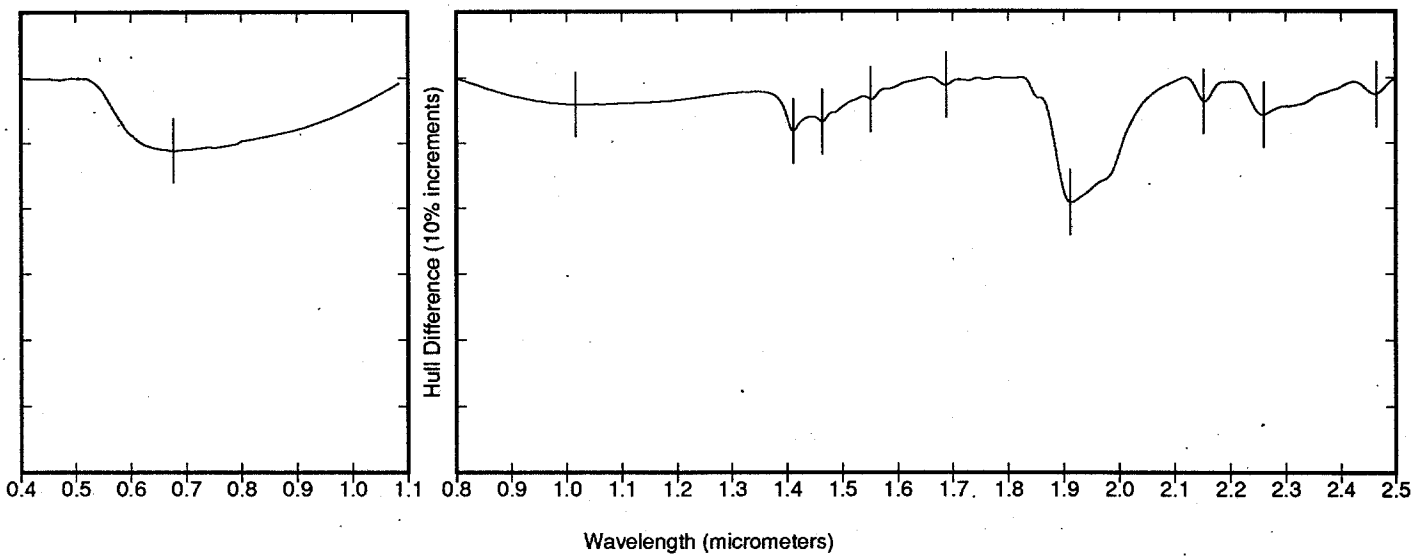
WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9400	5.3880	0.7111	0.6089
1.4560	1.4569	0.1941	0.9854
2.4680	0.5771	0.0267	1.3381

103



DESCRIPTION: ATACAMITE
SAMPLE_NUM: H-04A
COUNTRY: CHILE
POLITICAL_SUBDIVISION: ATACAMA
GEOGRAPHICAL_REGION: COPIAPO
SITE: COPIAPO
COLLECTOR: GRIEGER'S INC
MINERALOGY: ATACAMITE(A),CHRYSOCOLLA(M)
CHEMICAL FORMULA: $Cu_2Cl(OH)_3$

ATACAMITE (H-04A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 39.0000

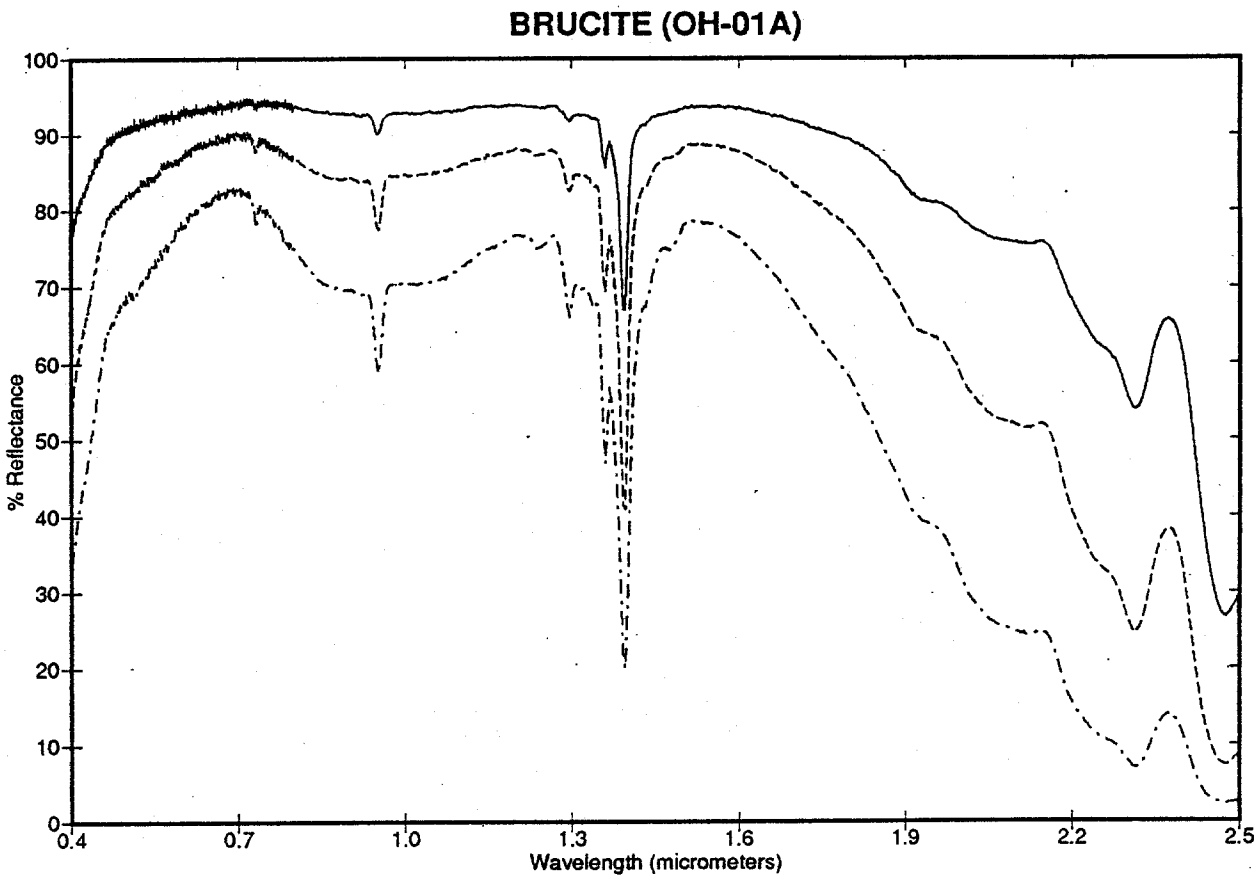
WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6770	11.1997	4.1822	0.3626

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = . 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9120	19.2020	2.5418	0.3452
1.4120	8.2355	0.5490	1.2868
1.4640	6.8477	0.4451	0.2970
2.2600	5.7581	0.7120	0.3309
1.0160	4.1301	1.6130	0.5380
2.1520	3.6900	0.1267	0.6912
1.5520	3.4008	0.1689	0.2860
2.4640	2.5070	0.1111	1.4185
1.6880	1.2193	0.0341	1.0749

125

HYDROXIDES



DESCRIPTION: BRUCITE
SAMPLE_NUM: OH-01A
COUNTRY: USA
POLITICAL_SUBDIVISION: NEVADA
GEOGRAPHICAL_REGION: NYE COUNTY
SITE: GABBS
COLLECTOR: JPL
MINERALOGY: BRUCITE(A)
CHEMICAL FORMULA: $Mg(OH)_2$

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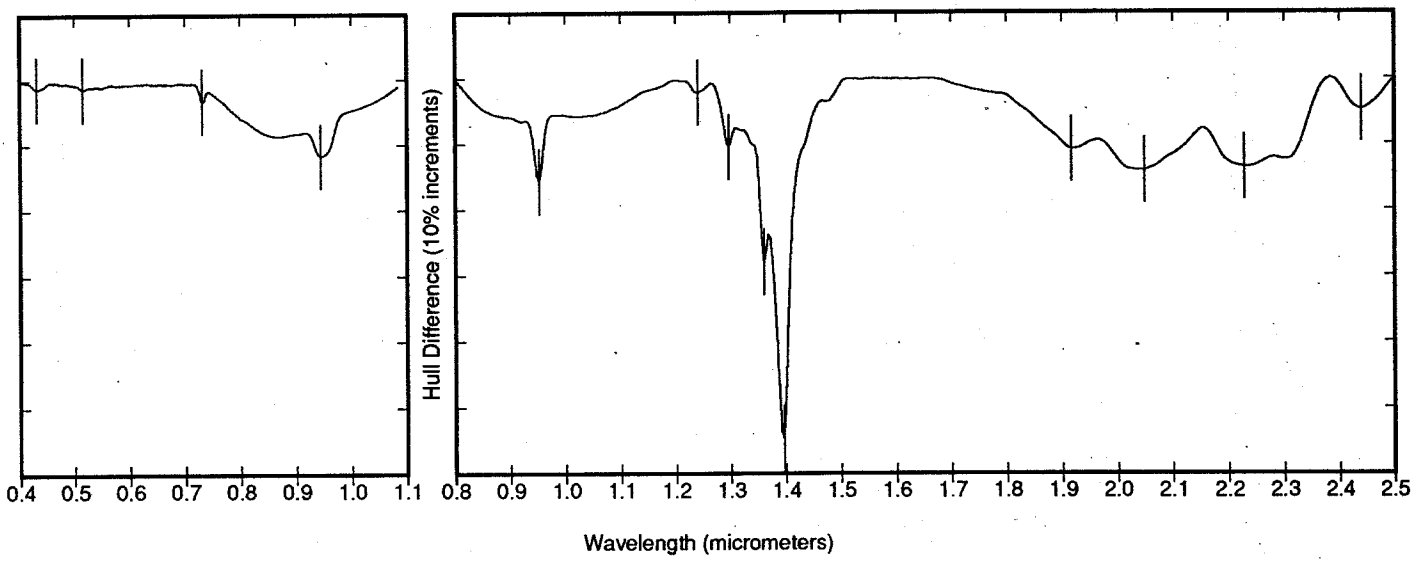
BRUCITE (OH-01A)



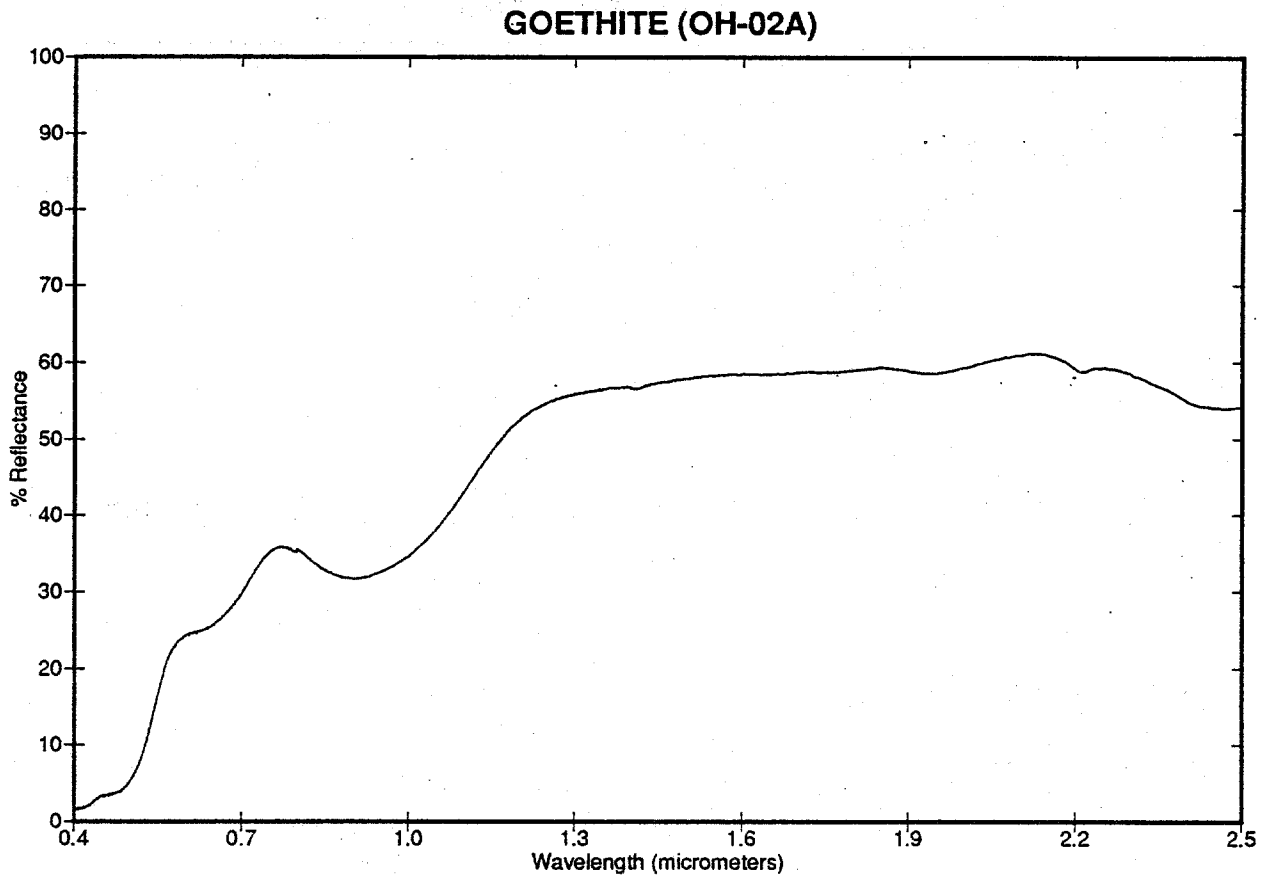
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 28.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9440	11.5600	2.0490	1.9758
0.7310	3.0868	0.0460	0.7607
0.5150	1.2417	0.0243	0.8642
0.4310	1.1578	0.0269	0.6073

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 34.0000

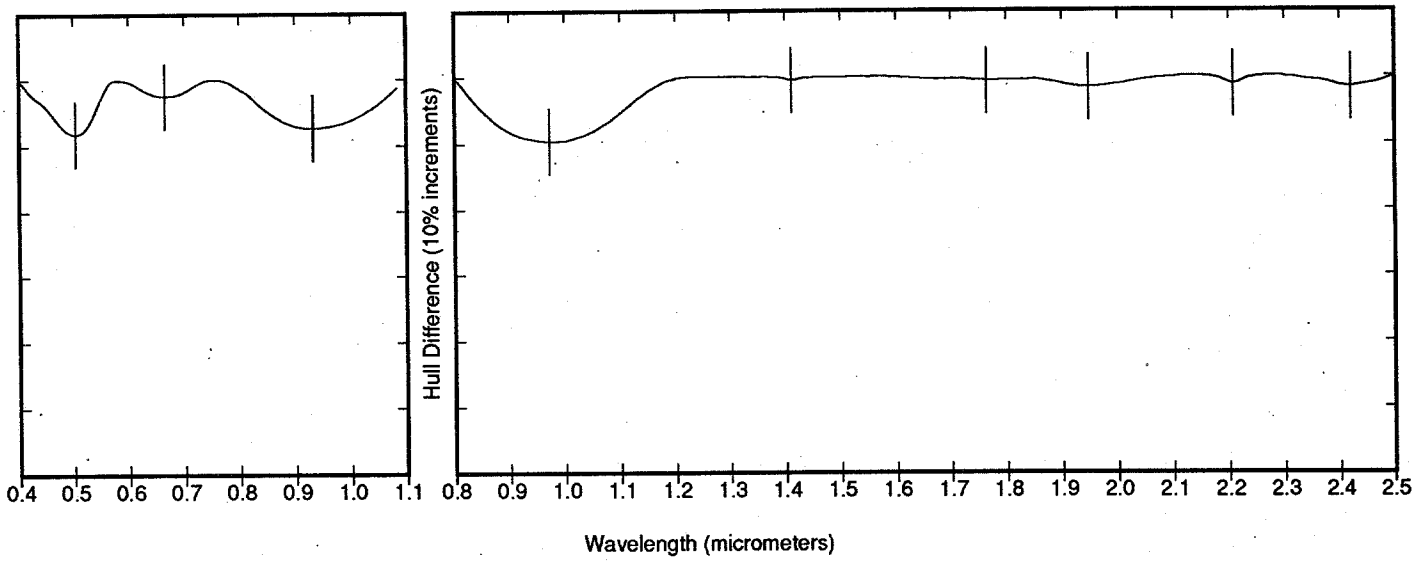
WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3960	54.6232	2.2658	0.8801
1.3600	27.8772	0.8091	2.8740
0.9520	15.6921	1.8921	0.7515
2.0480	14.0692	2.3746	0.9511
2.2280	13.6169	2.2969	0.5613
1.9160	10.8917	1.3644	2.6154
1.2960	10.4465	0.2521	1.3342
2.4400	4.7399	0.3091	0.8369
1.2400	2.1271	0.0636	0.7619

108



DESCRIPTION: GOETHITE
SAMPLE_NUM: OH-02A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: SAN DIEGO COUNTY
SITE: JULIAN
COLLECTOR: BURMINCO
MINERALOGY: GOETHITE(A)
CHEMICAL FORMULA: α $Fe^{3+}O(OH)$

GOETHITE (OH-02A)



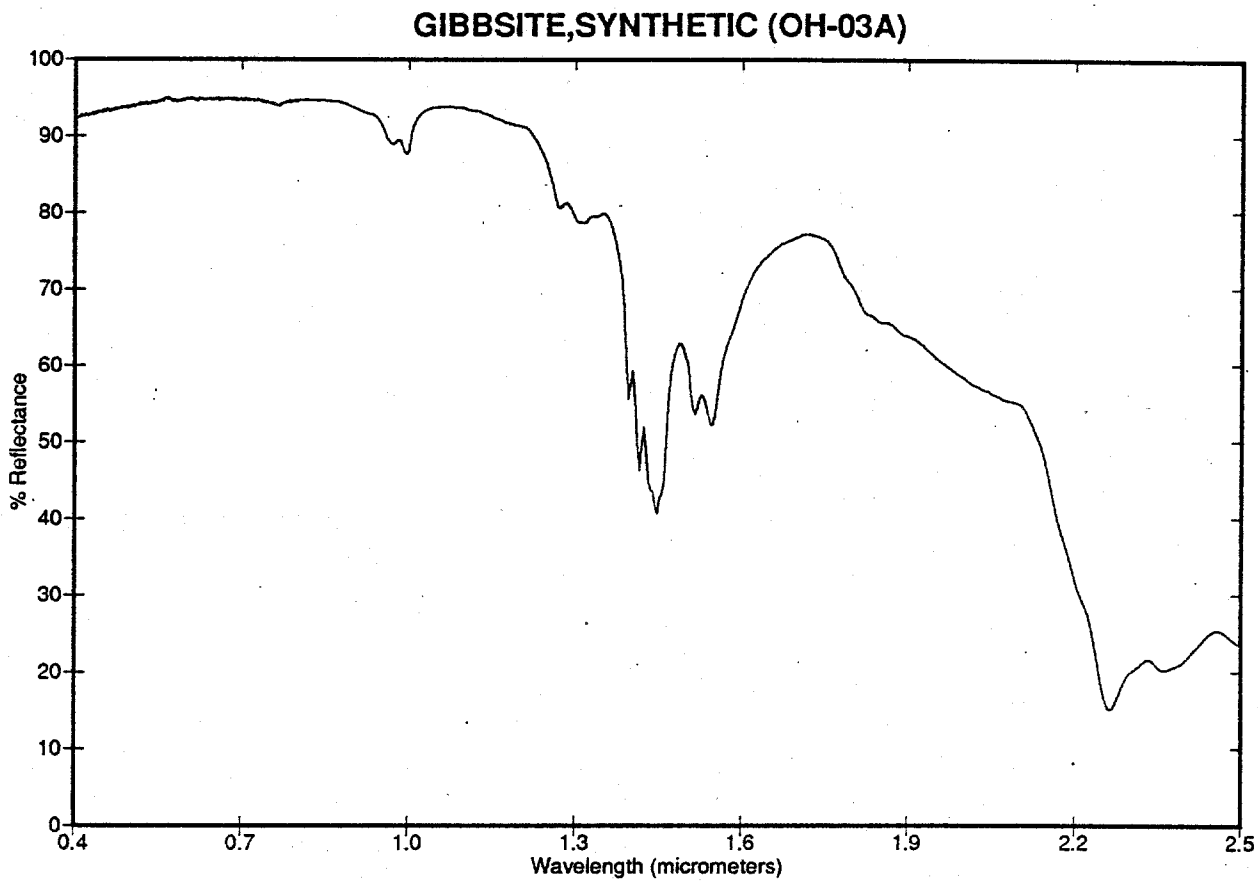
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5030	8.1560	0.7789	1.4230
0.9320	7.3004	1.5166	0.8719
0.6650	2.4675	0.2197	0.9288

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

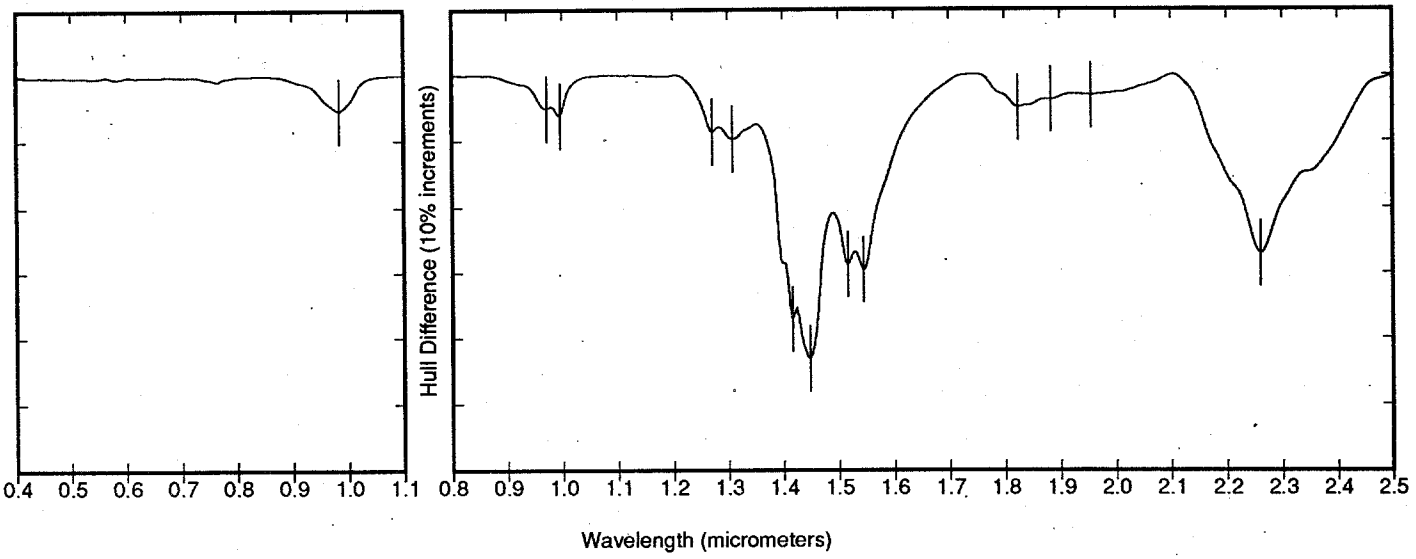
WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9720	9.6238	2.4274	0.8583
1.9480	1.6950	0.2555	0.7821
2.4200	1.6560	0.1821	1.1872
2.2080	1.2017	0.0556	0.9750
1.7640	0.6683	0.0898	0.8288
1.4120	0.5417	0.0309	0.5217

110



DESCRIPTION: GIBBSITE,SYNTHETIC
SAMPLE_NUM: OH-03A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: GIBBSITE(A)
CHEMICAL FORMULA: $Al(OH)_3$

GIBBSITE,SYNTHETIC (OH-03A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9840	5.4199	0.4036	1.4989

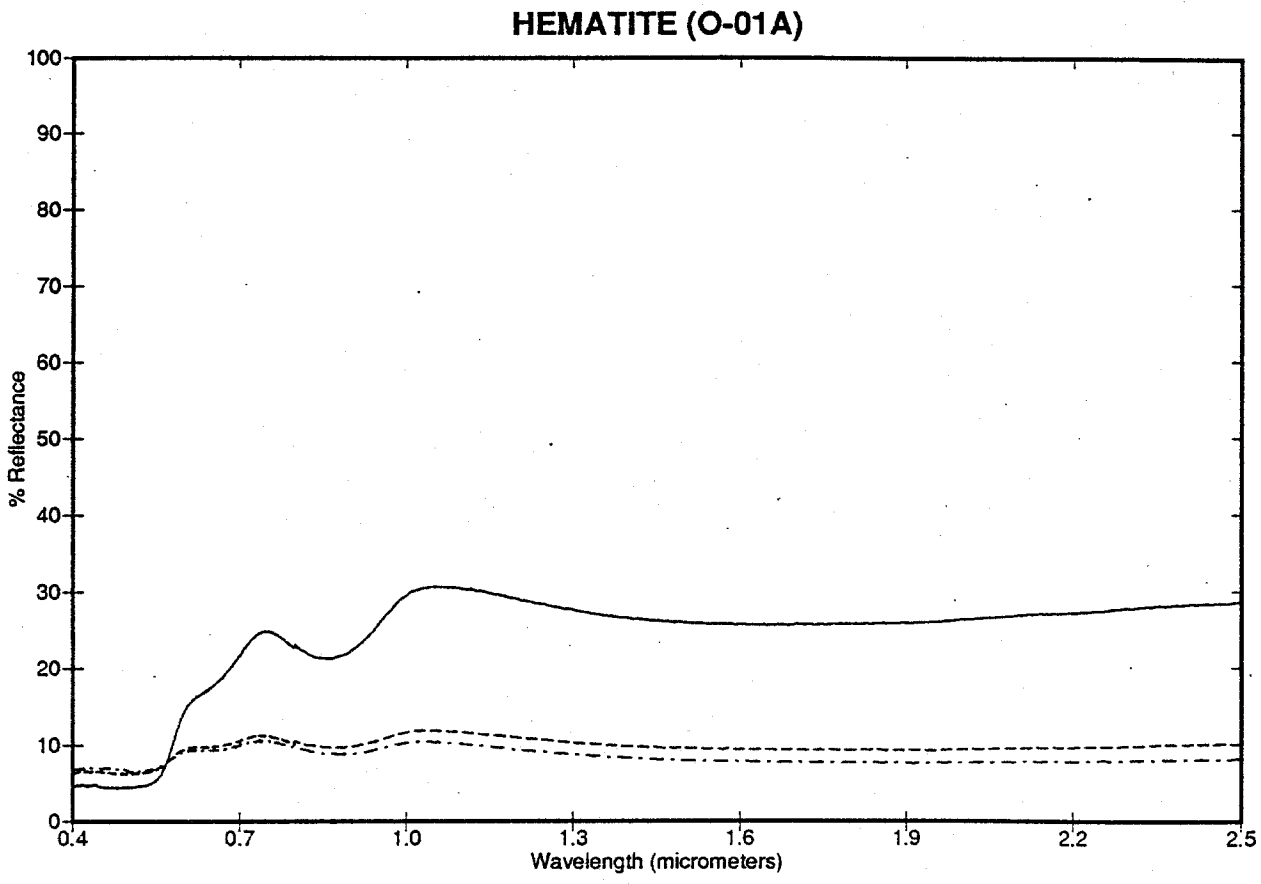
SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE =. 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4480	43.0577	2.2080	0.7750
1.4160	37.0254	1.4981	4.1725
1.5440	29.4912	2.1146	0.2673
1.5160	28.7213	1.0036	2.0154
2.2600	27.0055	4.5747	0.6737
1.3080	9.7547	0.5920	0.5663
1.2720	8.6600	0.3116	2.1397
0.9960	6.2108	0.1861	0.8963
0.9720	5.1532	0.2211	4.5515
1.8240	5.0309	0.4086	0.7648
1.8840	3.8188	0.1886	0.1919
1.9560	3.1909	0.3748	0.2475

112

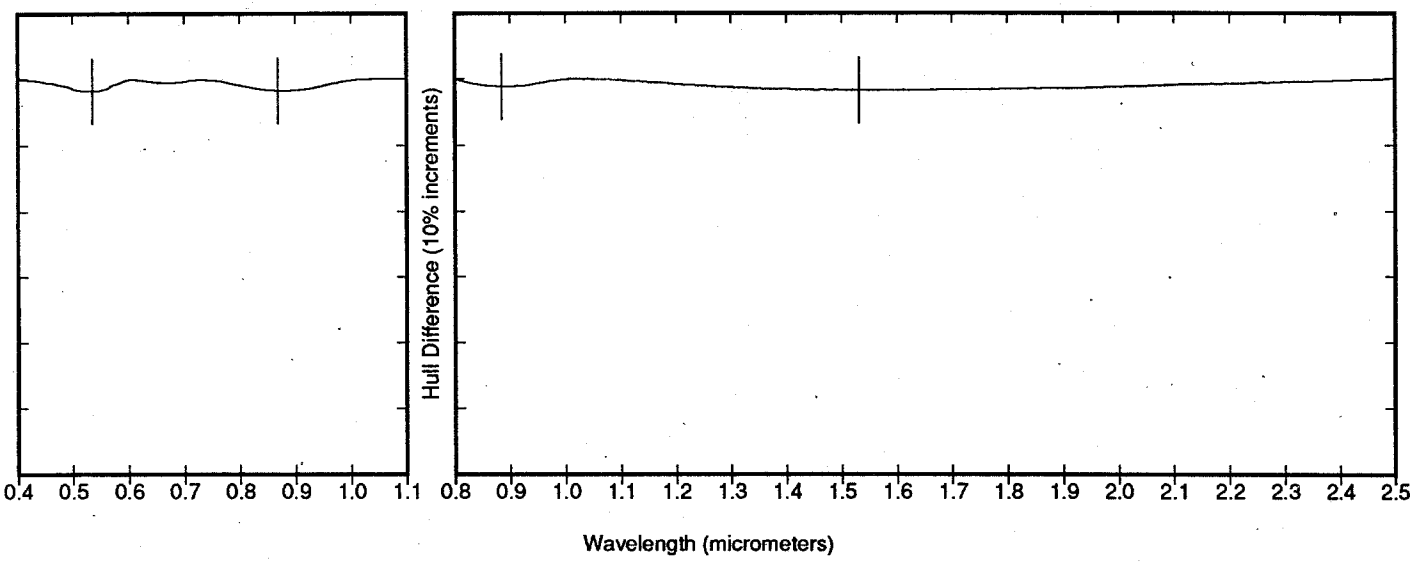
OXIDES

113



DESCRIPTION: HEMATITE
SAMPLE_NUM: O-01A
COUNTRY: USA
POLITICAL_SUBDIVISION: ALABAMA
GEOGRAPHICAL_REGION: BIRMINGHAM
SITE: BIRMINGHAM
COLLECTOR: BURMINCO
MINERALOGY: HEMATITE(A),QUARTZ(M),CALCITE(M)
CHEMICAL FORMULA: $\propto Fe_2O_3$

HEMATITE (O-01A)



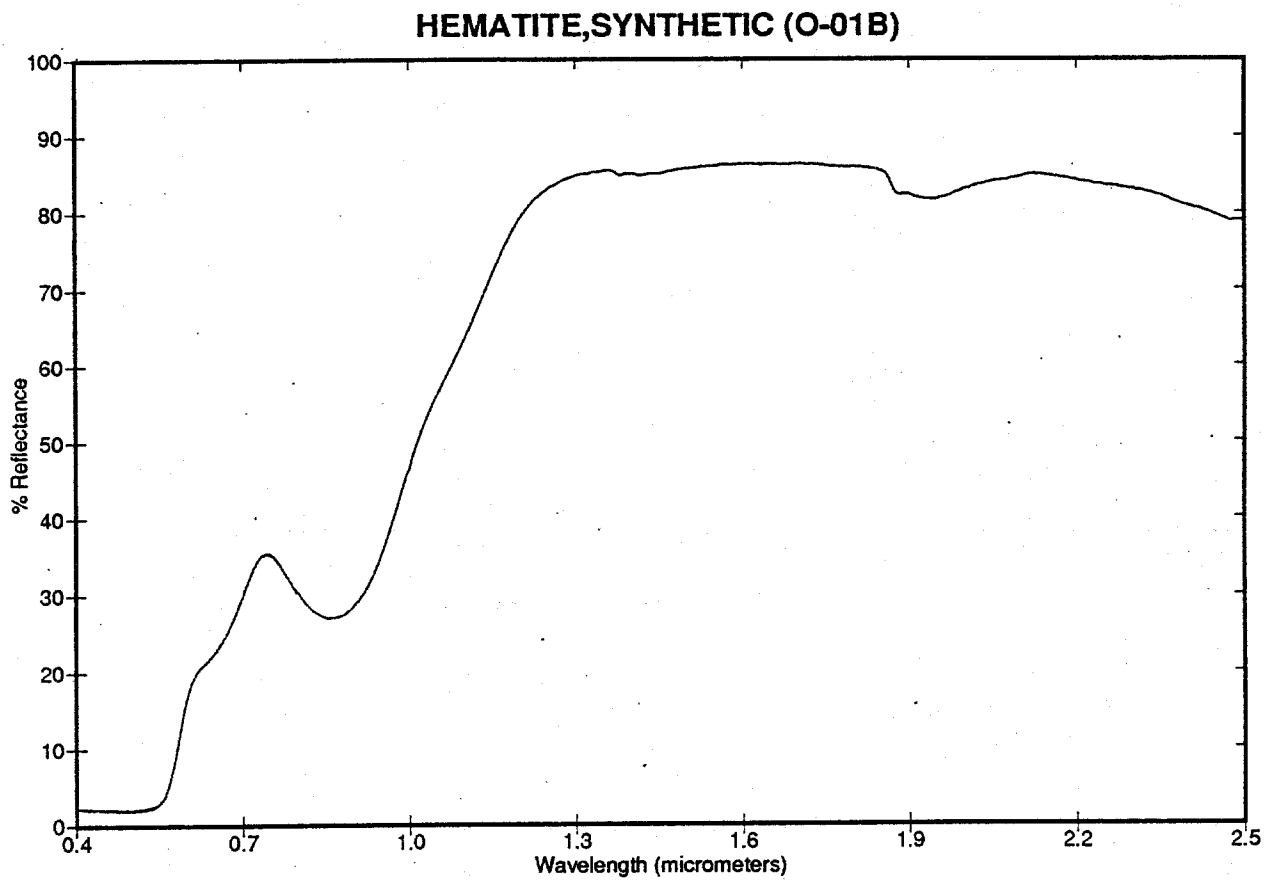
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 20.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5350	1.7742	0.1808	1.5786
0.8680	1.6990	0.2754	0.7841

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.5320	1.7826	1.6022	0.5076
0.8840	1.1813	0.1500	0.7348

115



DESCRIPTION: HEMATITE,SYNTHETIC
SAMPLE_NUM: O-01B
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: BAKER,J.T.
MINERALOGY: HEMATITE(A)
CHEMICAL FORMULA: $\propto Fe_2O_3$

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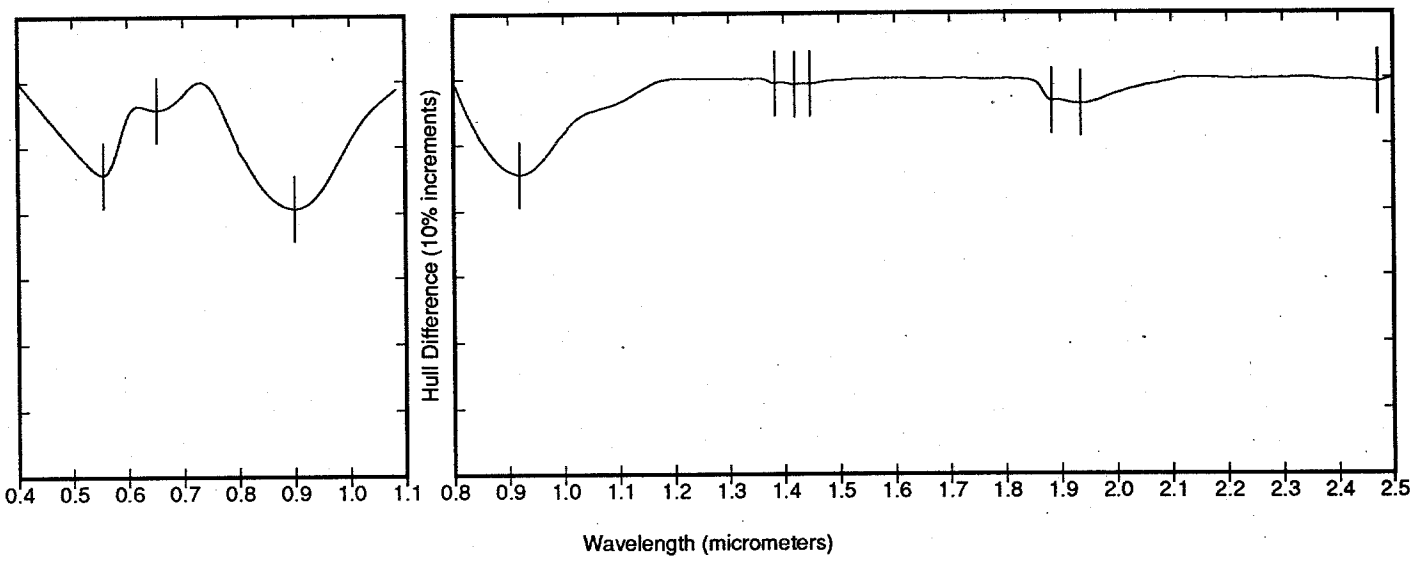
HEMATITE,SYNTHETIC (O-01B)



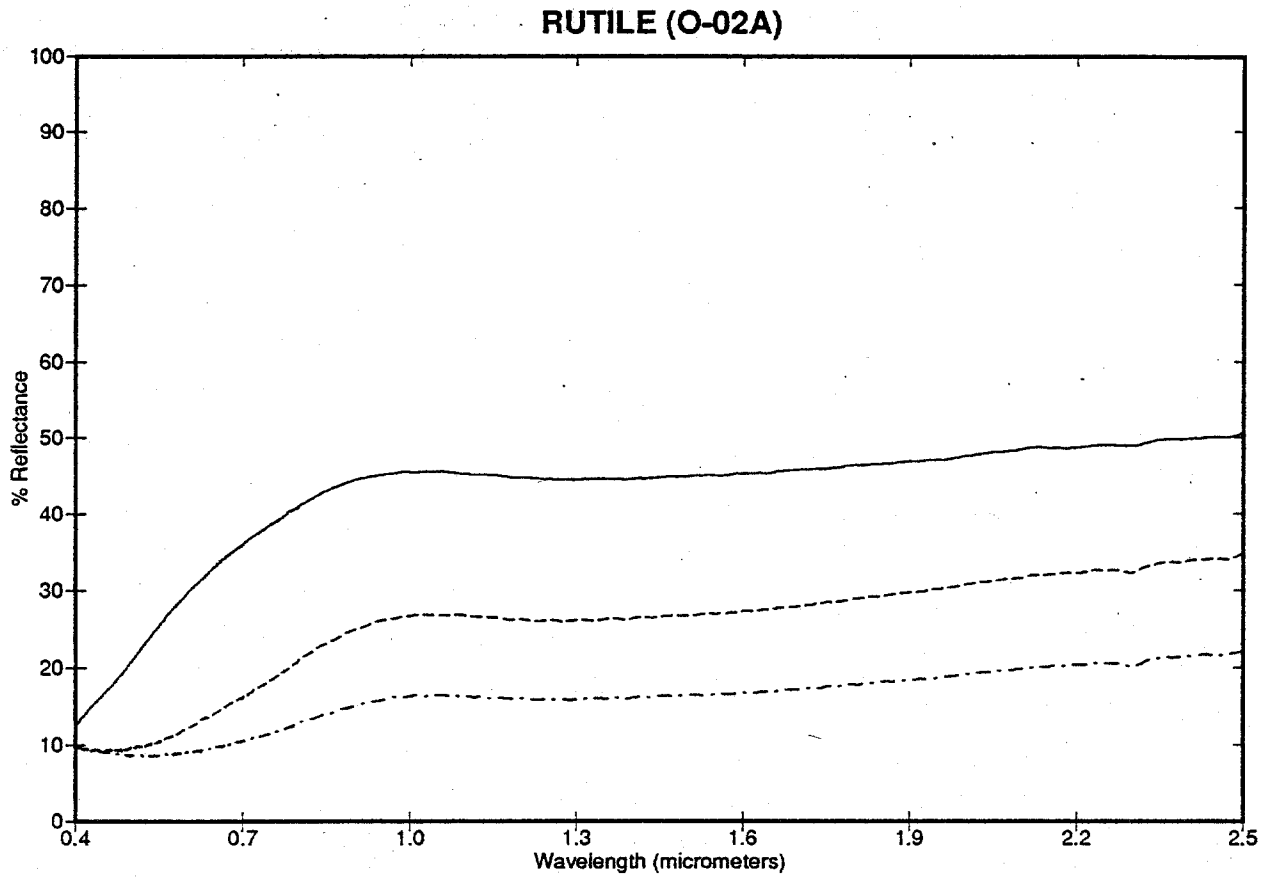
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9000	19.2750	3.8311	0.9759
0.5560	14.1390	1.7403	2.1624
0.6530	4.2176	0.3069	0.6728

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 6.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9200	14.5127	2.7764	0.6959
1.9360	3.9443	0.5022	0.4225
1.8840	3.5200	0.1210	1.9221
1.4200	0.8910	0.0396	1.0643
1.4480	0.8015	0.0420	0.0811
1.3840	0.7371	0.0164	2.0866
2.4720	0.7127	0.0367	2.2662

117



DESCRIPTION: RUTILE
SAMPLE_NUM: O-02A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: RUTILE(A),CALCITE(T),FELDSPAR(T)
CHEMICAL FORMULA: TiO_2

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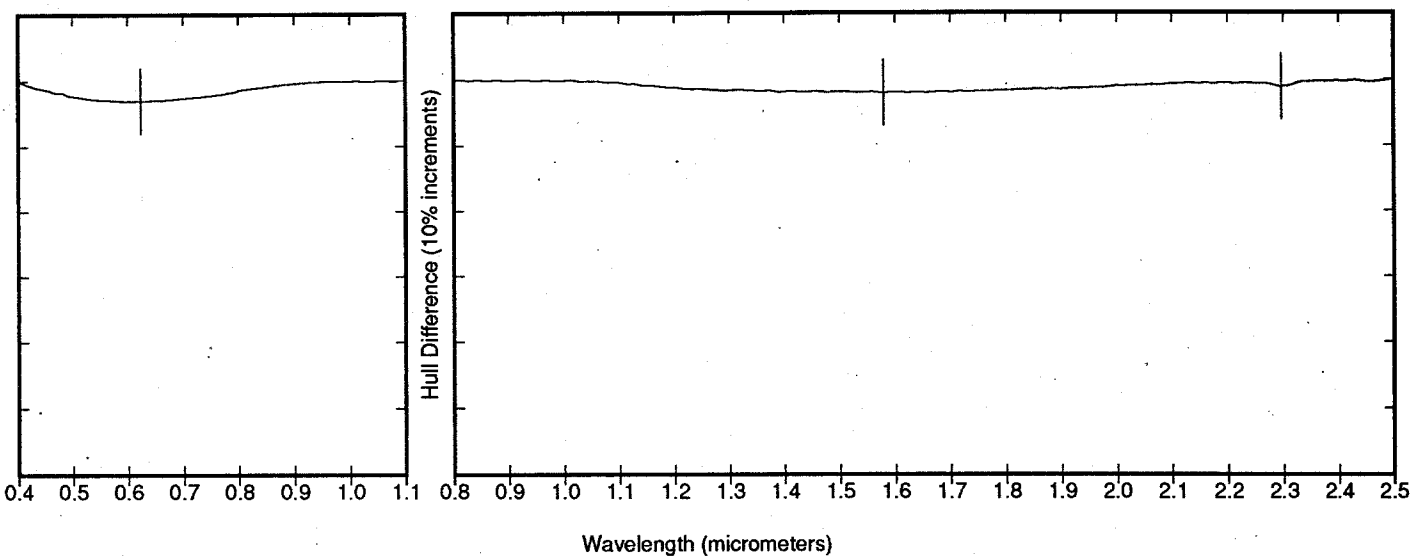
RUTILE (O-02A)



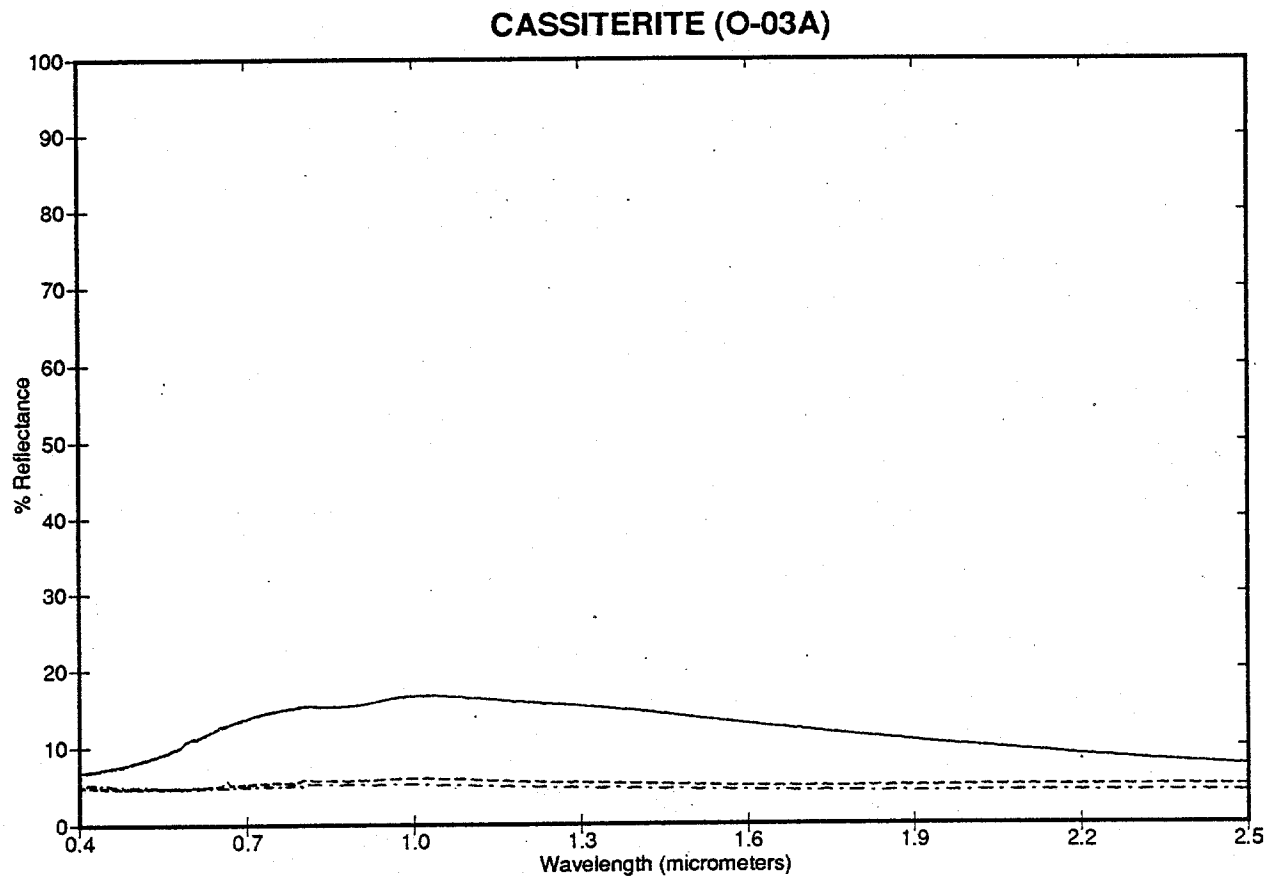
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 21.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6230	3.0259	0.9923	0.8714

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

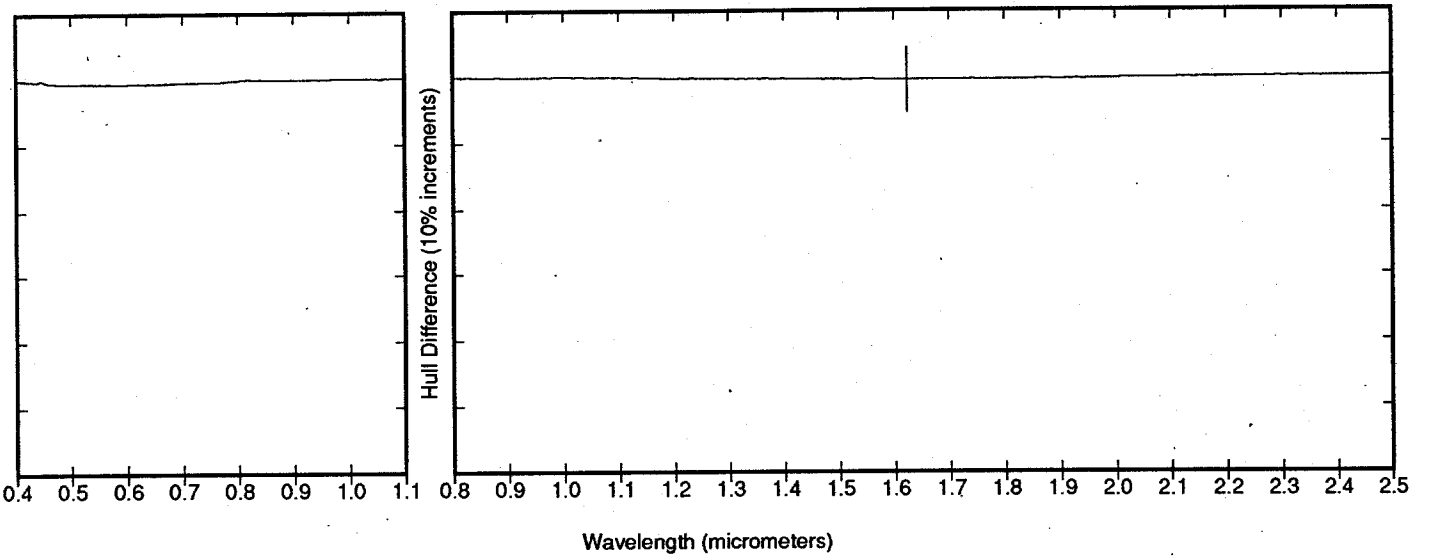
WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.5800	2.0636	1.6834	0.8616
2.2960	1.1510	0.0823	0.3250

119



DESCRIPTION: CASSITERITE
SAMPLE_NUM: O-03A
COUNTRY: USA
POLITICAL_SUBDIVISION: SOUTH DAKOTA
GEOGRAPHICAL_REGION: LAWRENCE COUNTY
SITE: TINTON
COLLECTOR: BURMINCO
MINERALOGY: CASSITERITE(A),UNIDENTIFIED PHASE(T)
CHEMICAL FORMULA: SnO_2

CASSITERITE (O-03A)

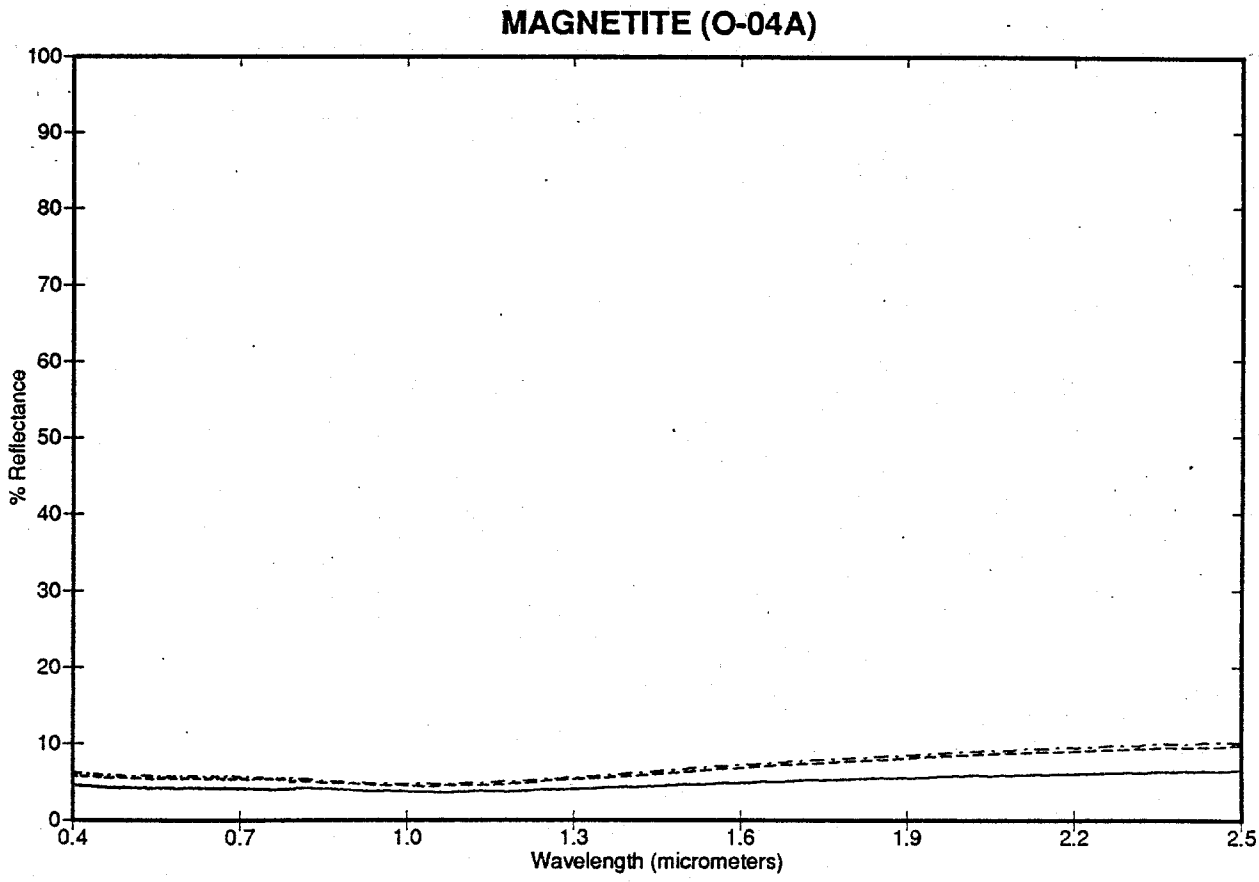


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

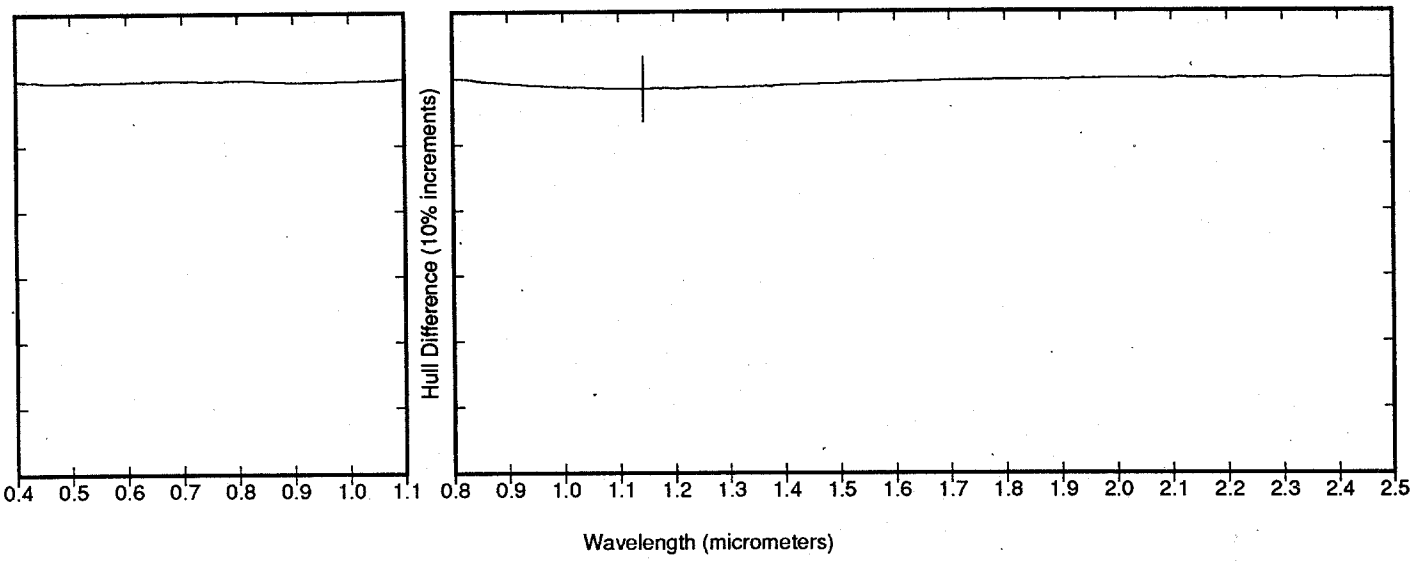
WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.6240	0.5356	0.2132	0.4495

121



DESCRIPTION: MAGNETITE
SAMPLE_NUM: O-04A
COUNTRY: CANADA
POLITICAL_SUBDIVISION: ONTARIO
GEOGRAPHICAL_REGION: HALIBURTON COUNTY
SITE: WILBERFORCE
COLLECTOR: WARD'S
MINERALOGY: MAGNETITE(A)
CHEMICAL FORMULA: $Fe^{2+}Fe_2^{3+}O_4$

MAGNETITE (O-04A)

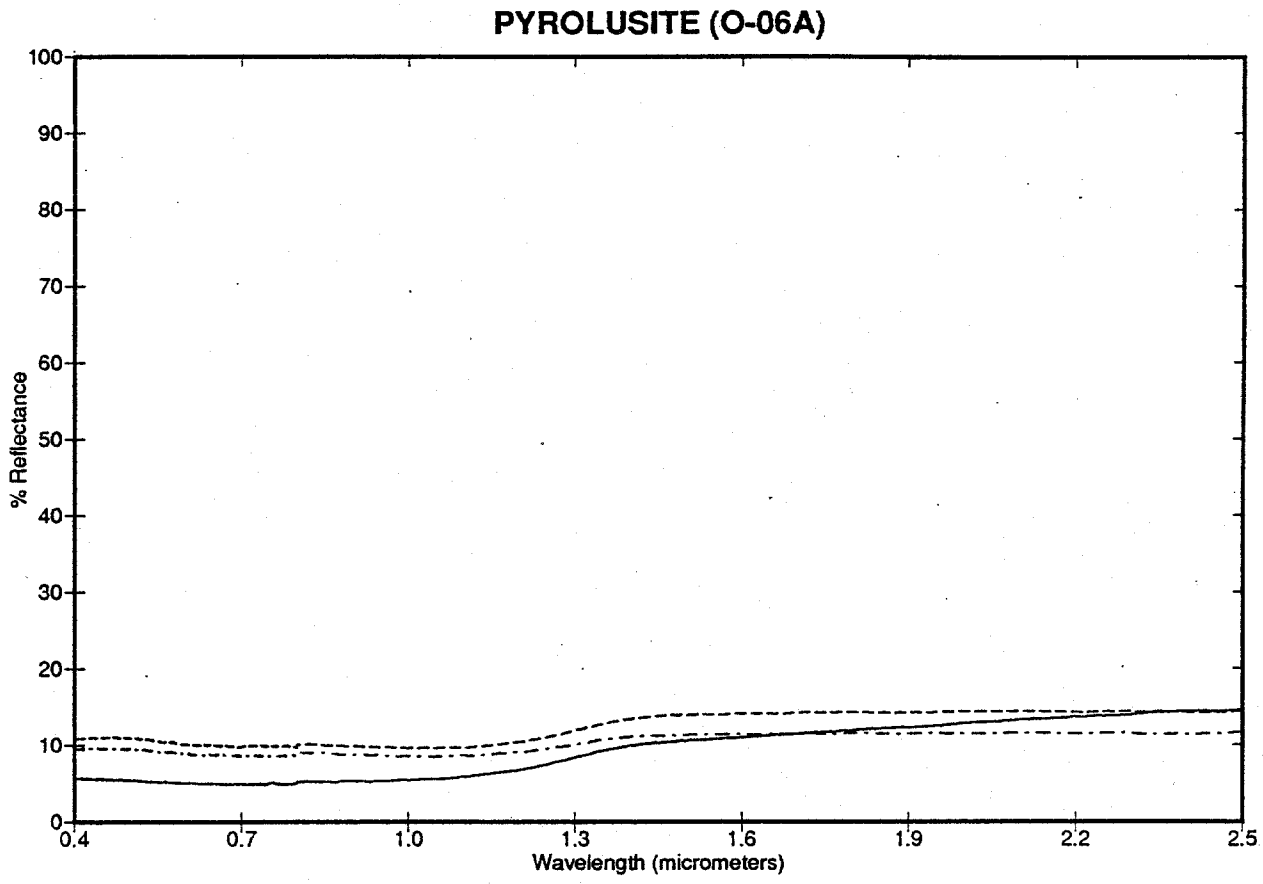


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.1440	1.6112	1.0174	0.5403

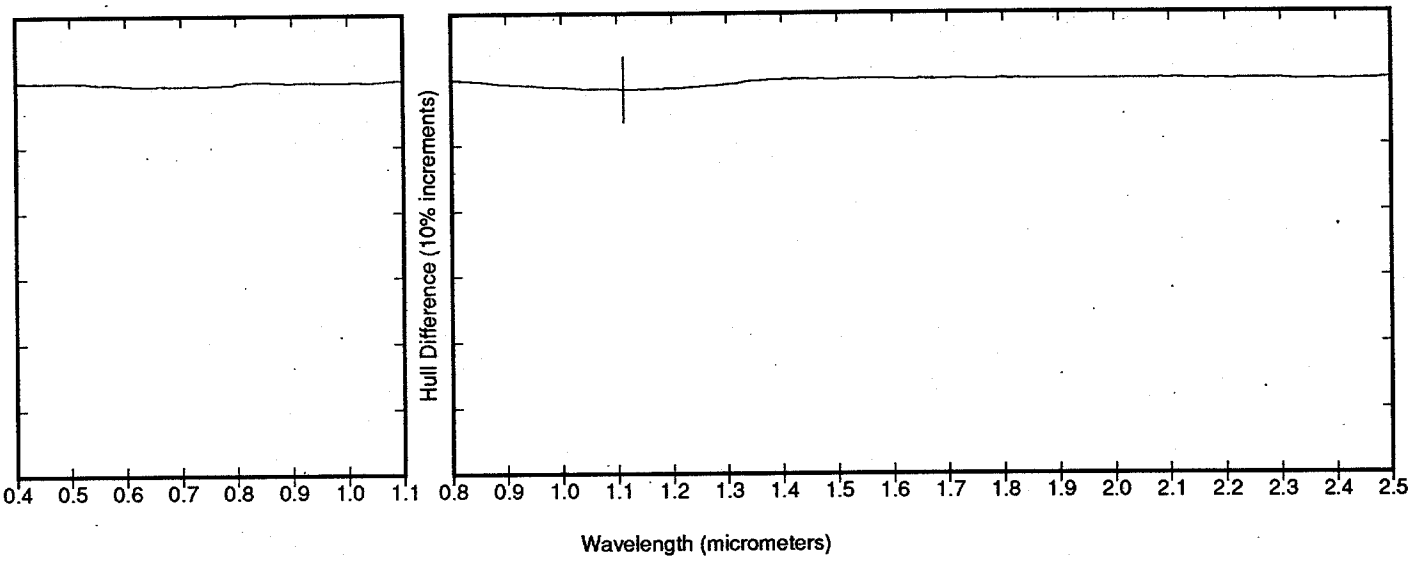
123



DESCRIPTION: PYROLUSITE
SAMPLE_NUM: O-06A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: CHIHUAHUA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: GRIEGER'S INC
MINERALOGY: PYROLUSITE(A),RAMSDELLITE(M)
CHEMICAL FORMULA: MnO_2

124

PYROLUSITE (O-06A)

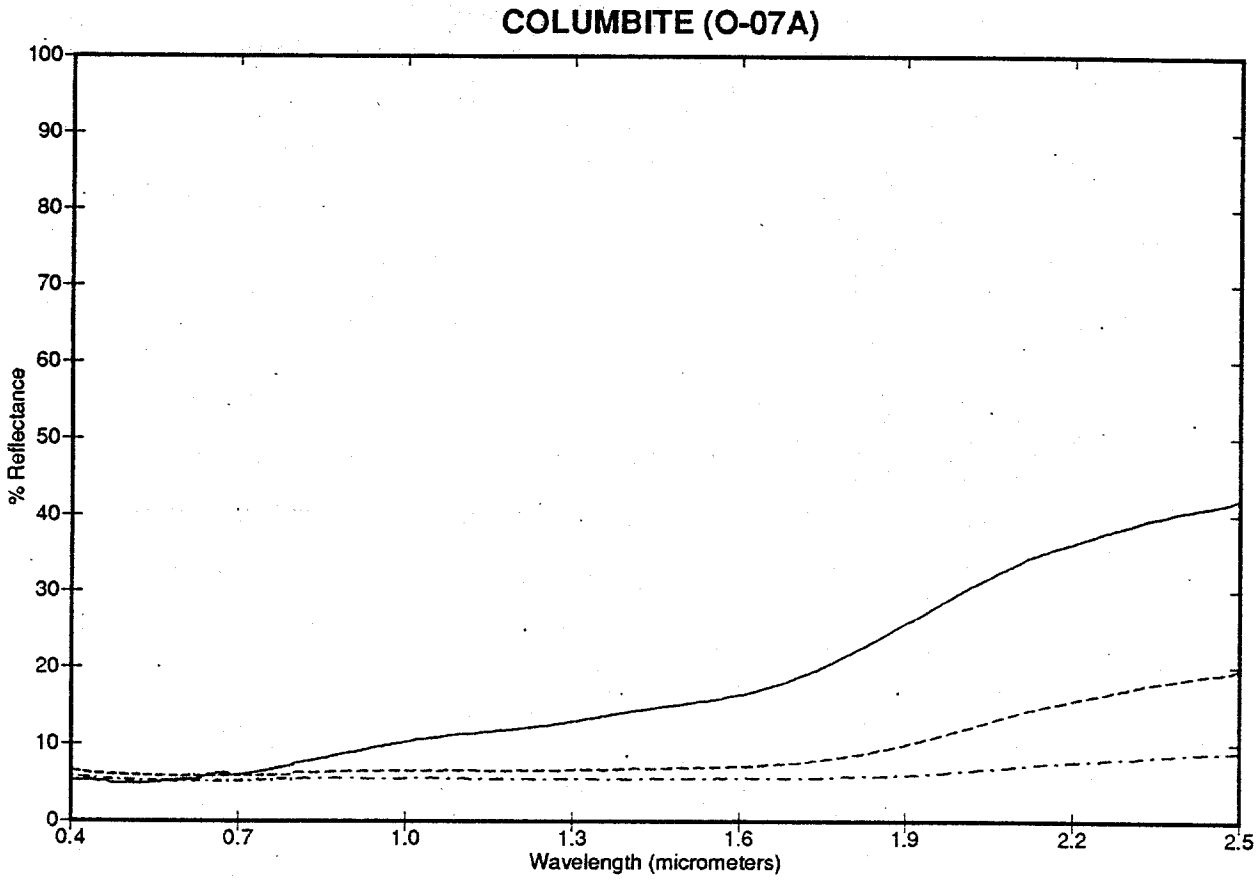


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.1120	1.6006	0.5711	1.0411

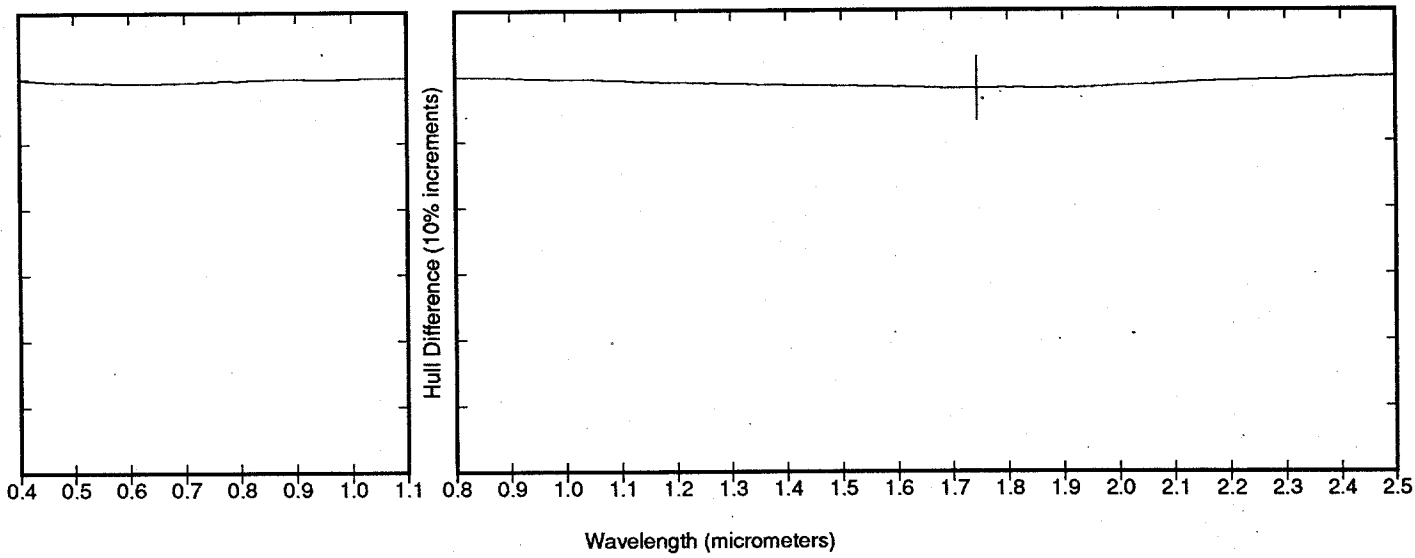
125



DESCRIPTION: COLUMBITE
SAMPLE_NUM: O-07A
COUNTRY: USA
POLITICAL_SUBDIVISION: SOUTH DAKOTA
GEOGRAPHICAL_REGION: PENNINGTON COUNTY
SITE: KEYSTONE
COLLECTOR: BURMINCO
MINERALOGY: COLUMBITE(A)
CHEMICAL FORMULA: $Fe^{2+}Nb_2O_6$

126

COLUMBITE (O-07A)

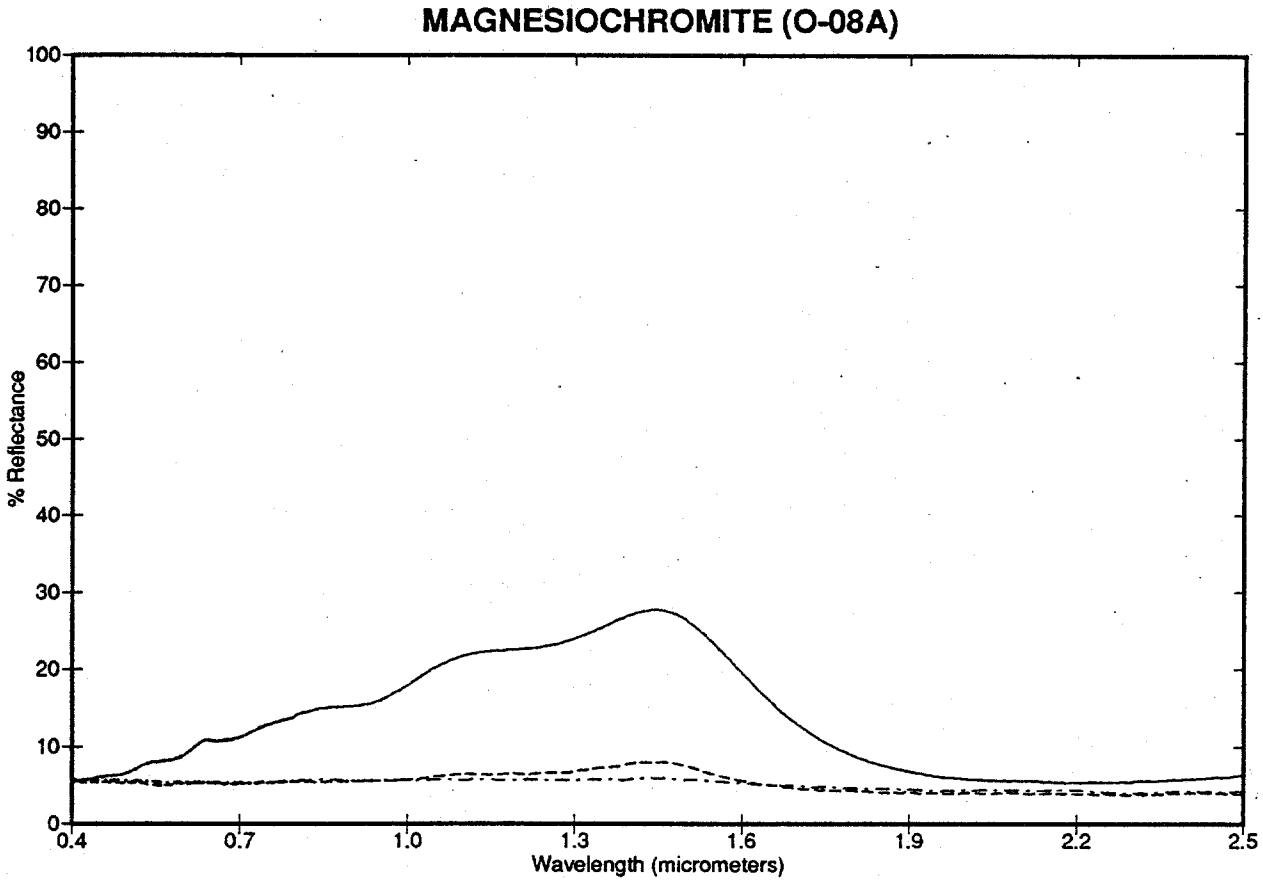


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.7440	1.8945	1.7063	1.1624

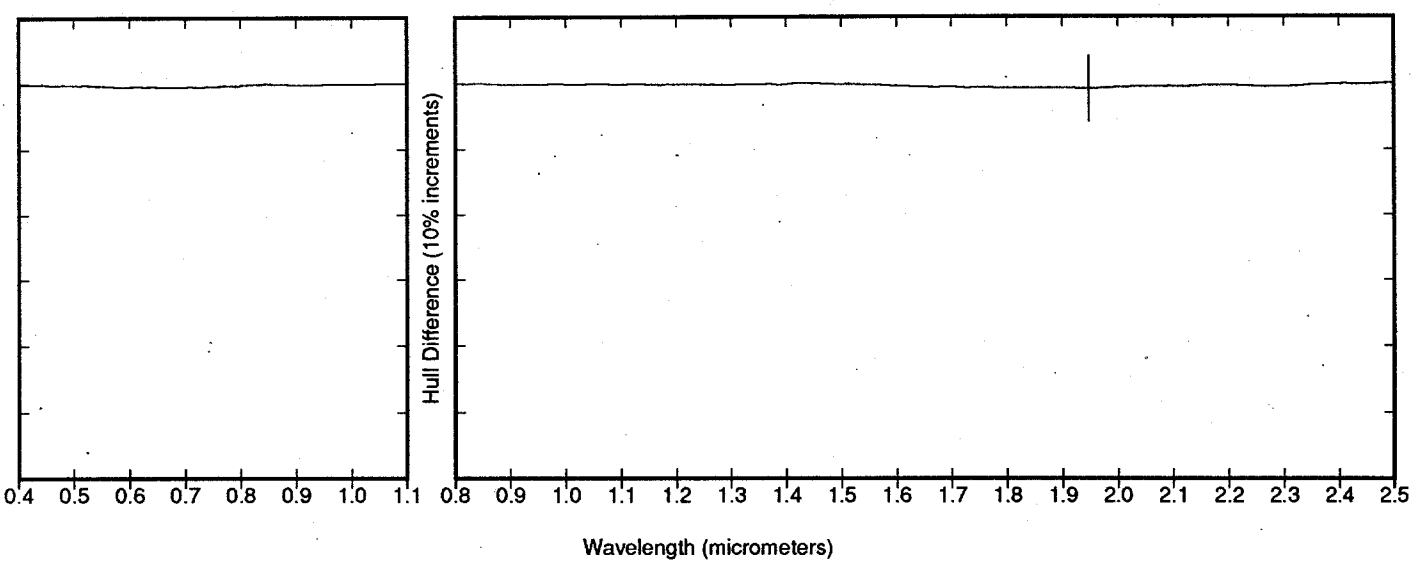
127



DESCRIPTION: MAGNESIOCHROMITE
SAMPLE_NUM: 0-08A
COUNTRY: CANADA
POLITICAL_SUBDIVISION: QUEBEC
GEOGRAPHICAL_REGION: COLERAINE TOWNSHIP
SITE: COLERAINE TOWNSHIP
COLLECTOR: WARD'S
MINERALOGY: MAGNESIOCHROMITE(A),CLINOCHLORE(A)
CHEMICAL_FORMULA: $MgCr_2O_4$

138

MAGNESIOCHROMITE (O-08A)

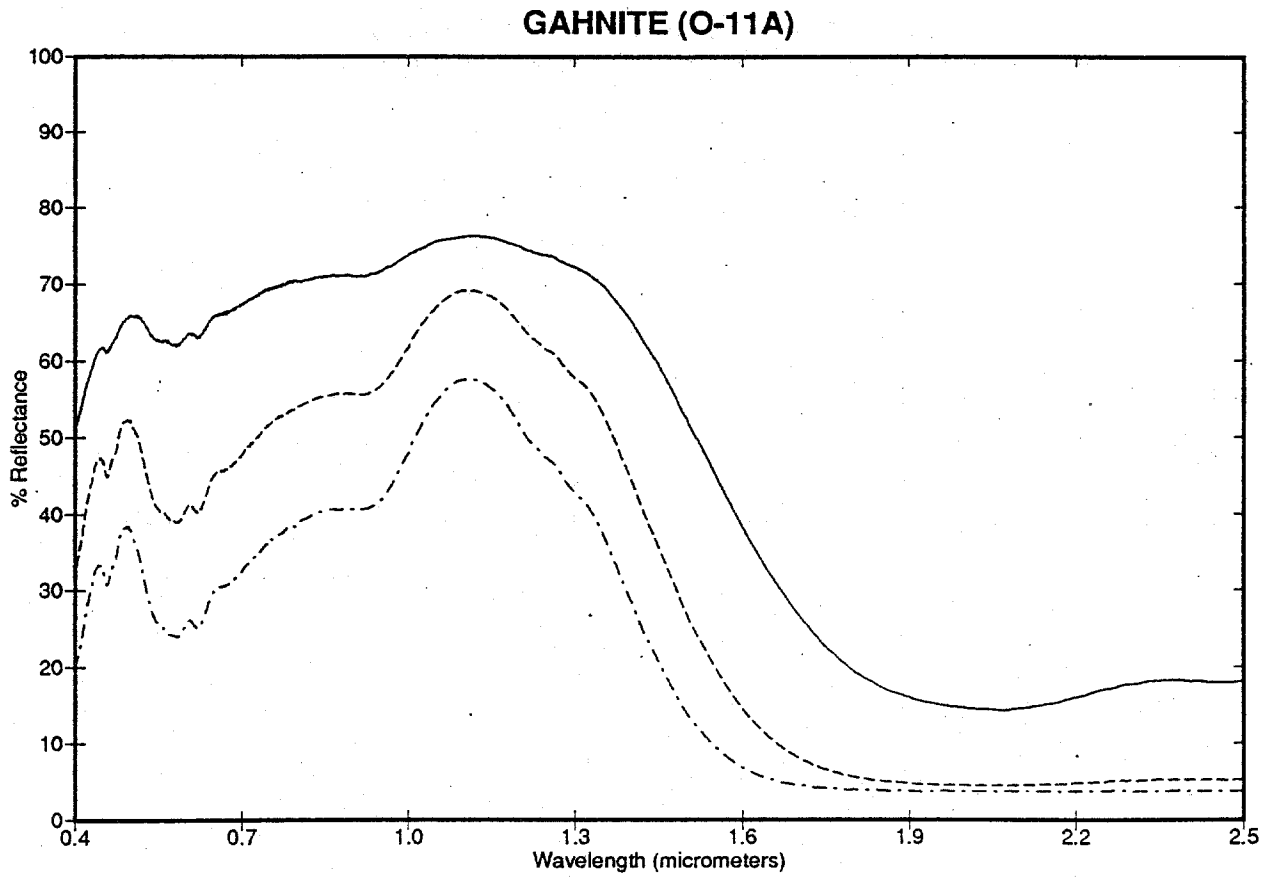


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9480	0.8892	0.5365	1.1253

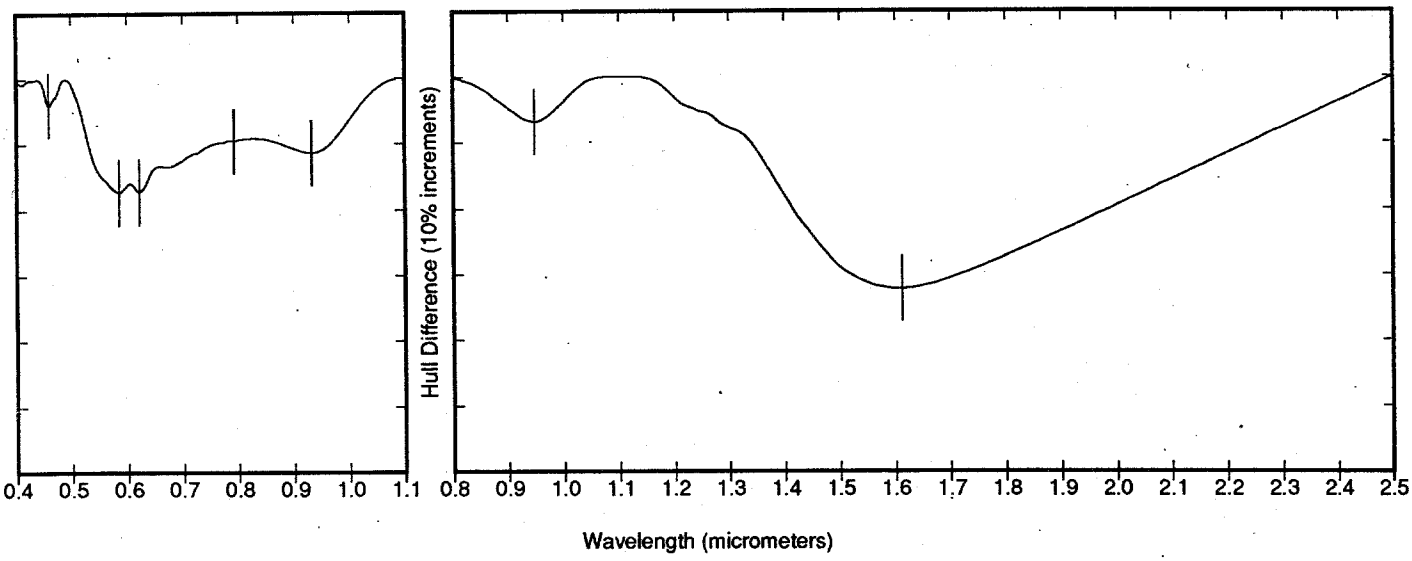
129



DESCRIPTION: GAHNITE
SAMPLE_NUM: O-11A
COUNTRY: NIGERIA
POLITICAL_SUBDIVISION: KADUNA
GEOGRAPHICAL_REGION: JEMAA
SITE: GODOGODO MINE
COLLECTOR: NEW,DAVID
MINERALOGY: GAHNITE(A)
CHEMICAL FORMULA: $ZnAl_2O_4$

130

GAHNITE (O-11A)



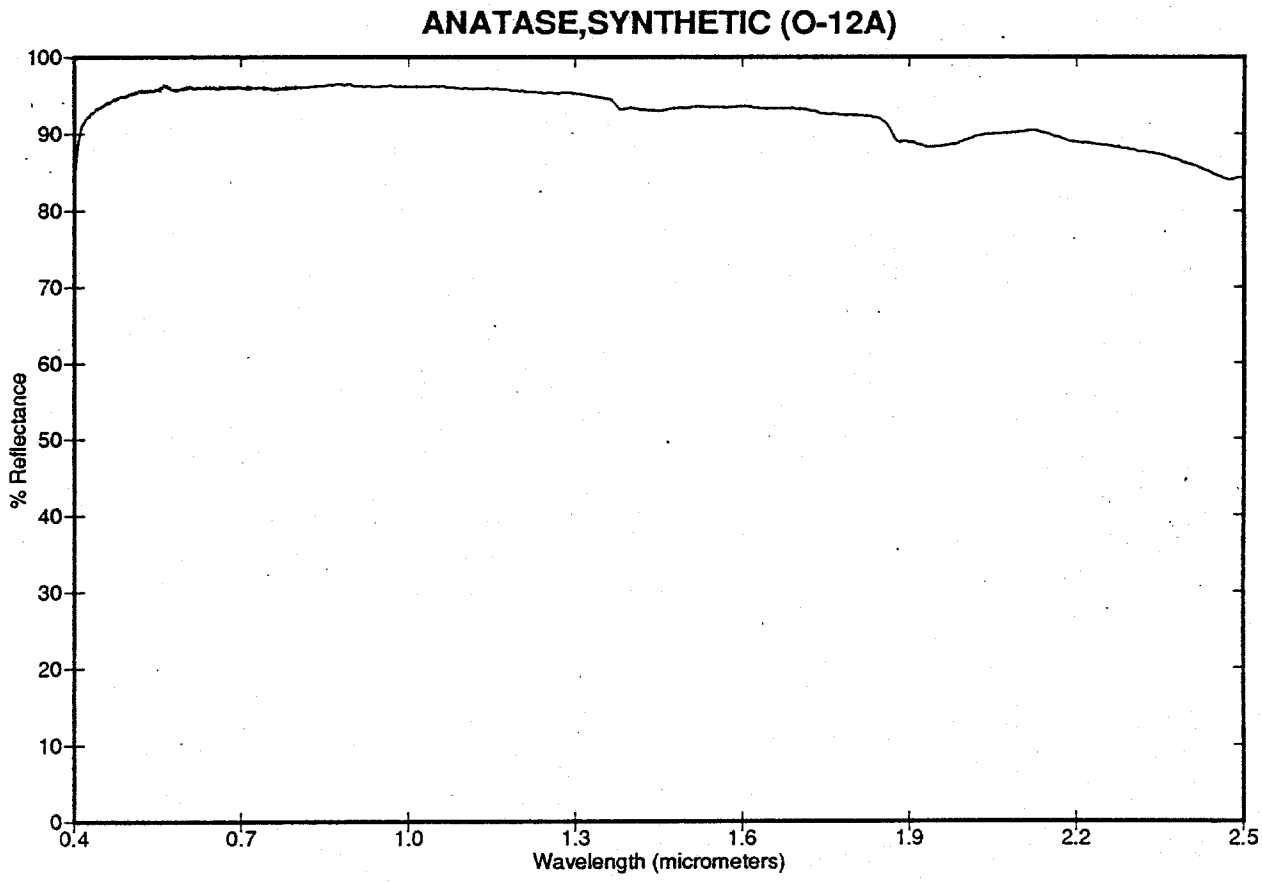
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 16.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5850	17.2568	1.3166	2.7758
0.6210	17.1624	2.2752	0.1231
0.9320	11.3574	2.1741	1.5309
0.7920	9.5684	0.1332	0.7549
0.4590	4.0144	0.0924	0.5430

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.6120	32.0976	22.8885	0.5040
0.9480	6.8245	0.8758	1.2518

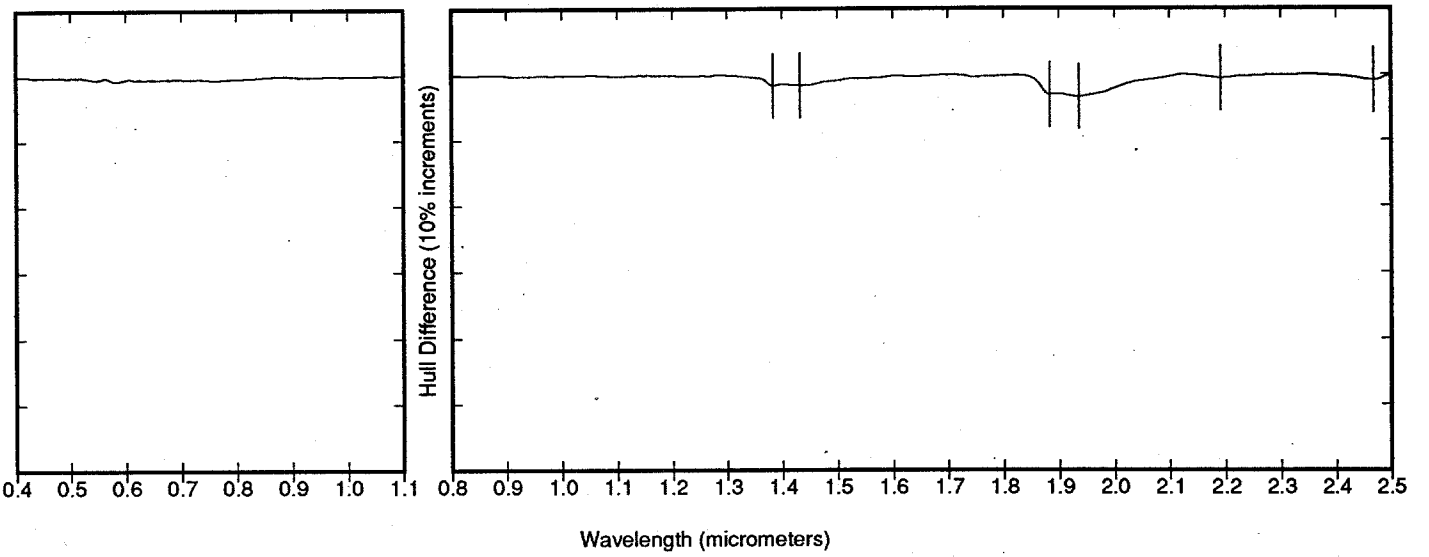
131



DESCRIPTION: ANATASE,SYNTHETIC
SAMPLE_NUM: O-12A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: ANATASE(A)
CHEMICAL FORMULA: TiO_2

132

ANATASE,SYNTHETIC (O-12A)

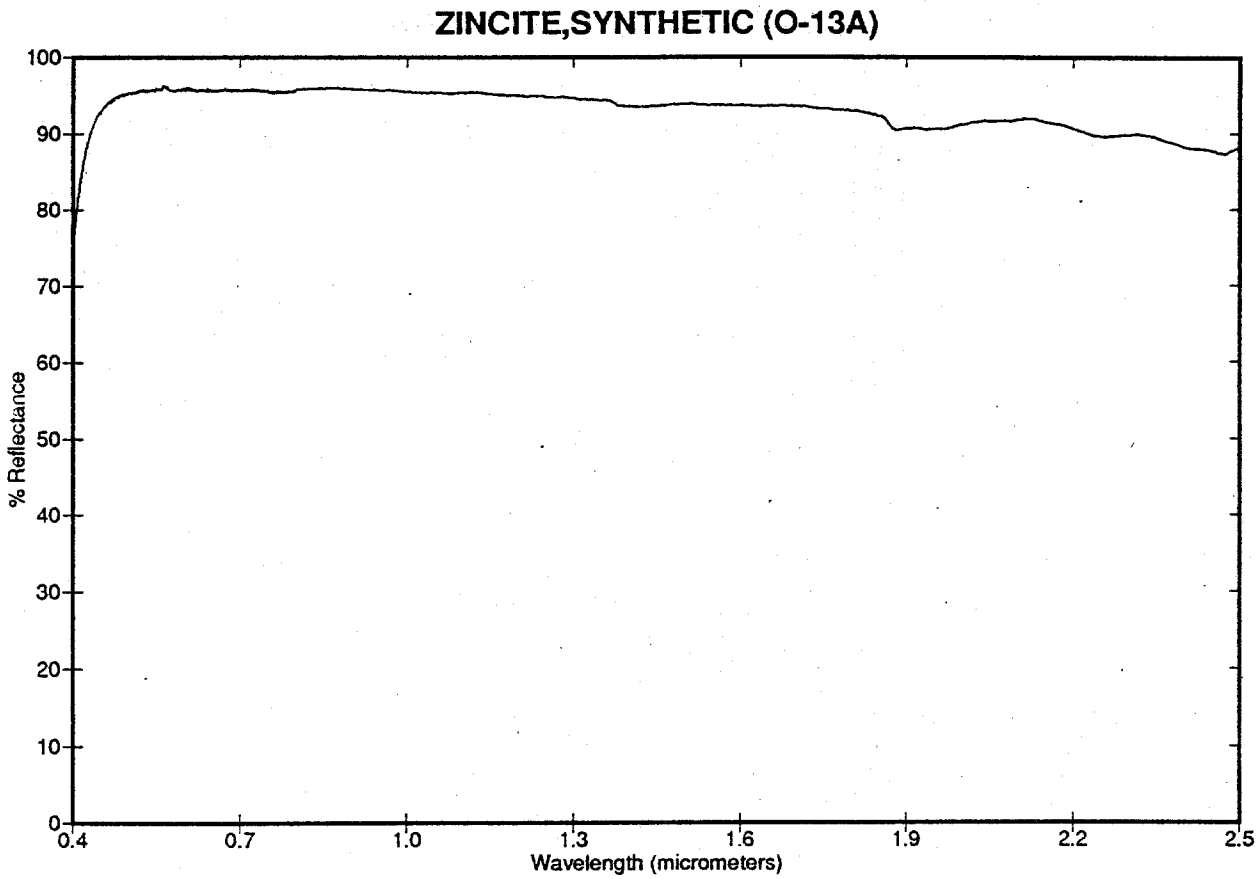


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9360	3.4204	0.4401	0.4685
1.8840	3.0996	0.0970	2.9795
1.3840	1.7087	0.0749	1.4209
1.4320	1.6263	0.1903	0.2961
2.4680	0.9244	0.0540	2.1039
2.1920	0.5767	0.0510	0.6149

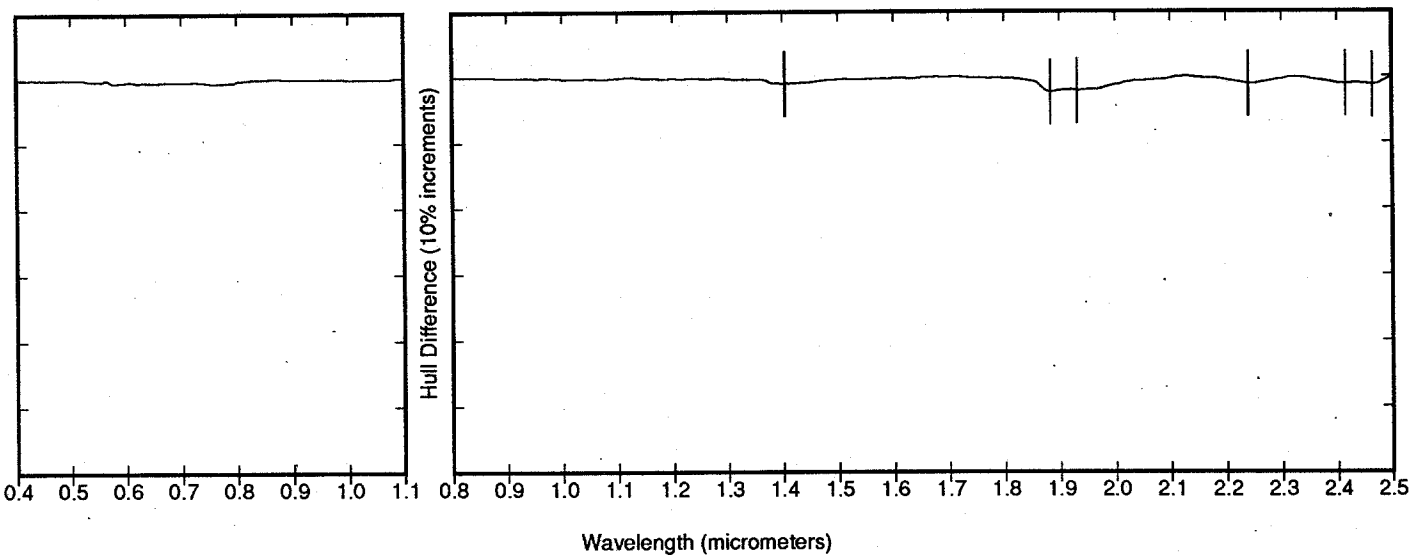
133



DESCRIPTION: ZINCITE,SYNTHETIC
SAMPLE_NUM: O-13A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: ZINCITE(A)
CHEMICAL FORMULA: (Zn,Mn)O

134

ZINCITE,SYNTHETIC (O-13A)

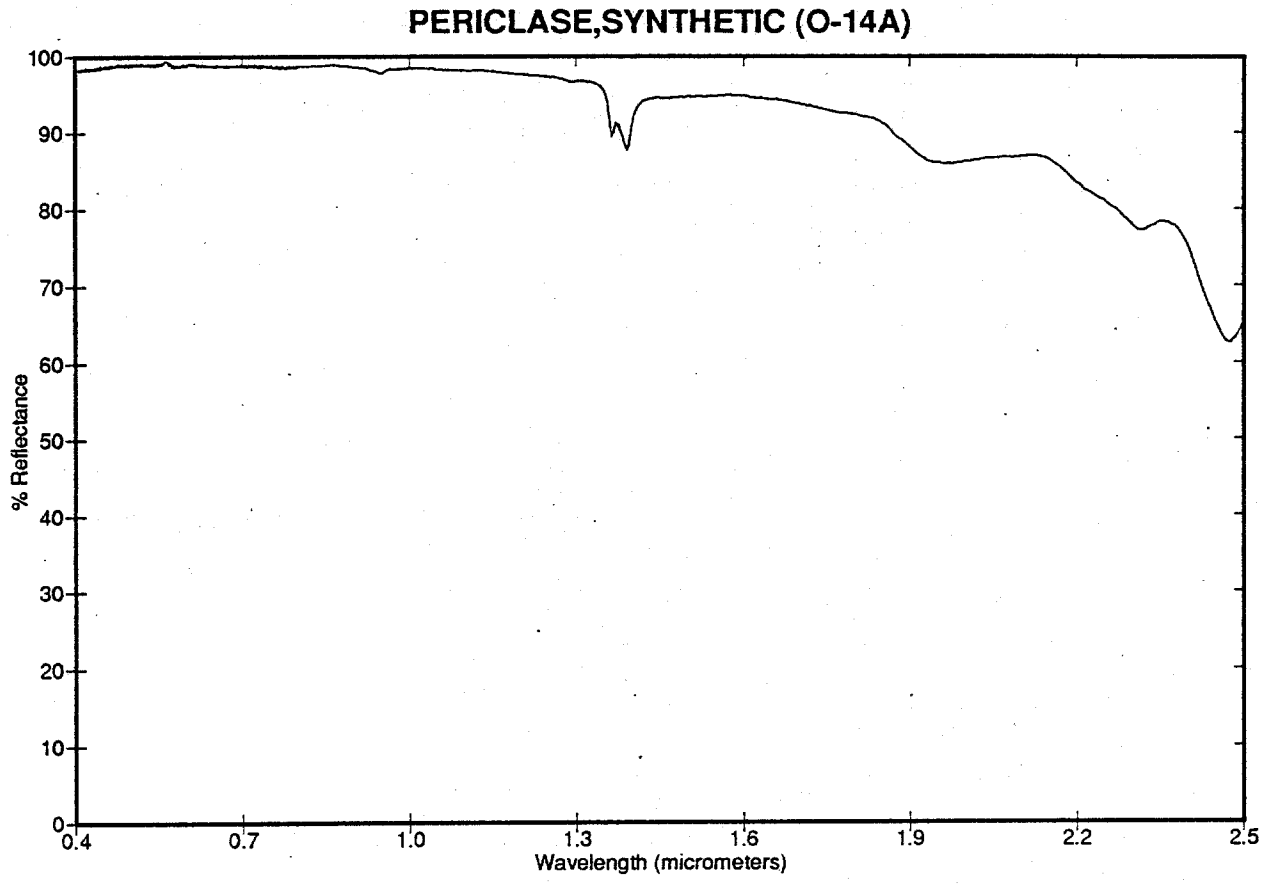


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 6.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.8840	2.4566	0.1556	0.9347
1.9320	2.2286	0.2305	0.1259
2.4640	1.3326	0.0681	1.2539
2.4160	1.2071	0.0853	3.6296
2.2400	1.1625	0.1123	0.9808
1.4040	1.0424	0.1195	0.4918

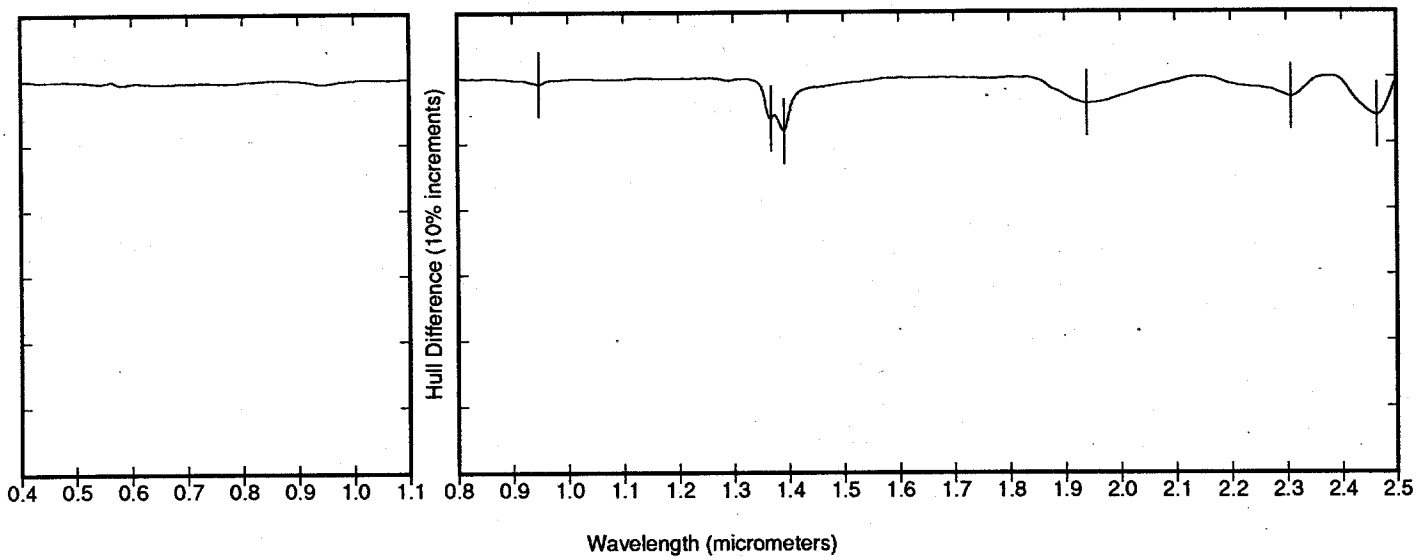
135



DESCRIPTION: PERICLASE,SYNTHETIC
SAMPLE_NUM: O-14A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: PERICLASE(A)
CHEMICAL FORMULA: MgO

136

PERICLASE,SYNTHETIC (O-14A)

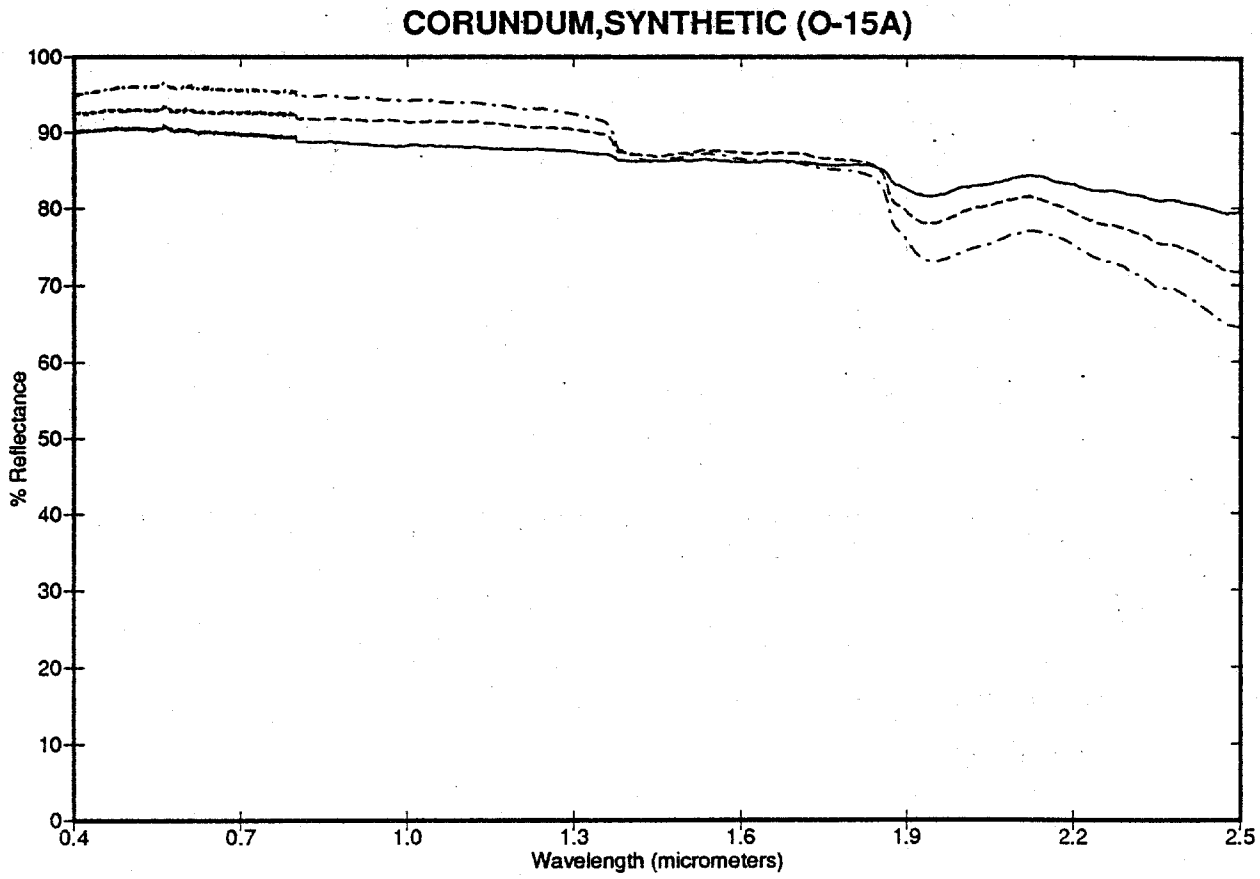


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3920	8.2076	0.3910	0.4044
1.3680	6.2645	0.1386	1.9521
2.4640	5.8409	0.3710	1.8291
1.9400	3.9953	0.6128	0.5682
2.3080	3.0205	0.3044	2.6296
0.9480	0.9240	0.0528	1.3183

137



DESCRIPTION: CORUNDUM,SYNTHETIC
SAMPLE_NUM: O-15A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: CORUNDUM(A)
CHEMICAL FORMULA: Al_2O_3

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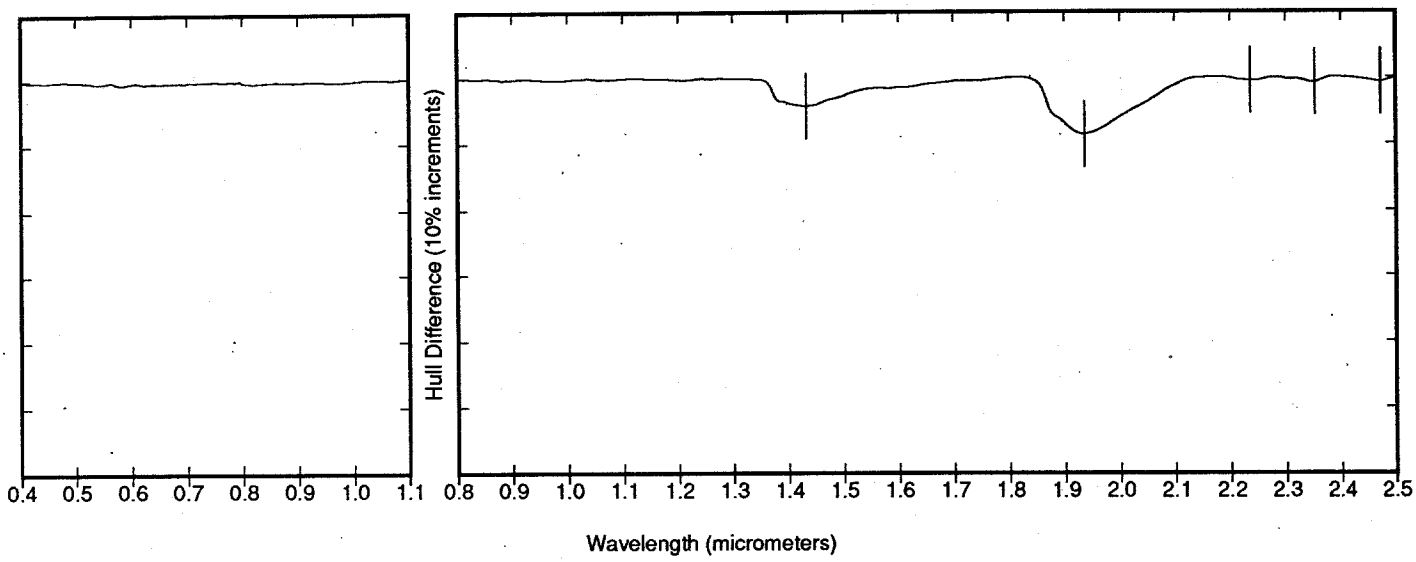
CORUNDUM,SYNTHETIC (O-15A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9360	8.6240	1.3808	0.5904
1.4320	4.2698	0.8717	0.5367
2.3520	0.8206	0.0491	1.4668
2.4720	0.6877	0.0267	1.3807
2.2360	0.5125	0.0277	1.1539

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PHOSPHATES

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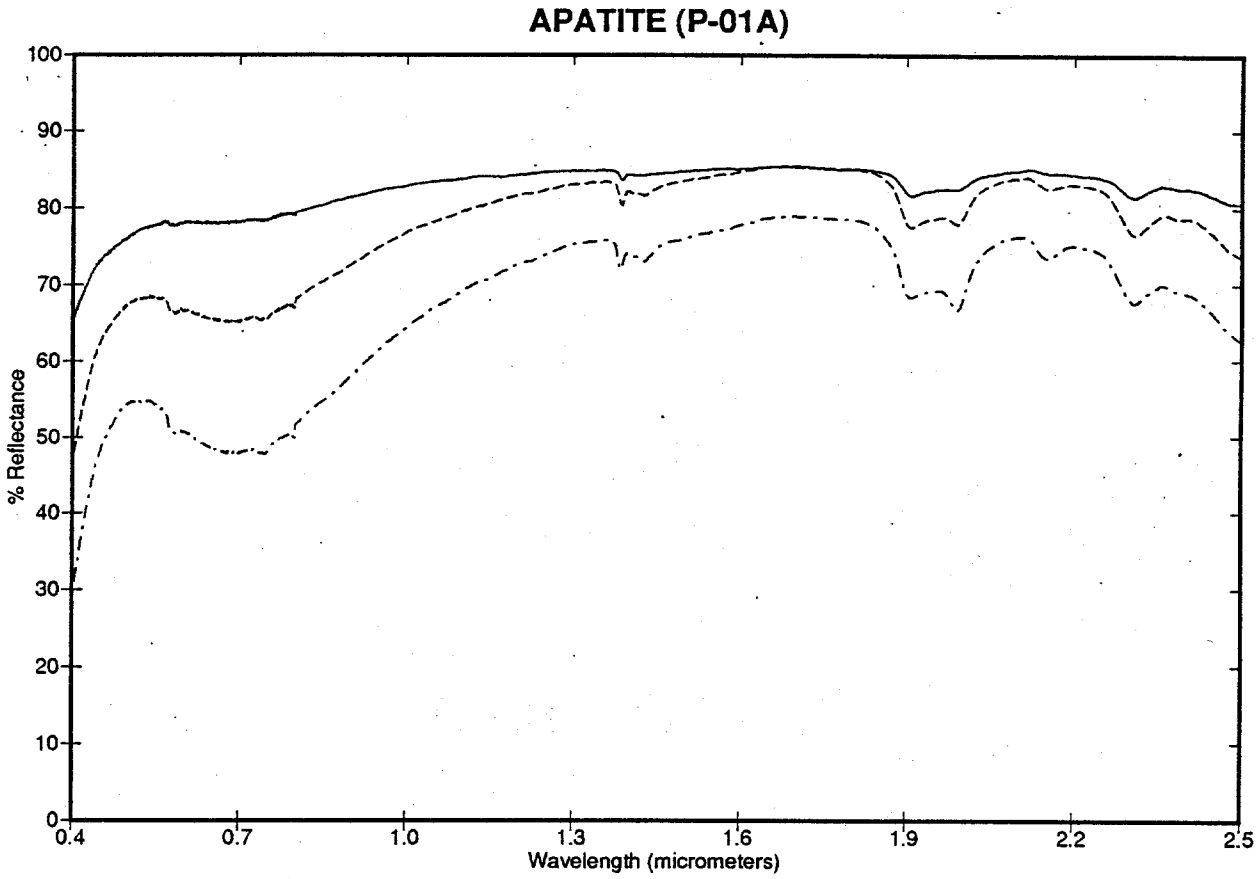
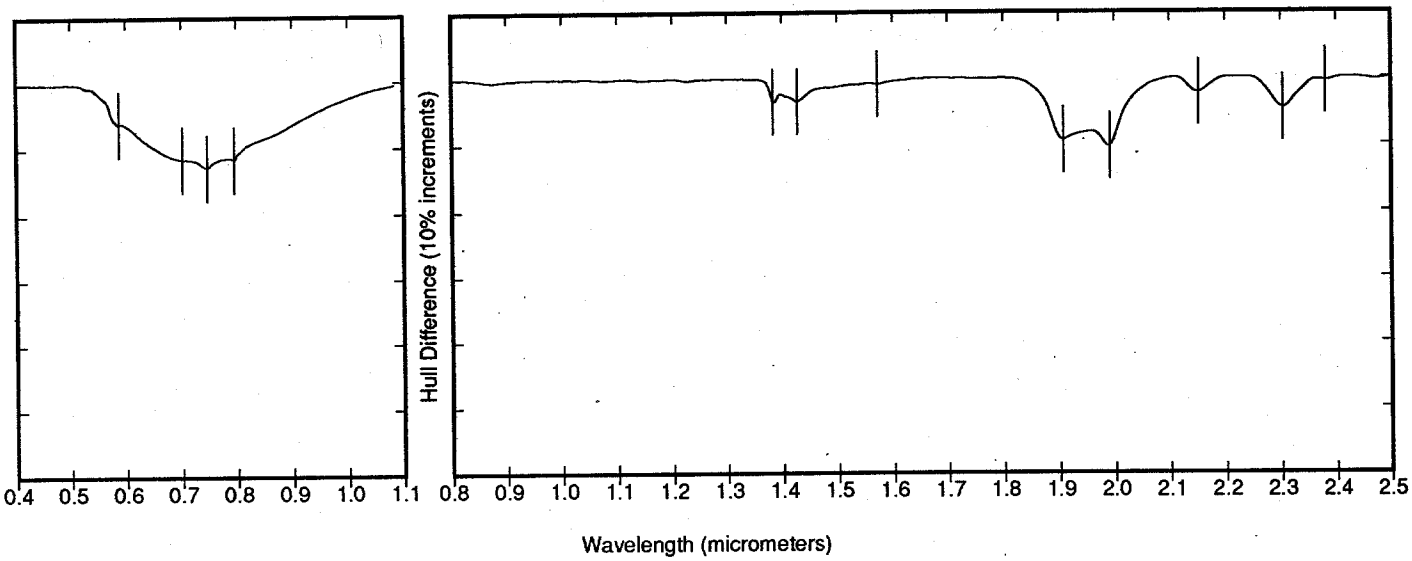


DESCRIPTION: APATITE
SAMPLE_NUM: P-01A
COUNTRY: CANADA
POLITICAL_SUBDIVISION: ONTARIO
GEOGRAPHICAL_REGION: LANARK COUNTY
SITE: PERTH
COLLECTOR: WARD'S
MINERALOGY: APATITE(A)
CHEMICAL FORMULA: $Ca_5(PO_4)_3F$

APATITE (P-01A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7460	12.6658	0.9547	1.0384
0.7950	11.5595	1.5186	0.0720
0.7020	11.4541	1.0444	29.4300
0.5870	6.0713	0.1789	6.4163

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9920	10.3472	0.6669	0.9617
1.9080	9.3879	0.7166	0.7214
2.3040	4.5841	0.2668	0.8670
1.3840	3.5432	0.0698	0.8874
1.4280	3.4586	0.2900	0.4602
2.1520	2.2508	0.0968	0.9506
1.5720	0.9126	0.0429	0.3108
2.3800	0.5067	0.0141	0.5995

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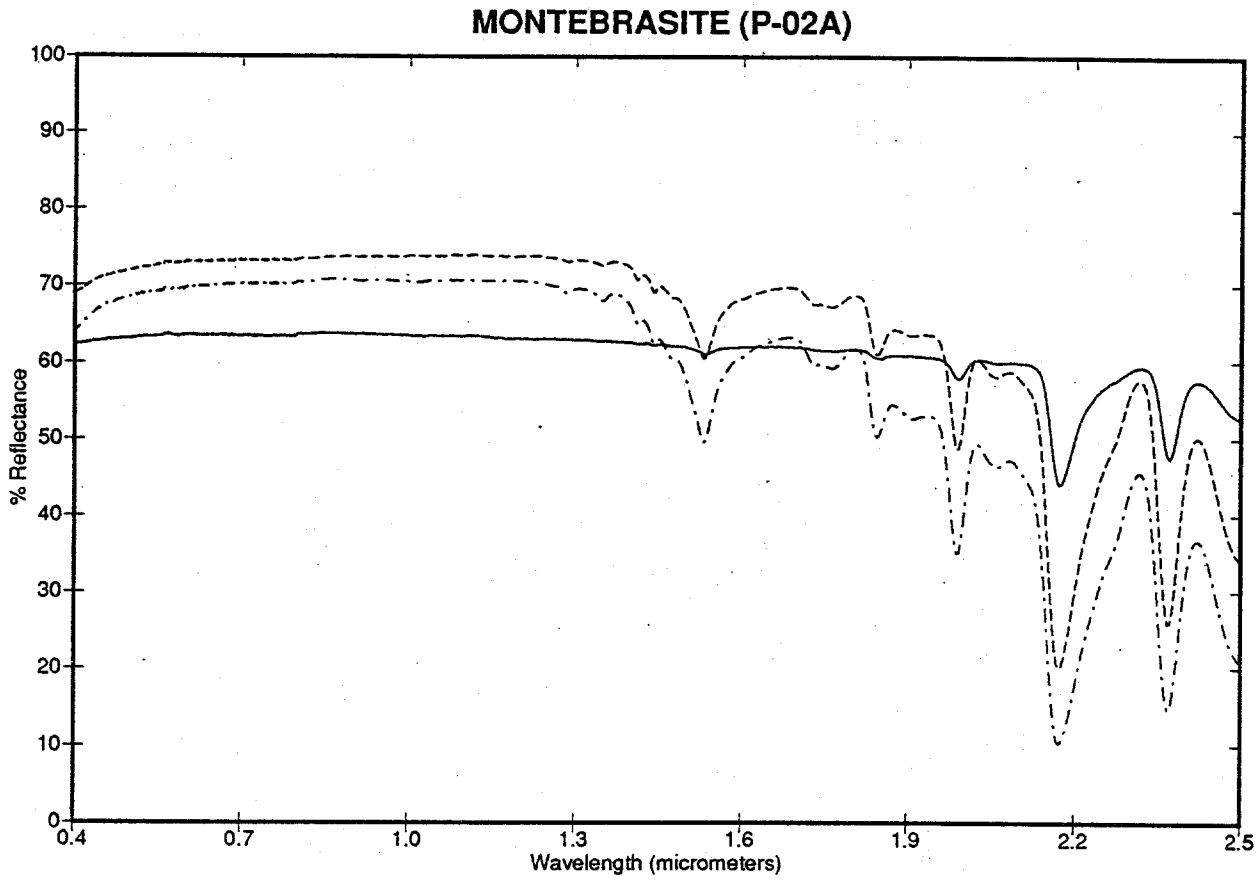

DESCRIPTION: MONTEBRASITE
SAMPLE_NUM: P-02A
COUNTRY: USA
POLITICAL_SUBDIVISION: SOUTH DAKOTA
GEOGRAPHICAL_REGION: CUSTER COUNTY
SITE: CUSTER
COLLECTOR: BURMINCO
MINERALOGY: MONTEBRASITE(A),FLUORAPATITE(T)
CHEMICAL FORMULA: $LiAlPO_4(OH)$

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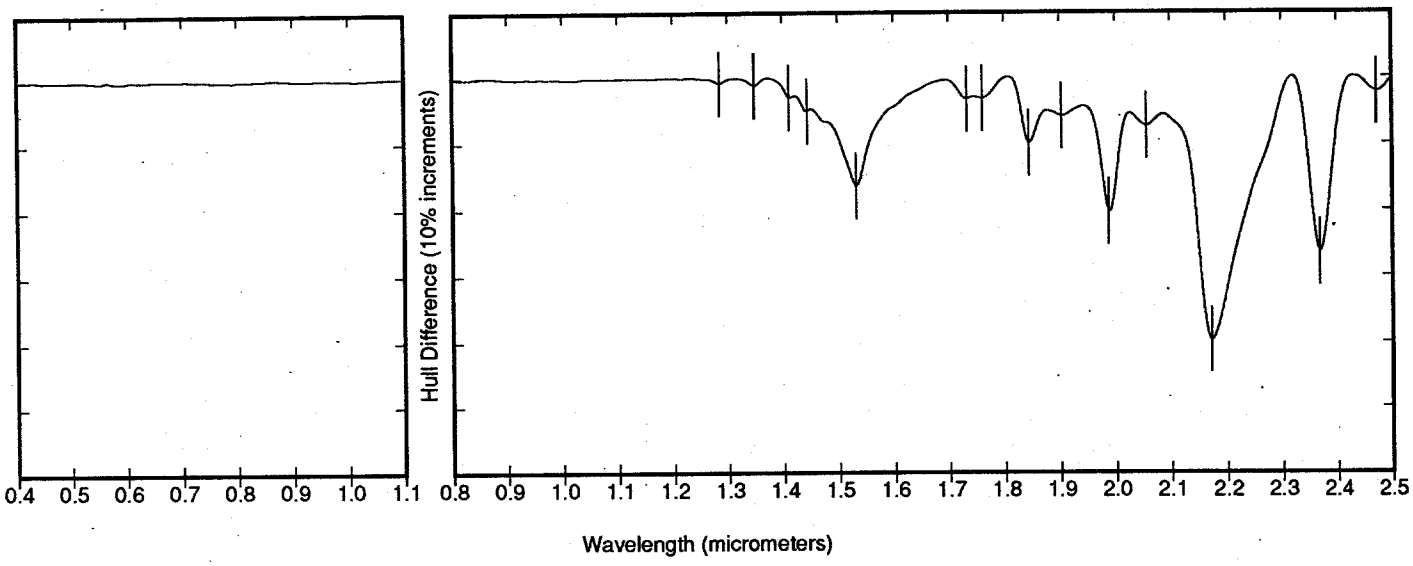
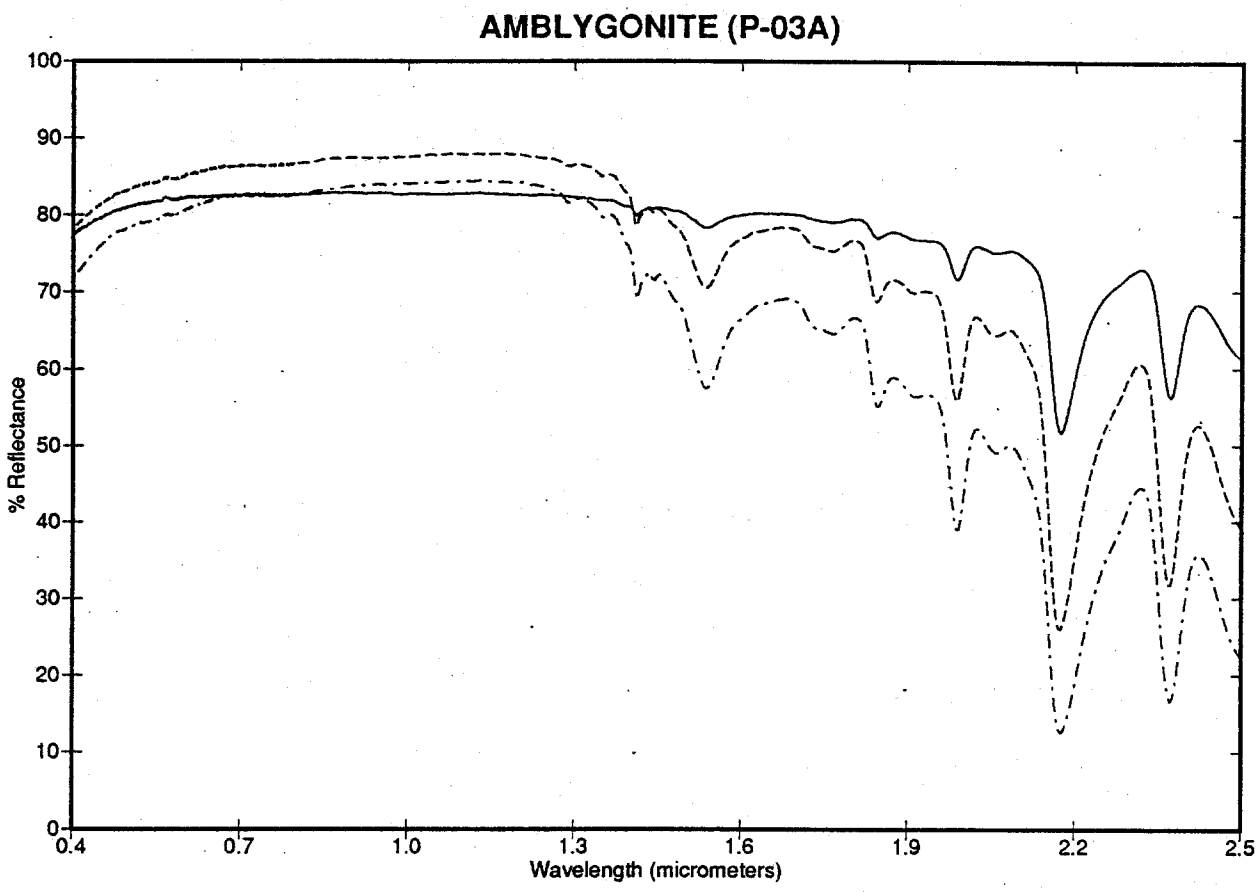
MONTEBRASITE (P-02A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.1720	39.7273	4.1326	0.5164
2.3680	26.4233	1.1888	0.8305
1.9880	20.3575	0.9358	0.9527
1.5320	16.4348	1.5294	0.9158
1.8440	9.9926	0.3779	0.6069
2.0560	7.4171	0.3936	0.8811
1.9040	5.9232	0.3428	0.8111
1.4440	5.1128	0.1307	2.3223
1.7320	3.3407	0.1023	1.6935
1.7600	3.2359	0.1258	0.6597
1.4120	3.0678	0.0638	1.6710
2.4720	2.2711	0.0829	1.0263
1.3480	1.1733	0.0306	1.1922
1.2840	0.8367	0.0239	1.2801



DESCRIPTION: AMBLYGONITE
SAMPLE_NUM: P-03A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: SAN DIEGO COUNTY
SITE: PALA
COLLECTOR: BURMINCO
MINERALOGY: AMBLYGONITE(A)
CHEMICAL FORMULA: (Li,Na) $Al(PO_4)$ (F,OH)

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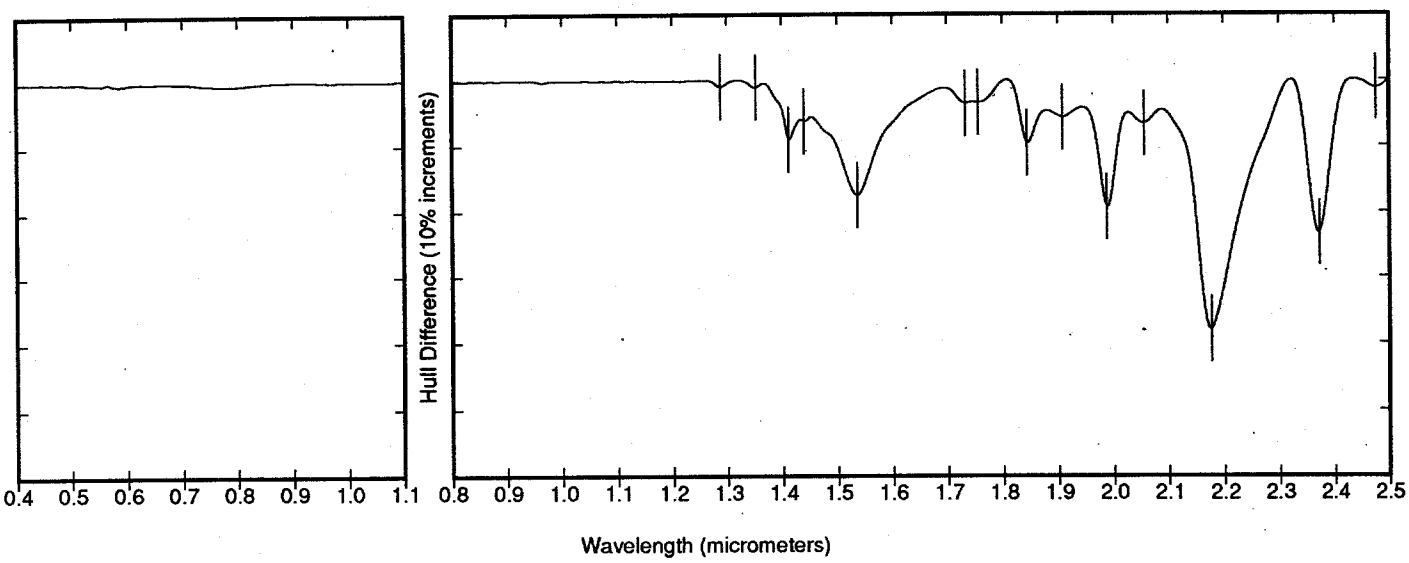
AMBLYGONITE (P-03A)

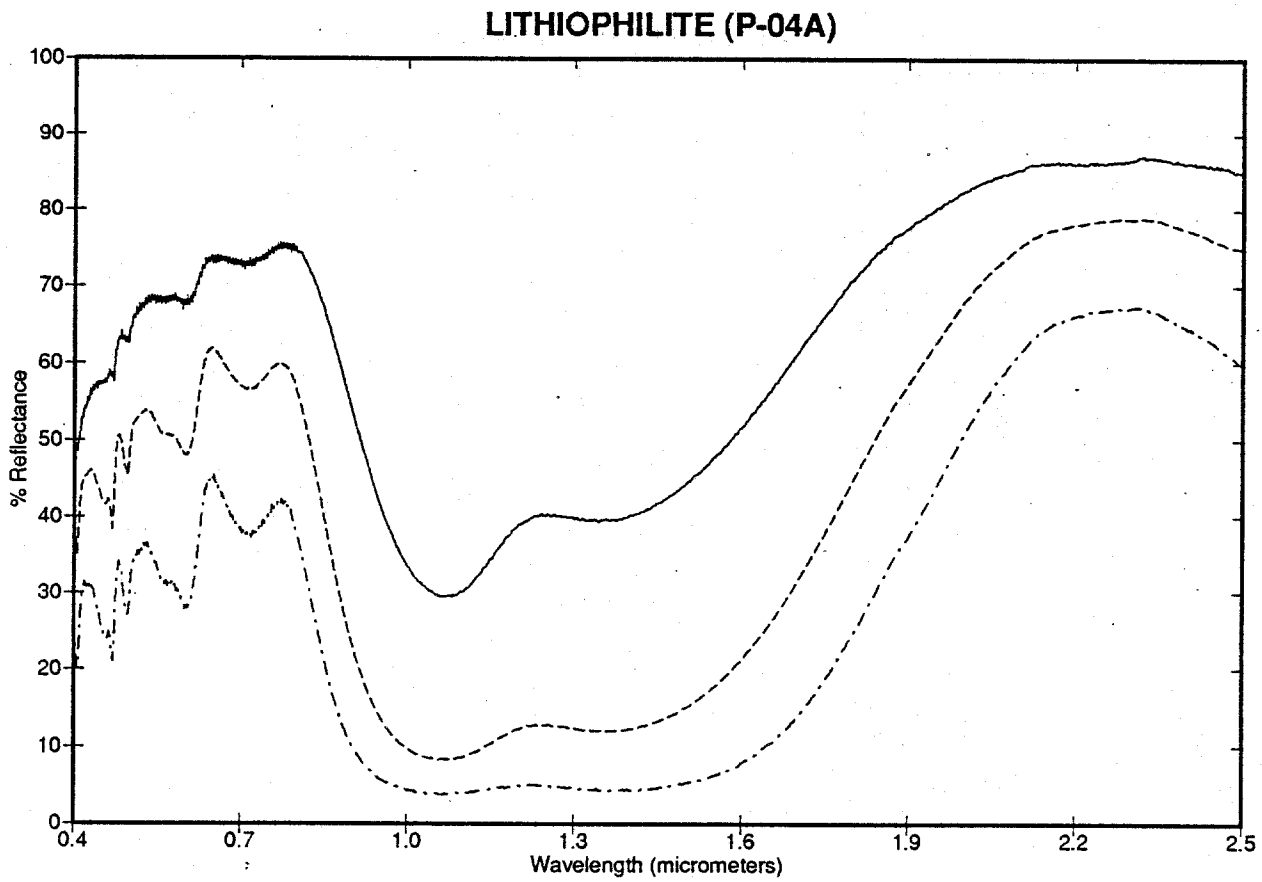


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.1760	37.9674	3.7707	0.5939
2.3720	23.3044	1.0553	0.9712
1.9880	19.3291	0.8668	0.9243
1.5360	17.5459	1.9404	0.8293
1.8440	9.6545	0.3800	0.5340
1.4120	9.0545	0.3265	0.8595
2.0560	6.6802	0.3478	0.9296
1.4400	6.2643	0.0971	0.3403
1.9080	5.7477	0.3266	0.8052
1.7320	3.5811	0.1385	1.4921
1.7560	3.4356	0.1253	0.2793
2.4760	1.2347	0.0406	1.2085
1.3520	1.1198	0.0267	1.2578
1.2880	0.9881	0.0231	0.9405

146



DESCRIPTION: LITHIOPHILITE
SAMPLE_NUM: P-04A
COUNTRY: USA
POLITICAL_SUBDIVISION: NEW HAMPSHIRE
GEOGRAPHICAL_REGION: NORTH GRATON
SITE: PALERMO MINE
COLLECTOR: BURMINCO
MINERALOGY: TRIPHYLITE(A)
CHEMICAL FORMULA: $Li(Mn,Fe)PO_4$

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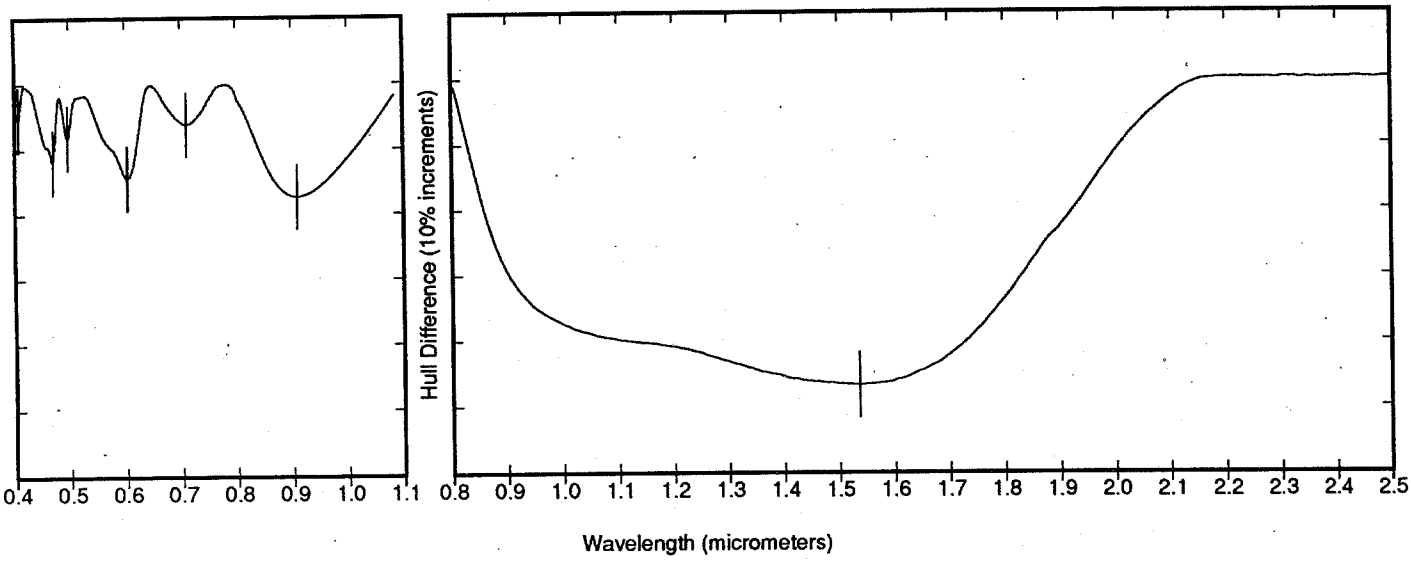
LITHIOPHILITE (P-04A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 49.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9080	17.2997	3.2103	0.6480
0.6030	14.3836	0.9302	2.0319
0.4690	11.7918	0.3546	3.2963
0.4960	8.1512	0.1706	0.7103
0.7100	6.1459	0.4277	1.0376
0.4070	5.3357	0.0415	0.5628

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 14.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.5360	46.7779	44.3991	1.6891

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SULPHATES

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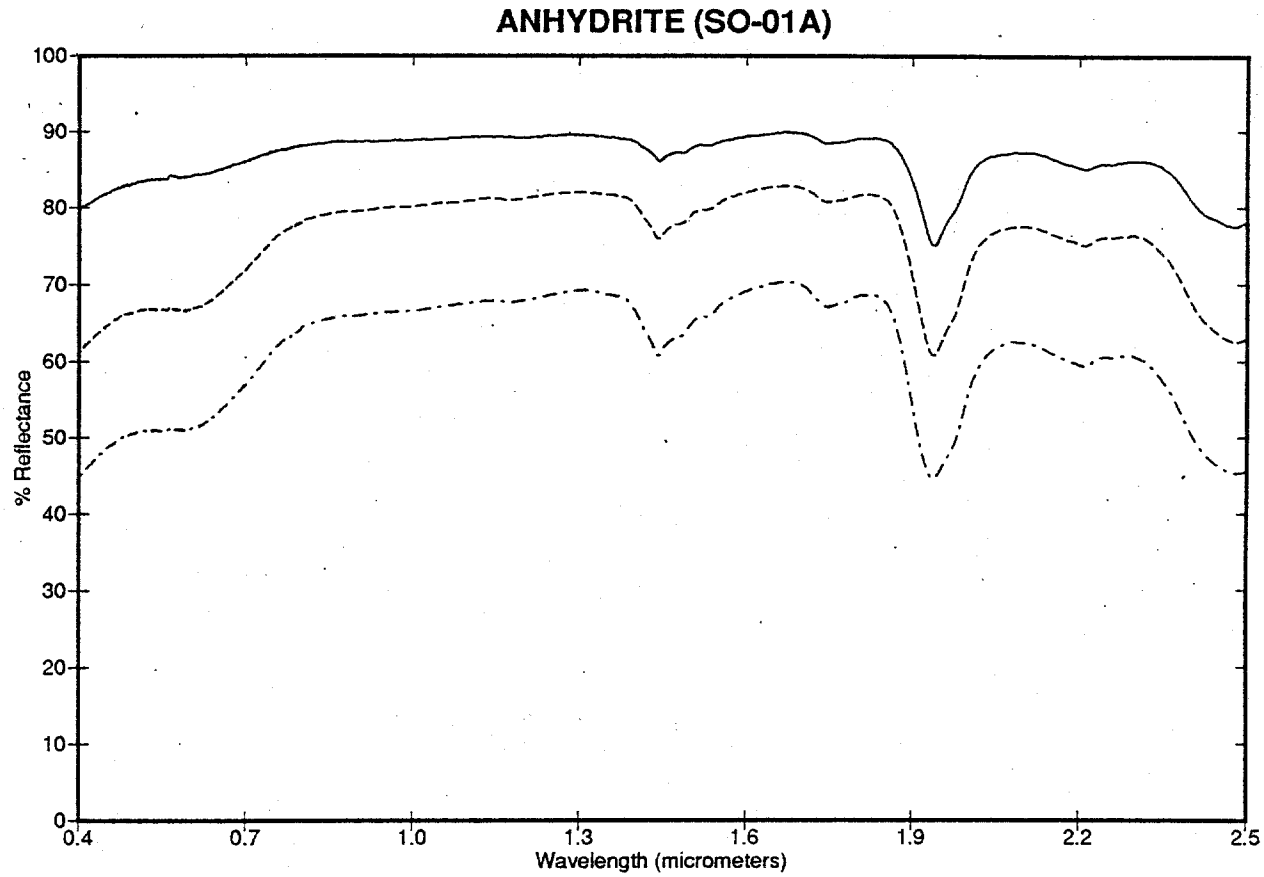

DESCRIPTION: ANHYDRITE
SAMPLE_NUM: SO-01A
COUNTRY: CANADA
POLITICAL_SUBDIVISION: NOVA SCOTIA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: ANHYDRITE(A),GYPSUM(M)
CHEMICAL FORMULA: $CaSO_4$

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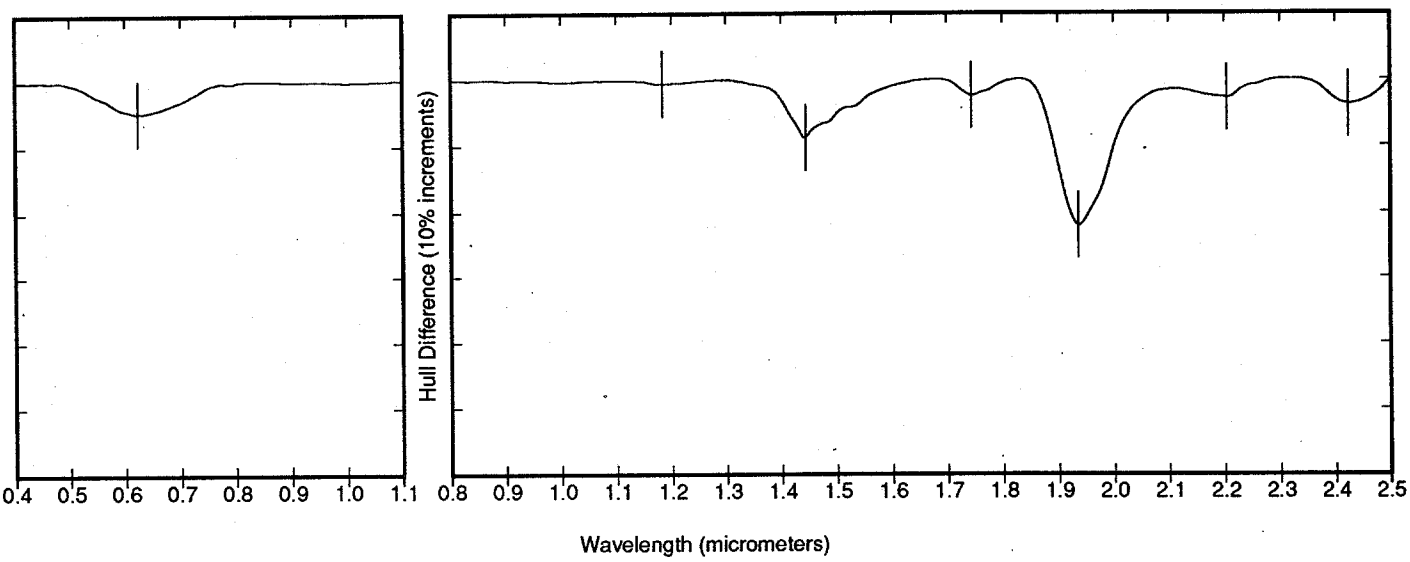
ANHYDRITE (SO-01A)



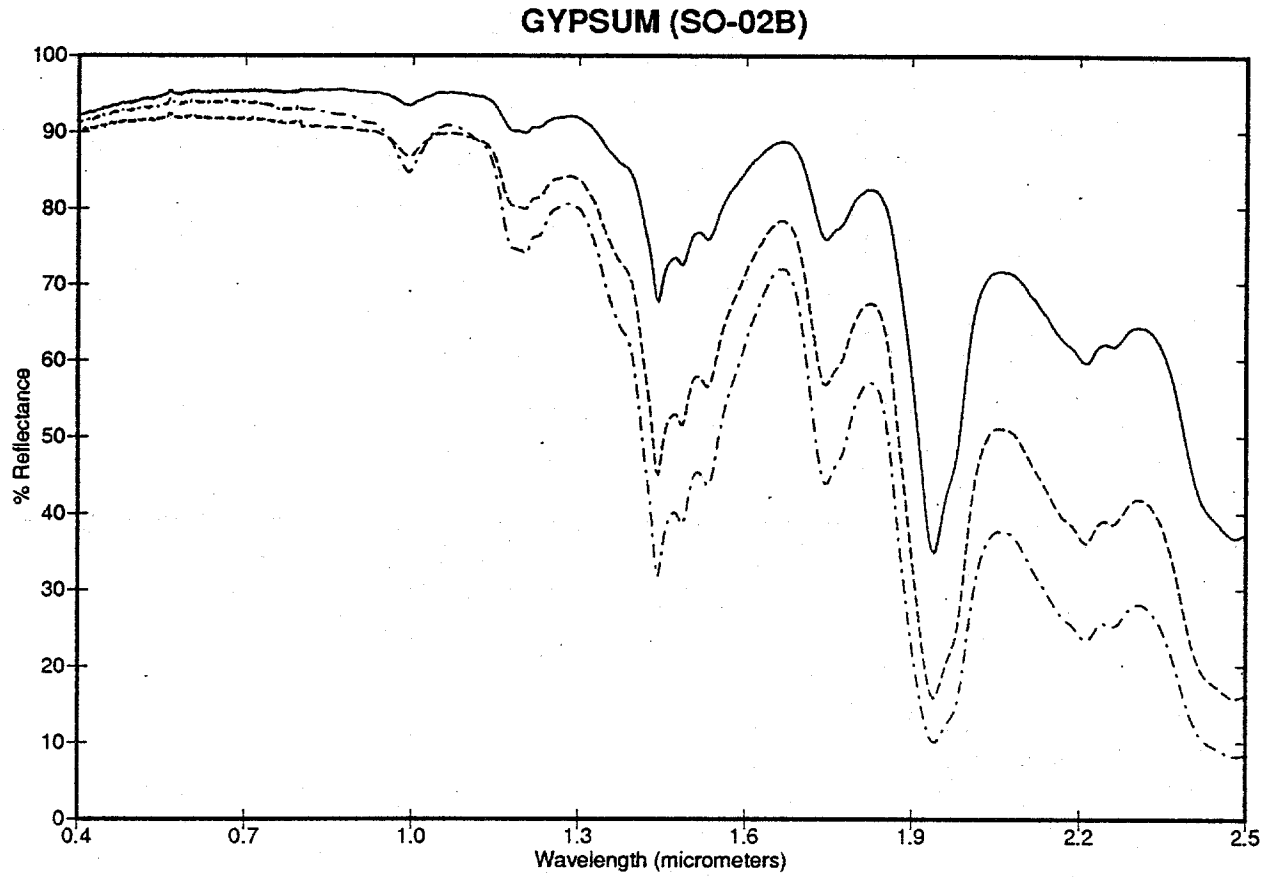
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6230	4.8020	0.7613	0.8026

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9360	22.0697	2.4812	0.5976
1.4440	8.7503	1.0697	0.5019
2.4240	3.7839	0.3519	0.8109
2.2040	2.8187	0.3102	1.9385
1.7440	2.4566	0.1584	0.6205
1.1840	0.6168	0.0555	0.6199

151



DESCRIPTION: GYPSUM
SAMPLE_NUM: SO-02B
COUNTRY: USA
POLITICAL_SUBDIVISION: UTAH
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: GYPSUM(A)
CHEMICAL FORMULA: $CaSO_4 \bullet 2H_2O$

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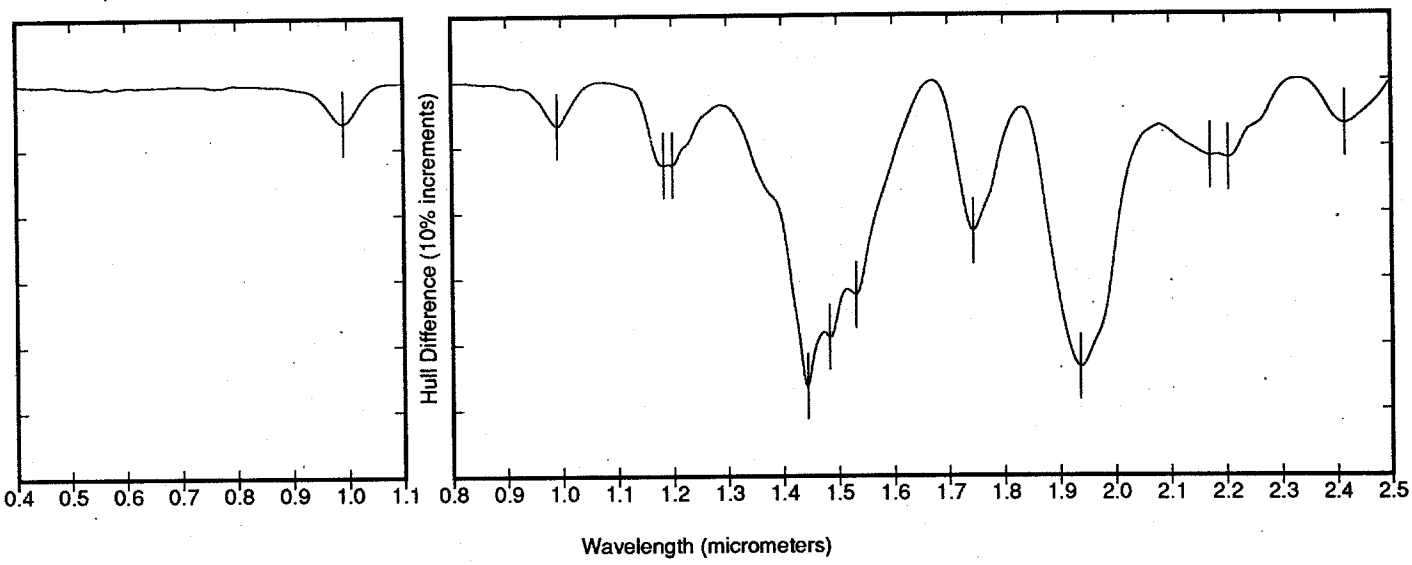
GYPSUM (SO-02B)



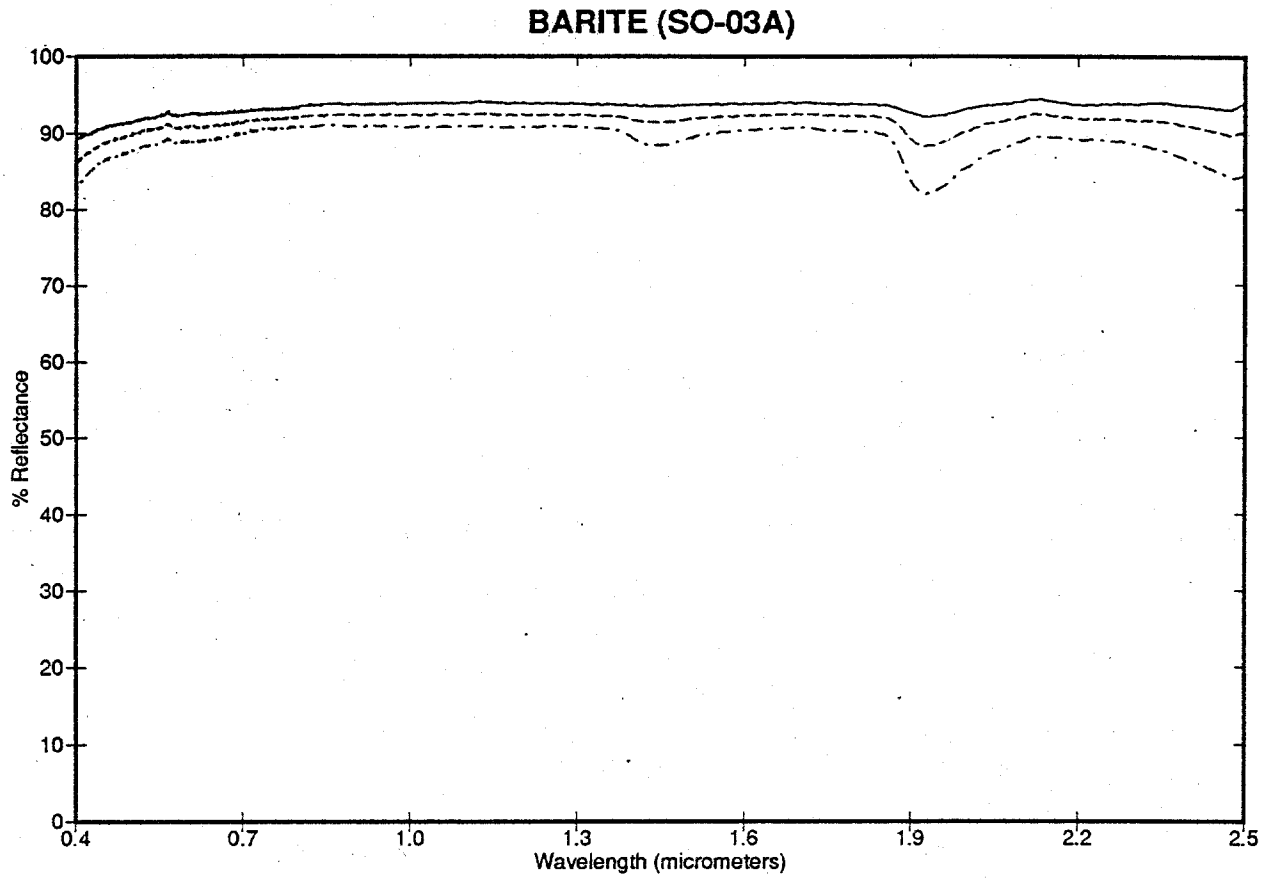
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9920	6.0183	0.4745	1.4420

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4440	46.3897	4.0873	2.1196
1.9360	43.5109	5.8615	0.7397
1.4840	38.8582	1.4282	0.2751
1.5320	32.4937	2.3254	0.2827
1.7440	22.9069	1.8498	0.6241
1.1840	12.7680	0.5111	4.0231
1.2000	12.7354	0.7484	0.1571
2.2040	11.8596	0.9063	0.3459
2.1720	11.5739	1.0035	6.2555
2.4160	6.7333	0.6015	0.7638
0.9920	6.7037	0.4522	1.3274

153



DESCRIPTION: BARITE
SAMPLE_NUM: SO-03A
COUNTRY: USA
POLITICAL_SUBDIVISION: SOUTH CAROLINA
GEOGRAPHICAL_REGION: CHEROKEE COUNTY
SITE: KINGS CREEK
COLLECTOR: WARD'S
MINERALOGY: BARITE(A)
CHEMICAL FORMULA: $BaSO_4$

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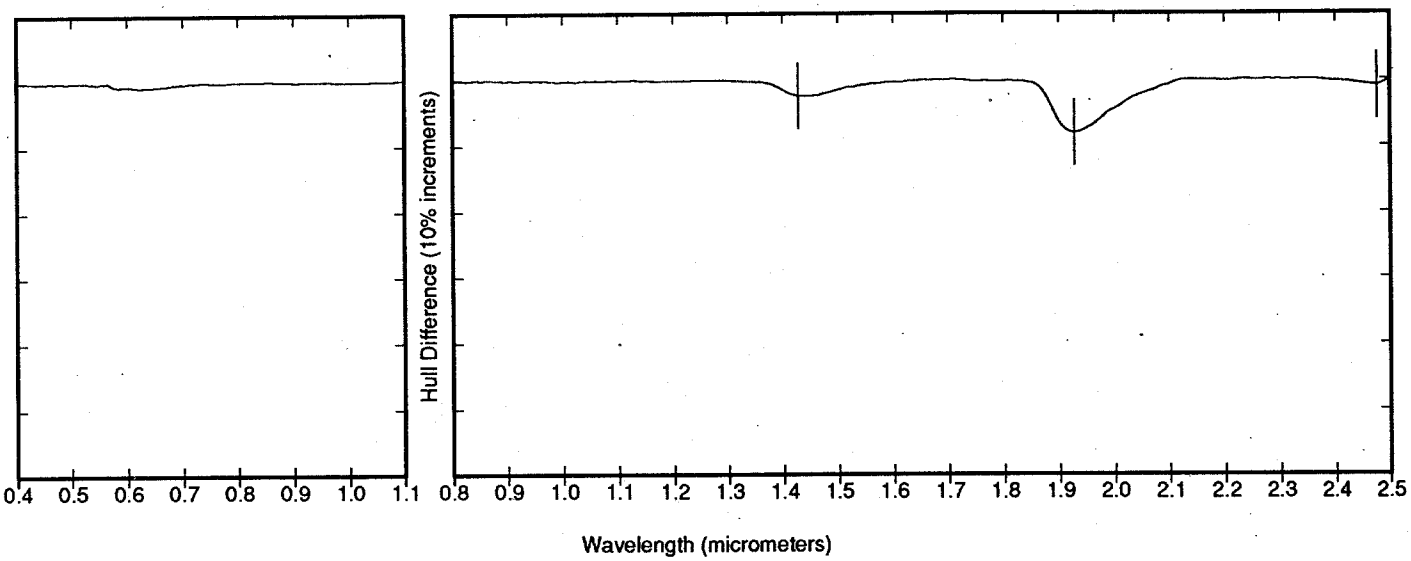
BARITE (SO-03A)

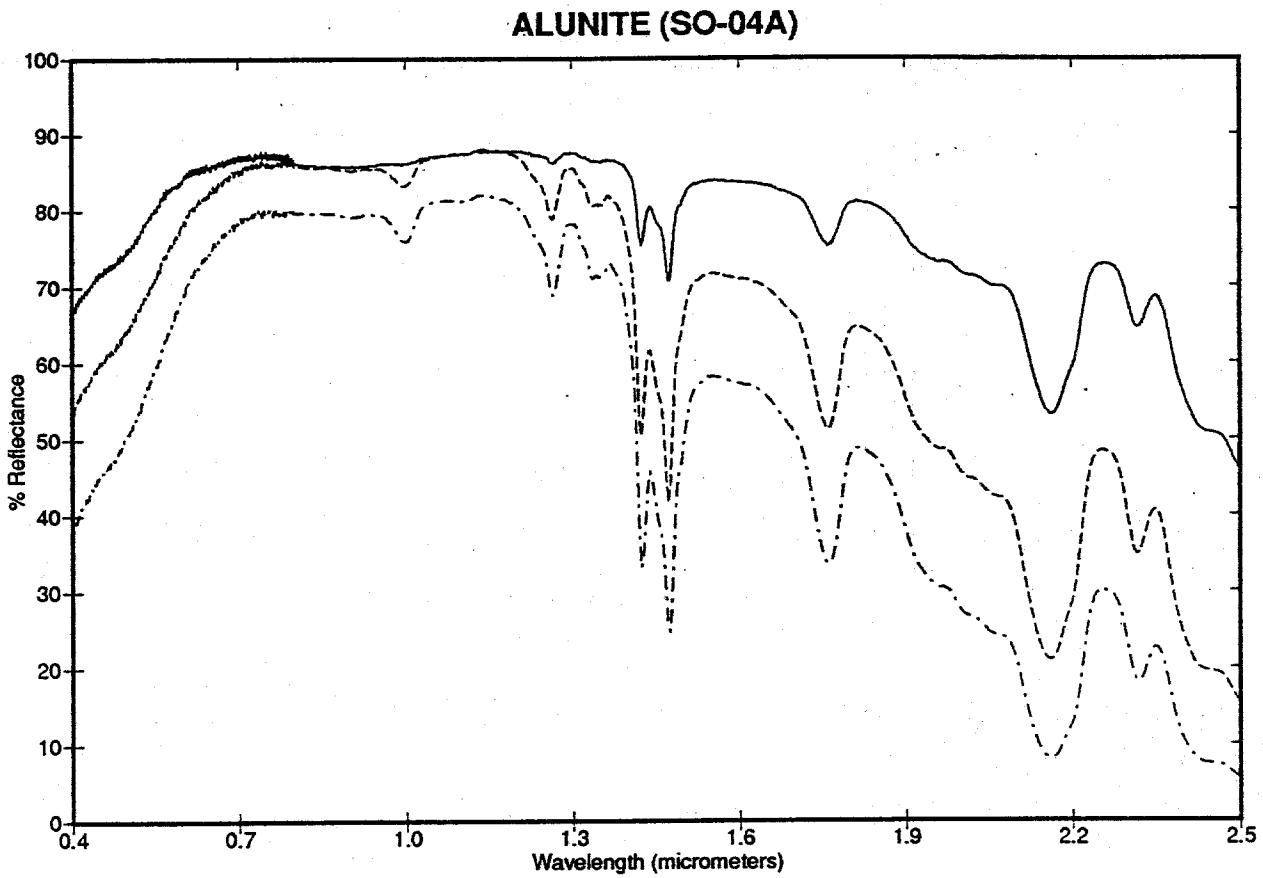


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9280	8.0933	1.0812	0.5035
1.4280	2.4487	0.3671	0.4230
2.4760	0.9470	0.0643	3.9359

155



DESCRIPTION: ALUNITE
SAMPLE_NUM: SO-04A
COUNTRY: USA
POLITICAL_SUBDIVISION: UTAH
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: ALUNITE(A)
CHEMICAL FORMULA: $K\ Al_3(SO_4)_2(OH)_6$

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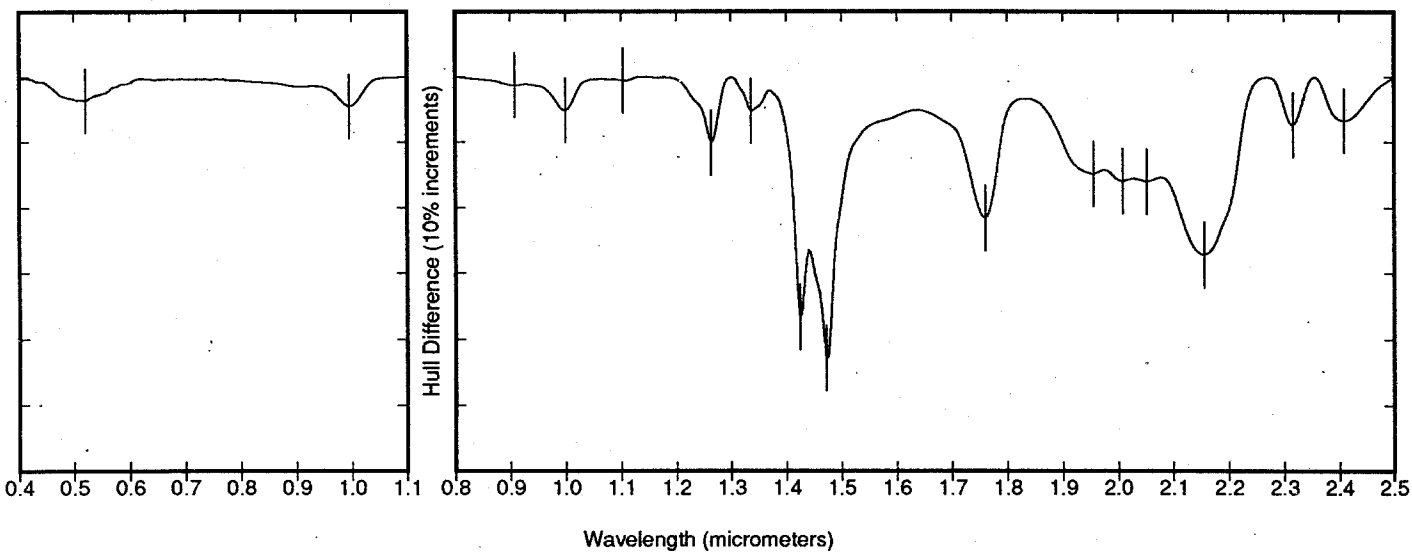
ALUNITE (SO-04A)



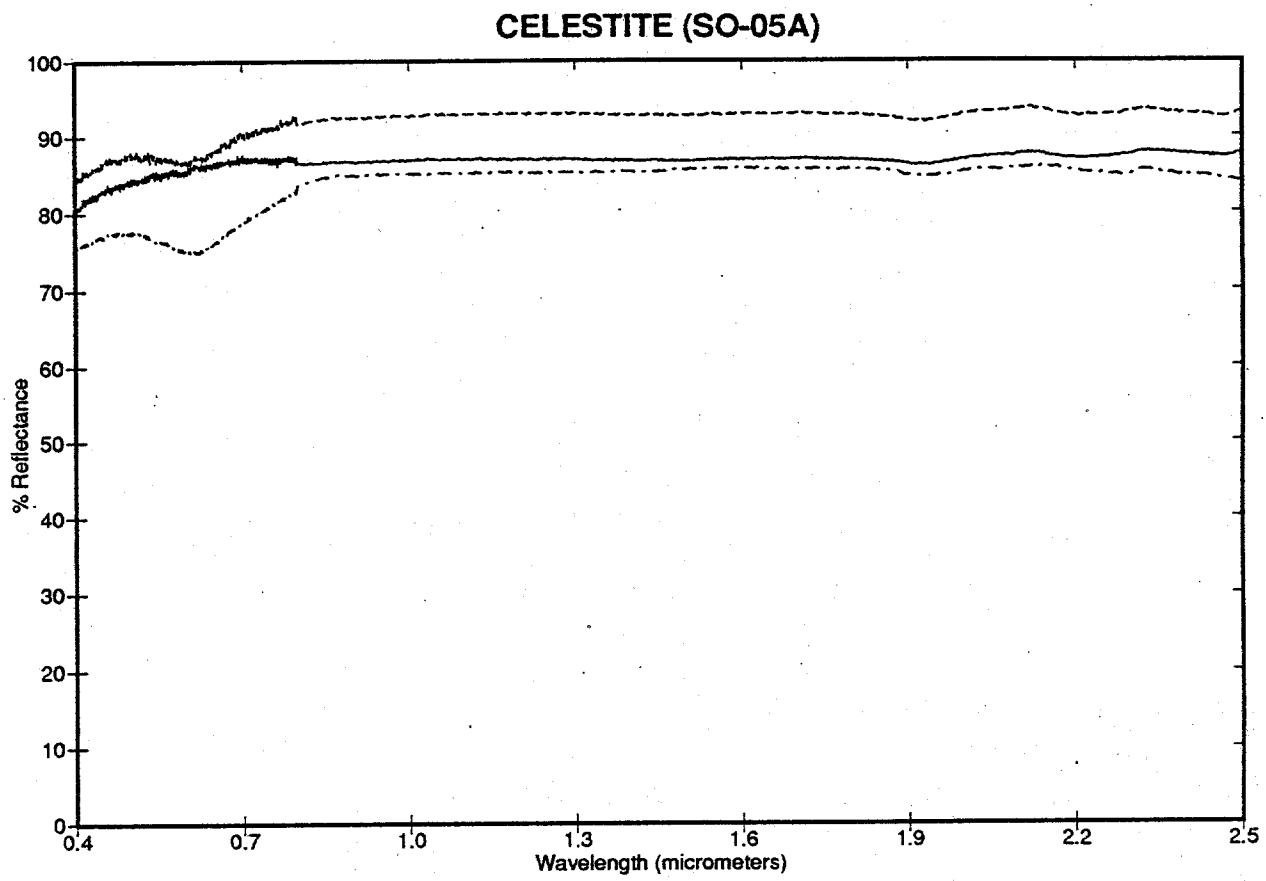
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 49.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9960	4.4678	0.4175	2.4957
0.5210	3.6021	0.3987	1.2472

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4720	42.7771	3.0285	0.5228
1.4240	36.5292	1.1209	1.1911
2.1560	27.1294	3.2487	1.1210
1.7600	21.6077	1.8929	1.7511
2.0520	16.0278	0.8193	1.1685
2.0080	15.9395	0.7376	1.9178
1.9560	14.8754	1.4260	3.9049
1.2640	10.1189	0.3992	1.6600
2.3160	7.3795	0.2805	1.1039
2.4080	6.7439	0.5274	0.6487
1.3360	5.2725	0.2087	0.5939
1.0000	5.1590	0.2961	1.5814
0.9080	1.2968	0.0820	2.4009
1.1040	0.6100	0.0161	0.6077

157



DESCRIPTION: CELESTITE
SAMPLE_NUM: SO-05A
COUNTRY: USA
POLITICAL_SUBDIVISION: UTAH
GEOGRAPHICAL_REGION: EMERY COUNTY
SITE: NULL
COLLECTOR: GRIEGER'S INC
MINERALOGY: CELESTITE(A)
CHEMICAL FORMULA: $SrSO_4$

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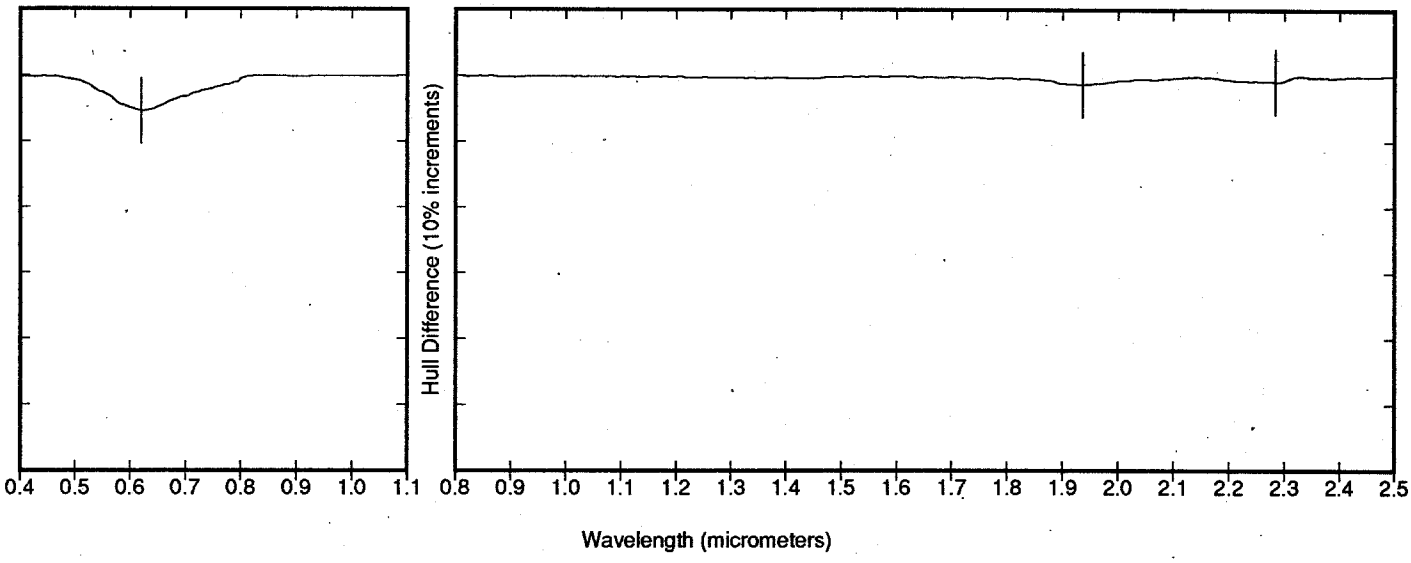
CELESTITE (SO-05A)



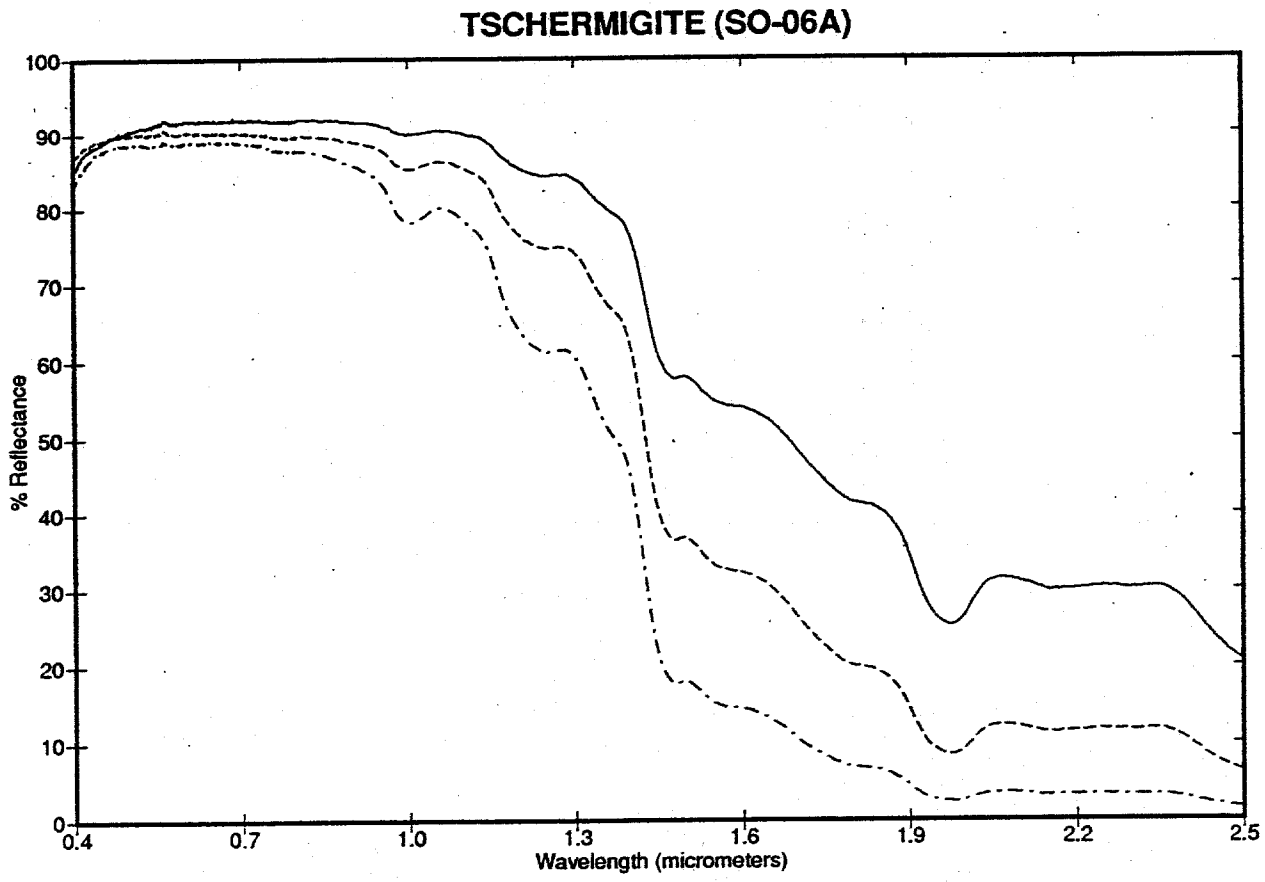
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 25.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6200	5.4032	0.9217	0.6798

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9360	1.3454	0.2273	0.9276
2.2840	0.9041	0.0934	3.4911

159



DESCRIPTION: TSCHERMIGITE
SAMPLE_NUM: SO-06A
COUNTRY: USA
POLITICAL_SUBDIVISION: NEVADA
GEOGRAPHICAL_REGION: ESMERALDA COUNTY
SITE: SILVER PEAK
COLLECTOR: BURMINCO
MINERALOGY: TSCHERMIGITE(A)
CHEMICAL FORMULA: $(NH_4)\ Al(SO_4)_2 \bullet 12H_2O$

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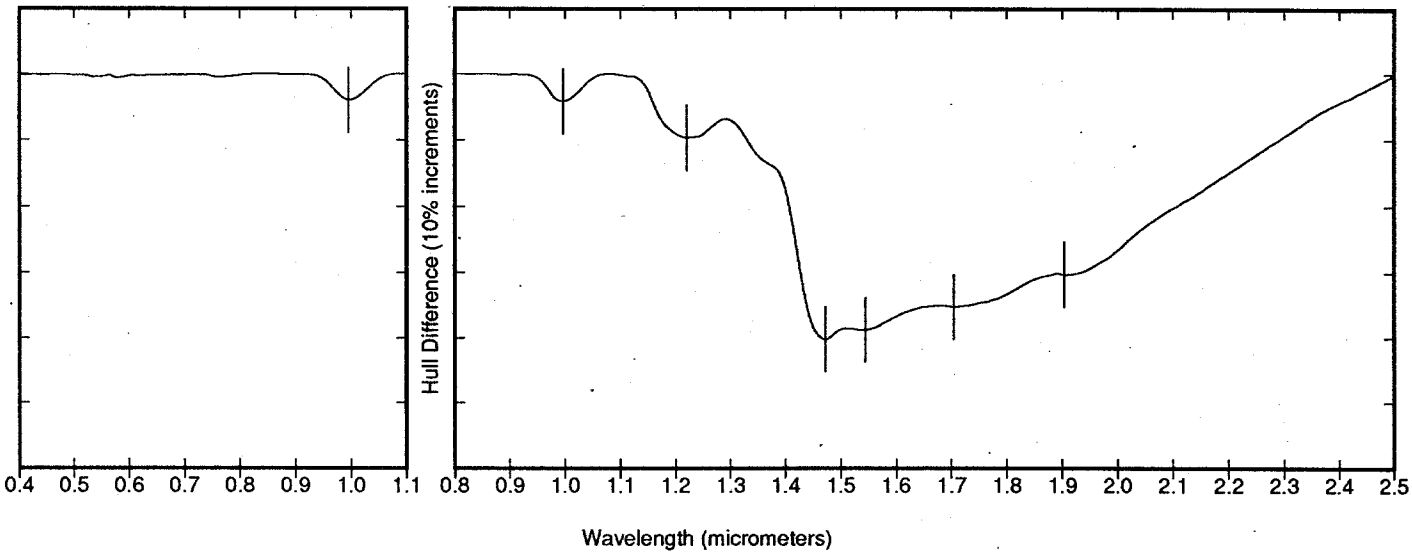
TSCHERMIGITE (SO-06A)



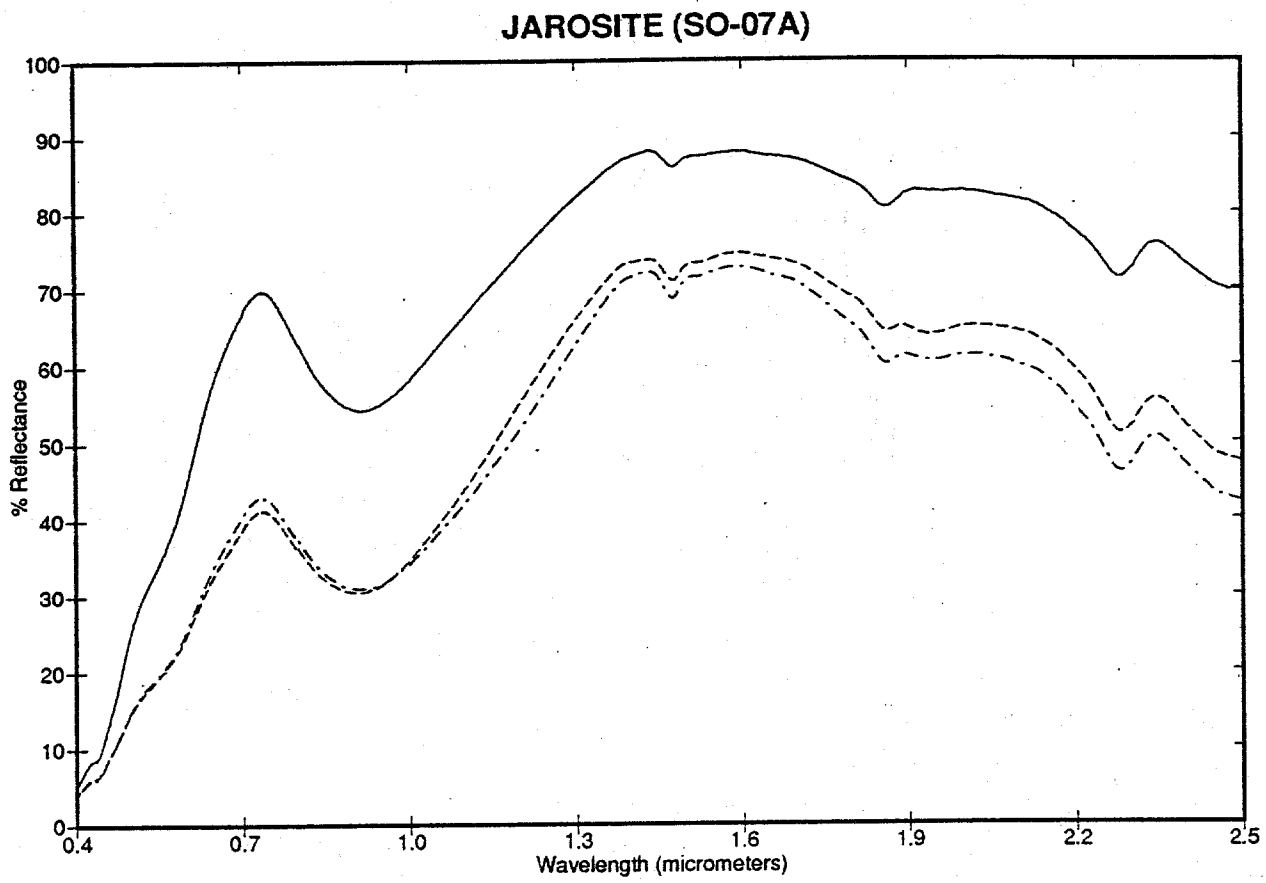
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9960	3.9867	0.2854	0.8786

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4720	40.1551	5.0985	2.2539
1.5440	38.7307	6.6187	0.2295
1.7040	35.2065	6.6130	0.0681
1.9040	30.2154	9.3494	0.0402
1.2200	9.6956	1.1718	0.9099
0.9960	4.1950	0.2838	0.8542

161



DESCRIPTION: JAROSITE
SAMPLE_NUM: SO-07A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: CHIHUAHUA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: JAROSITE(A)
CHEMICAL FORMULA: $K\ Fe_3^{3+}(SO_4)_2(OH)_6$

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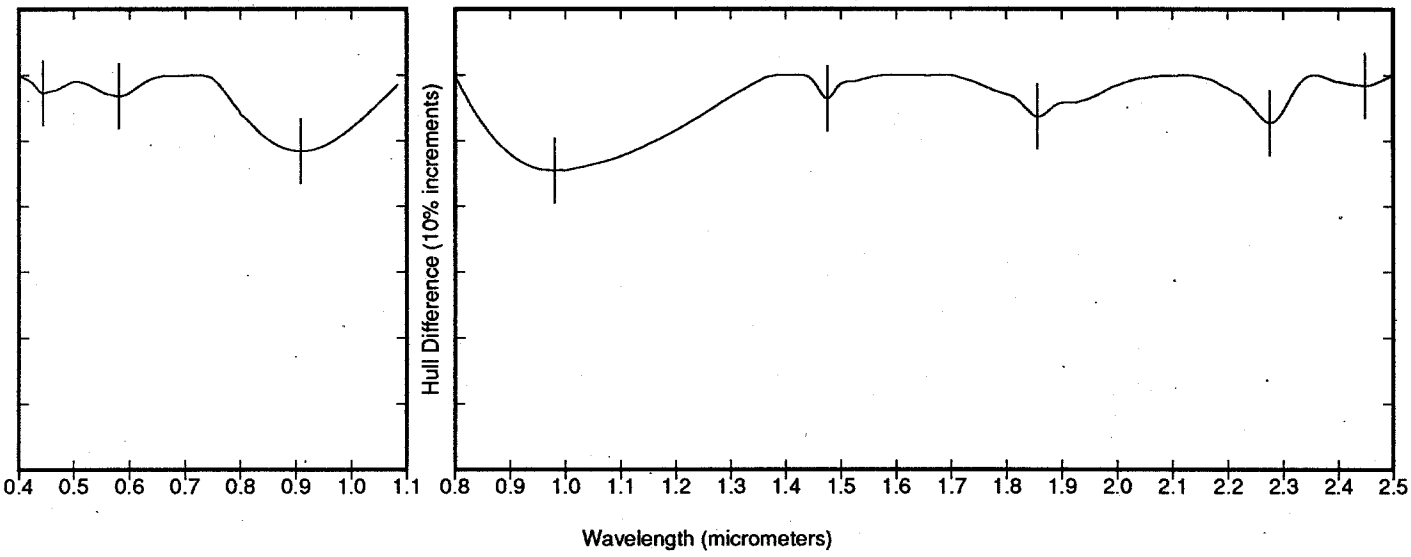
JAROSITE (SO-07A)



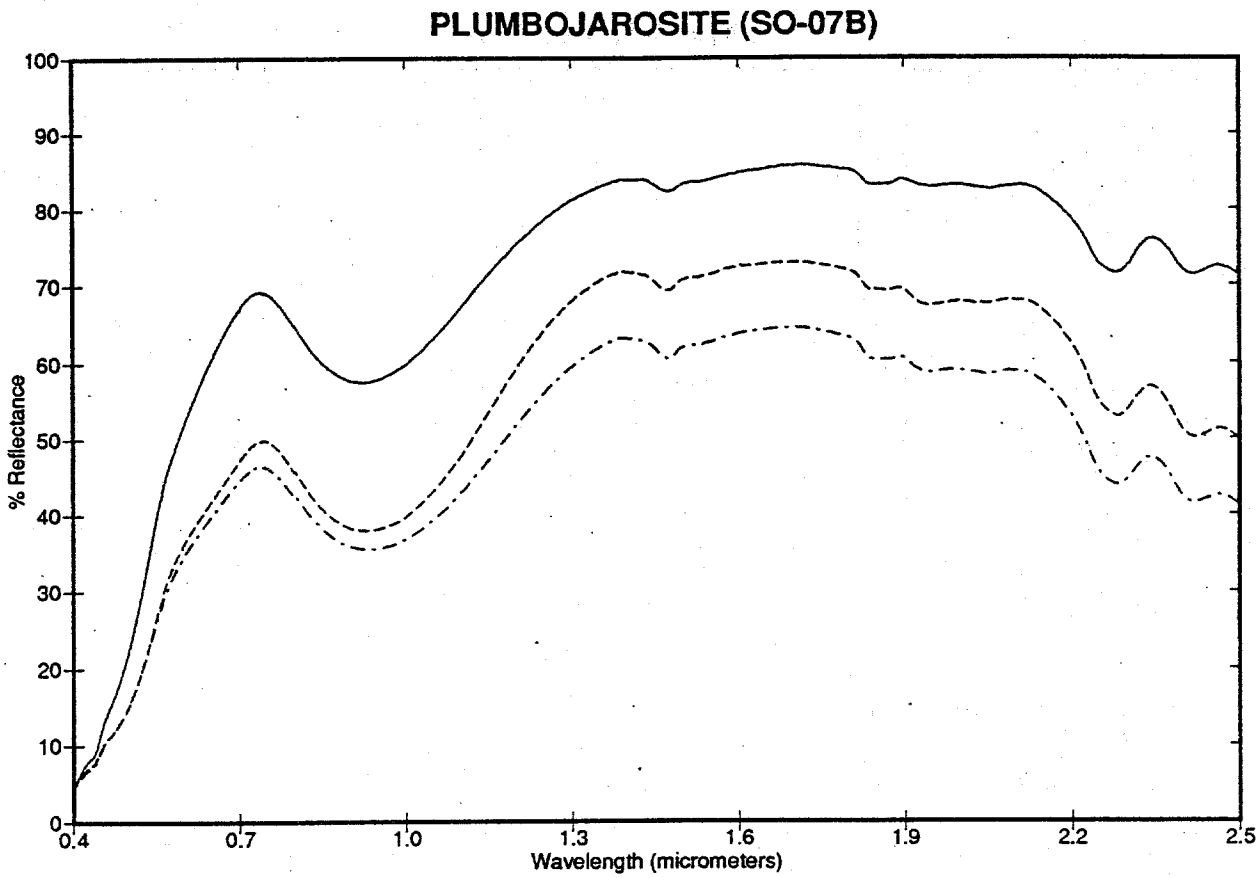
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9080	11.5734	2.5468	0.8783
0.5800	3.2140	0.2897	1.2778
0.4440	2.6826	0.1639	0.4745

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9800	14.5958	5.2175	0.5268
2.2760	7.2794	0.6689	1.5154
1.8560	6.3724	1.0131	0.6438
1.4760	3.6333	0.1857	0.6387
2.4480	1.5928	0.1319	1.7372

143



DESCRIPTION: PLUMBOJAROSITE
SAMPLE_NUM: SO-07B
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: HIDALGO
GEOGRAPHICAL_REGION: ZIMAPAN
SITE: LOMO DE TORO MINE
COLLECTOR: BURMINCO
MINERALOGY: PLUMBOJAROSITE(A),GOETHITE(M)
CHEMICAL FORMULA: $PbFe_3^{3+}(SO_4)_4(OH)_{12}$

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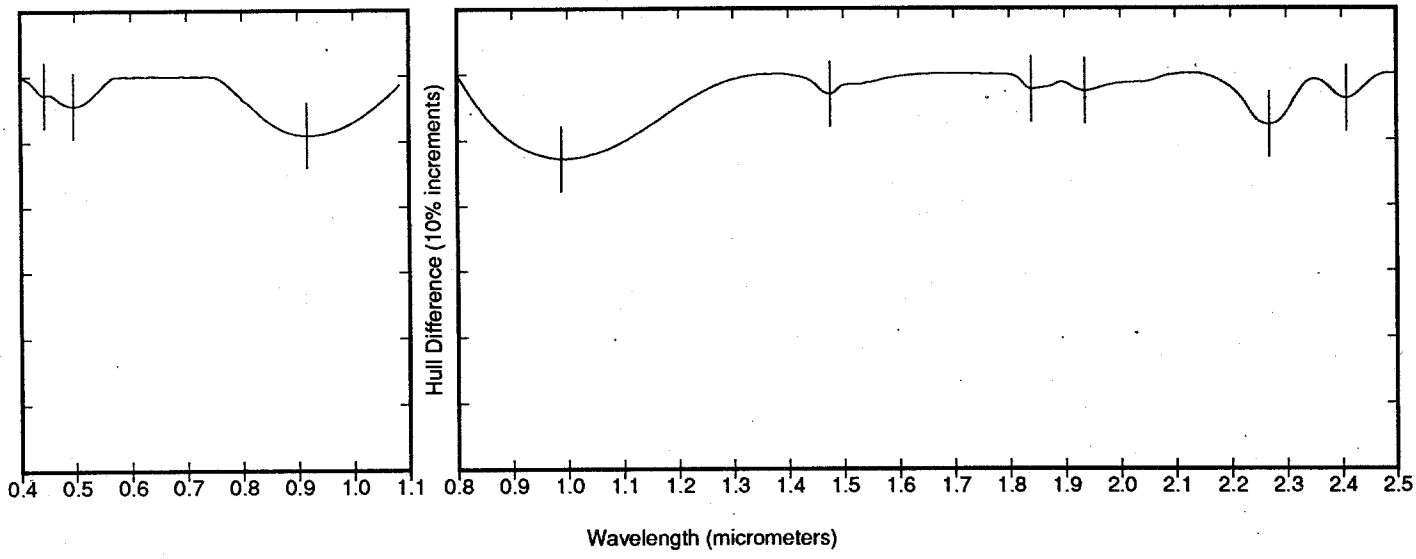
PLUMBOJAROSITE (SO-07B)



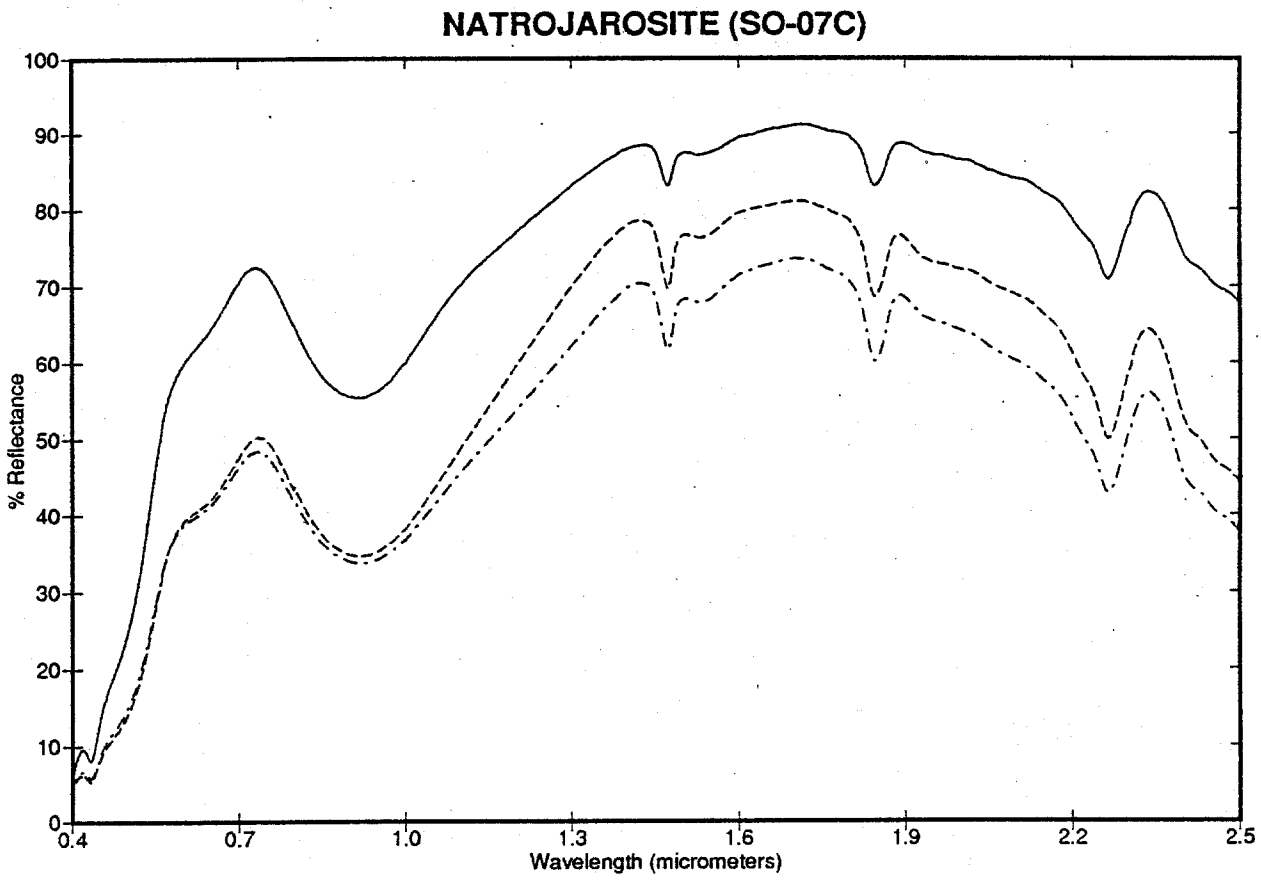
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9160	9.0271	1.9778	0.8415
0.4960	4.4508	0.3691	0.8924
0.4440	2.7865	0.0694	5.2932

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9880	12.8105	4.0161	0.6822
2.2680	7.7634	0.7907	1.1346
2.4080	3.8025	0.2665	0.9881
1.4760	3.0695	0.2854	0.5454
1.9360	2.6396	0.3153	0.3813
1.8400	2.3479	0.1553	0.5159

165



DESCRIPTION: NATROJAROSITE
SAMPLE_NUM: SO-07C
COUNTRY: USA
POLITICAL_SUBDIVISION: UTAH
GEOGRAPHICAL_REGION: TOOELE COUNTY
SITE: GOLD HILL
COLLECTOR: WARD'S
MINERALOGY: NATROJAROSITE(A),JAROSITE(M),GOETHITE(M)
CHEMICAL FORMULA: $NaFe_3^{3+}(SO_4)_2(OH)_6$

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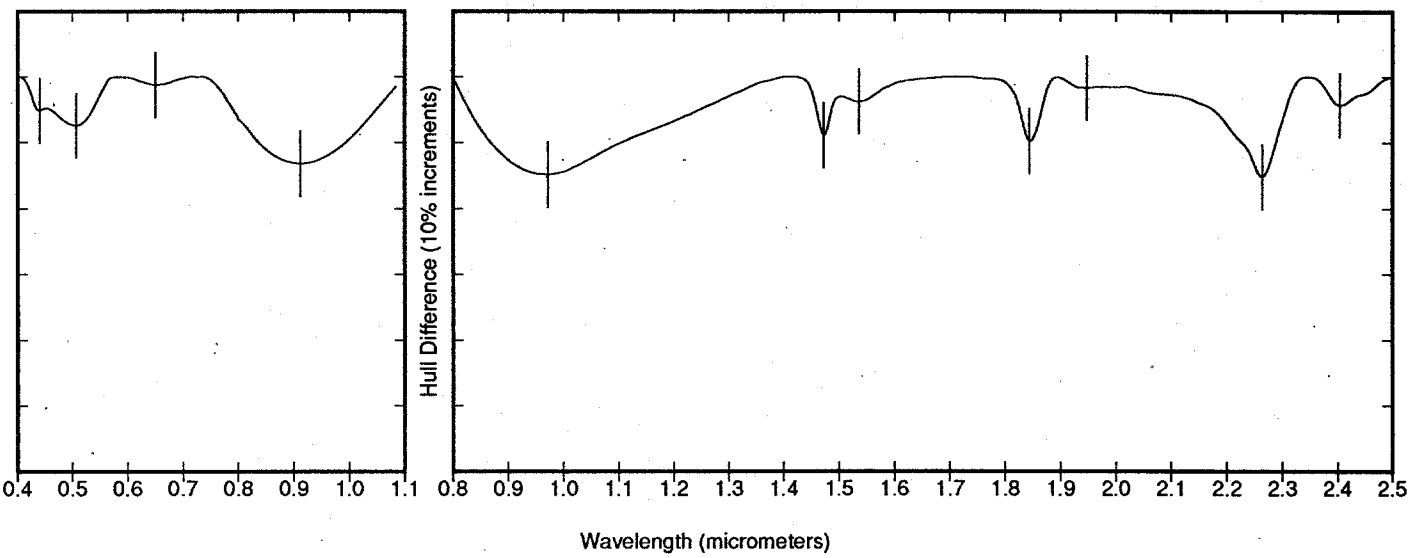
NATROJAROSITE (SO-07C)

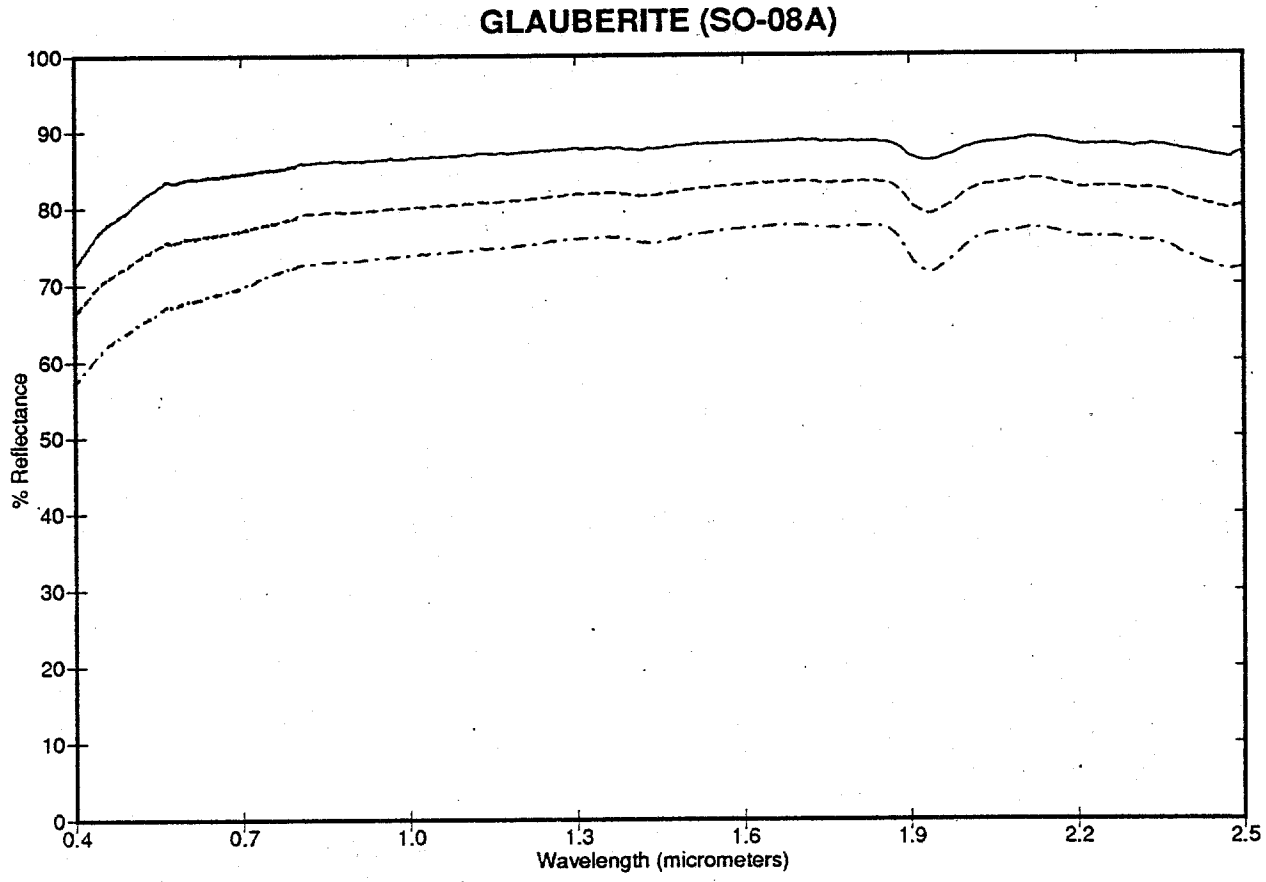


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9120	13.2161	2.8960	0.9054
0.5070	7.4173	0.6164	1.2452
0.4400	5.0973	0.1431	1.4150
0.6500	1.2576	0.0797	0.8196

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.2640	15.2351	1.8268	2.5870
0.9720	14.8793	4.8946	0.5645
1.8440	9.8581	0.4470	0.9756
1.4720	8.9933	0.3141	0.8178
2.4040	4.3467	0.3163	0.4860
1.5360	3.8367	0.3139	0.5497
1.9480	1.7175	0.1636	0.5322



DESCRIPTION: GLAUBERITE
SAMPLE_NUM: SO-08A
COUNTRY: USA
POLITICAL_SUBDIVISION: ARIZONA
GEOGRAPHICAL_REGION: YAVAPAI COUNTY
SITE: CAMPE VERDE
COLLECTOR: BURMINCO
MINERALOGY: GLAUBERITE(A)
CHEMICAL FORMULA: $Na_2Ca(SO_4)_2$

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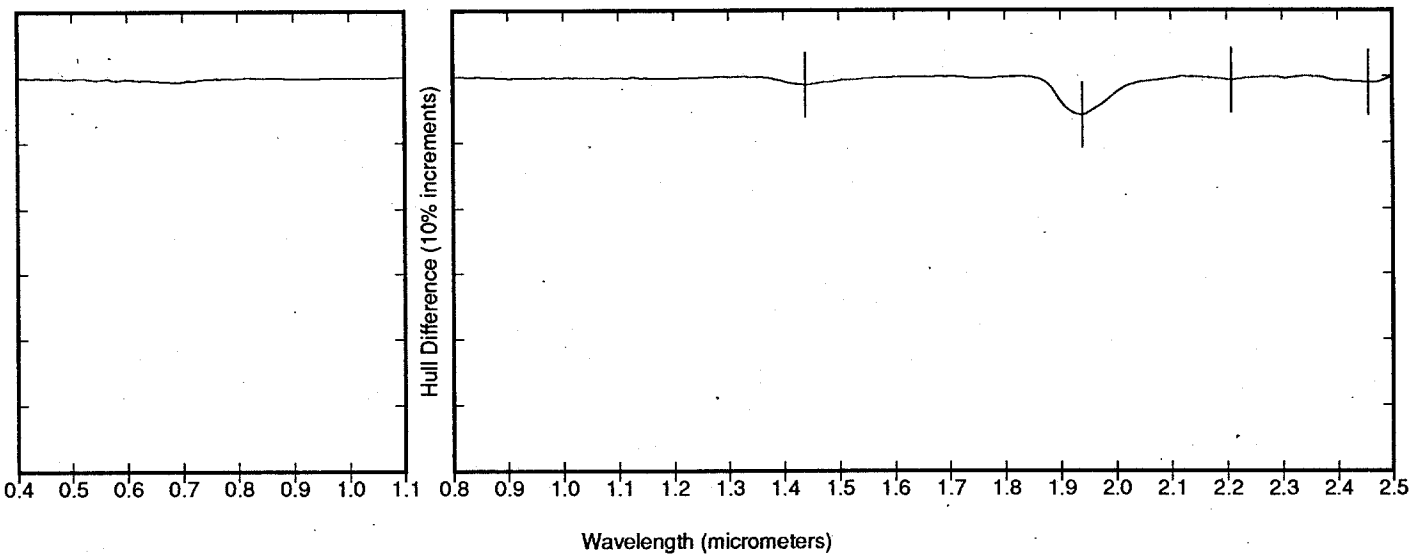
GLAUBERITE (SO-08A)

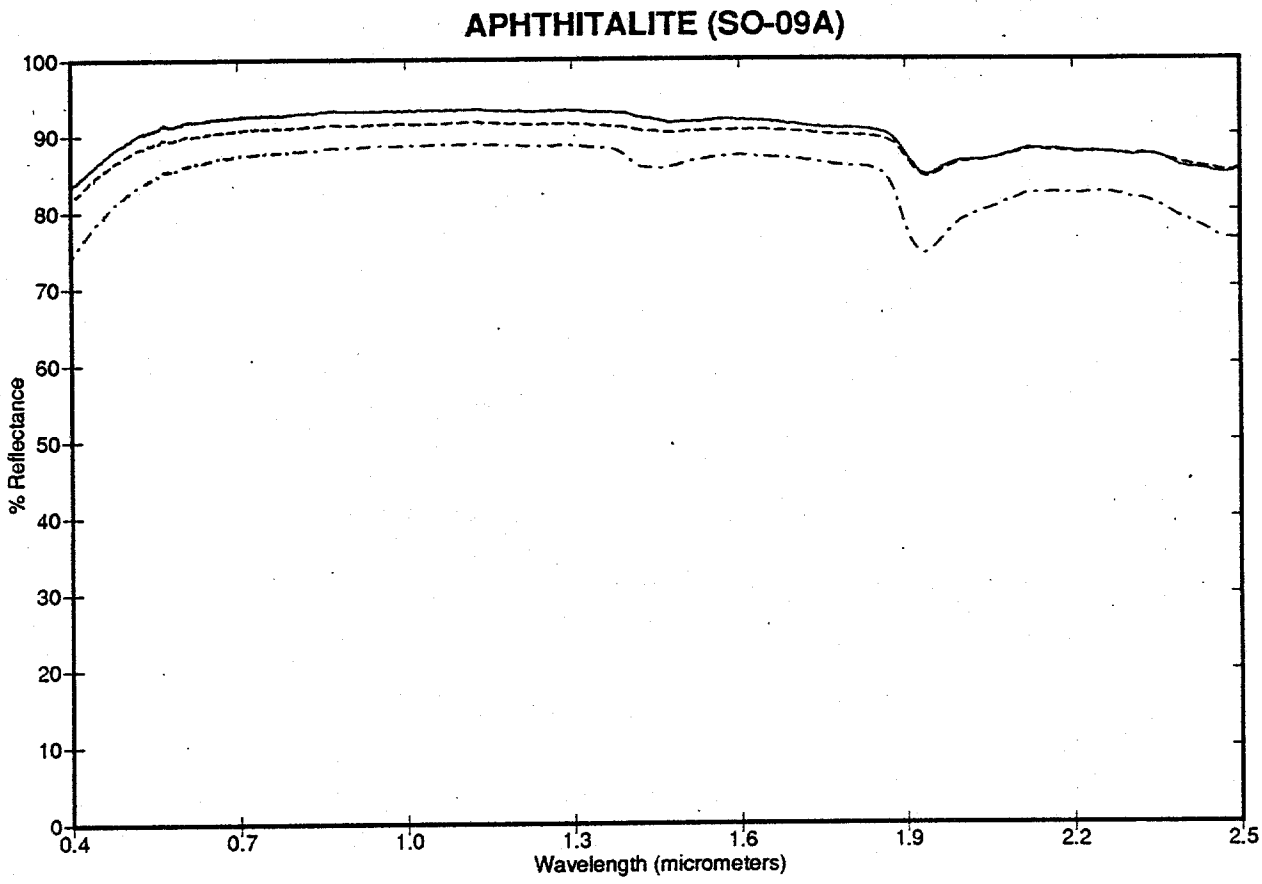


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9400	5.8982	0.6541	0.7553
1.4400	1.3255	0.1560	0.6533
2.4560	1.0163	0.0918	2.0270
2.2080	0.6457	0.0429	1.0437

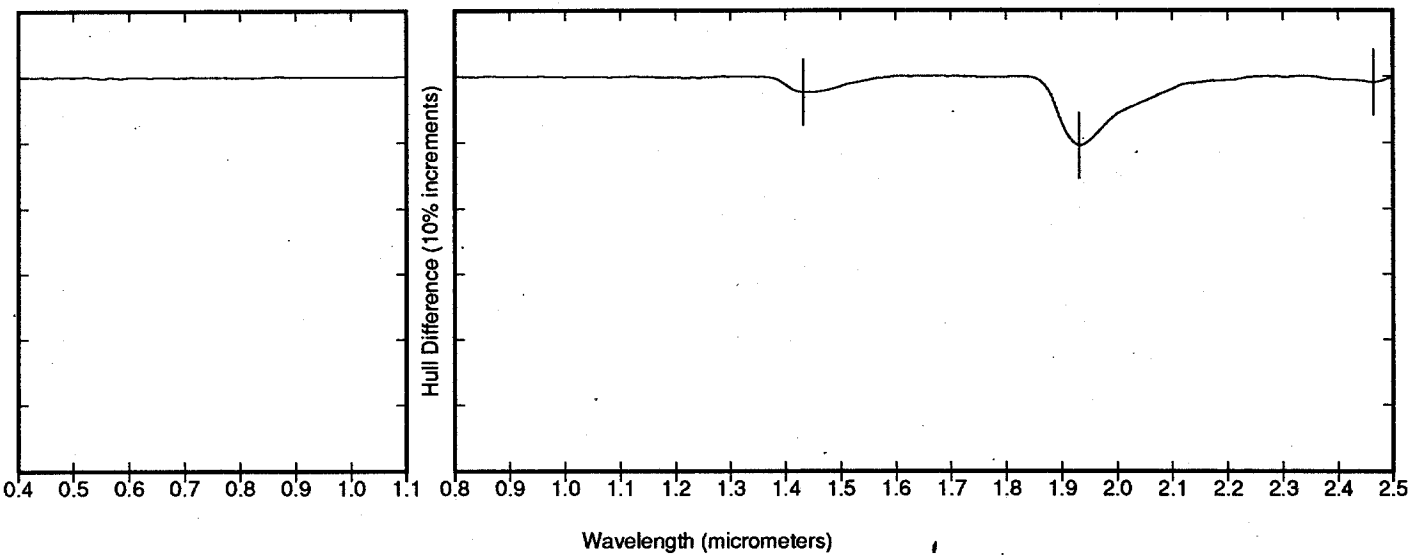
169



DESCRIPTION: APHTHITALITE
SAMPLE_NUM: SO-09A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: SAN BERNADINO COUNTY
SITE: SEARLES LAKE
COLLECTOR: BURMINCO
MINERALOGY: APHTHITALITE(A),QUARTZ(T)
CHEMICAL FORMULA: $(K,Na)_3Na(SO_4)_2$

170

APHTHITALITE (SO-09A)

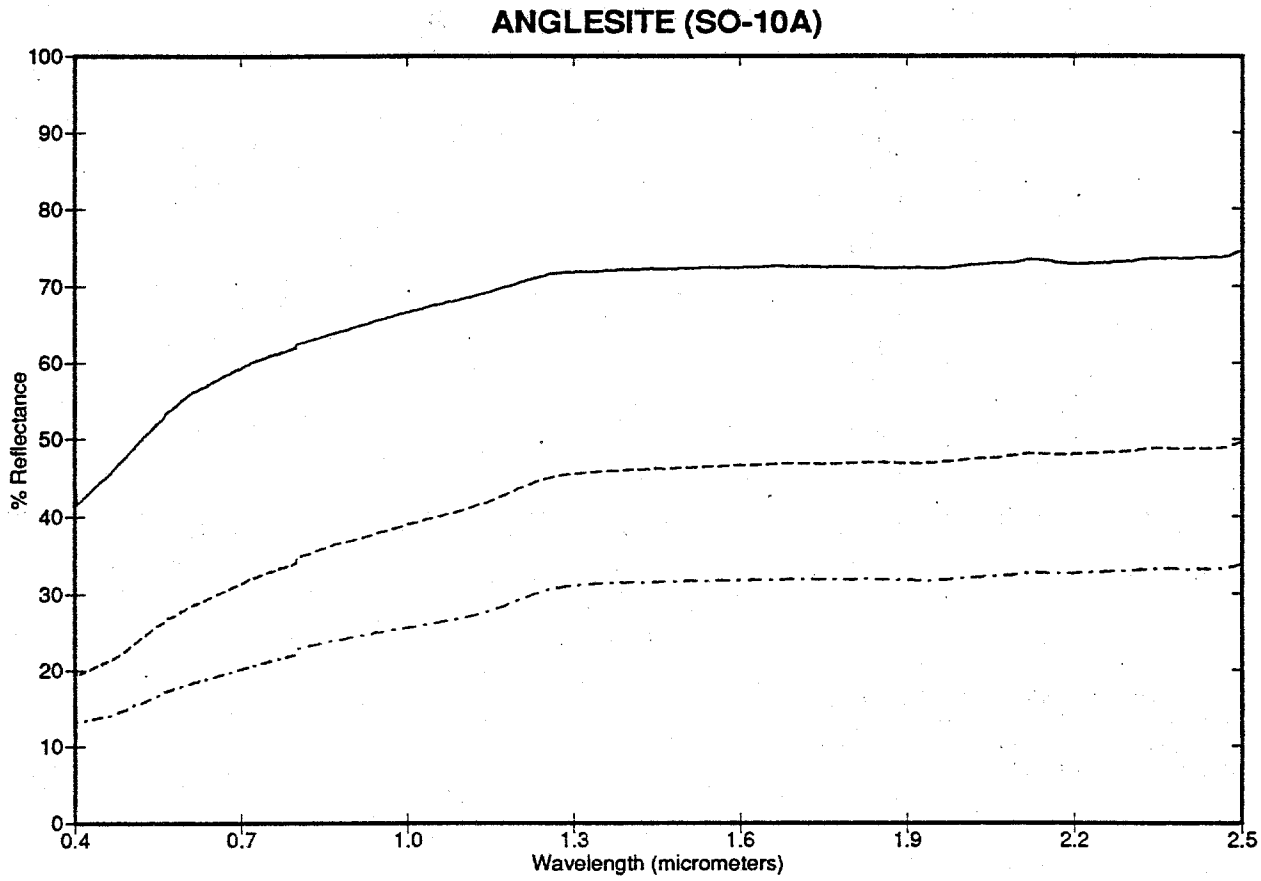


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9320	10.4897	1.4966	0.4042
1.4320	2.3947	0.3041	0.4395
2.4640	0.8665	0.0765	2.8481

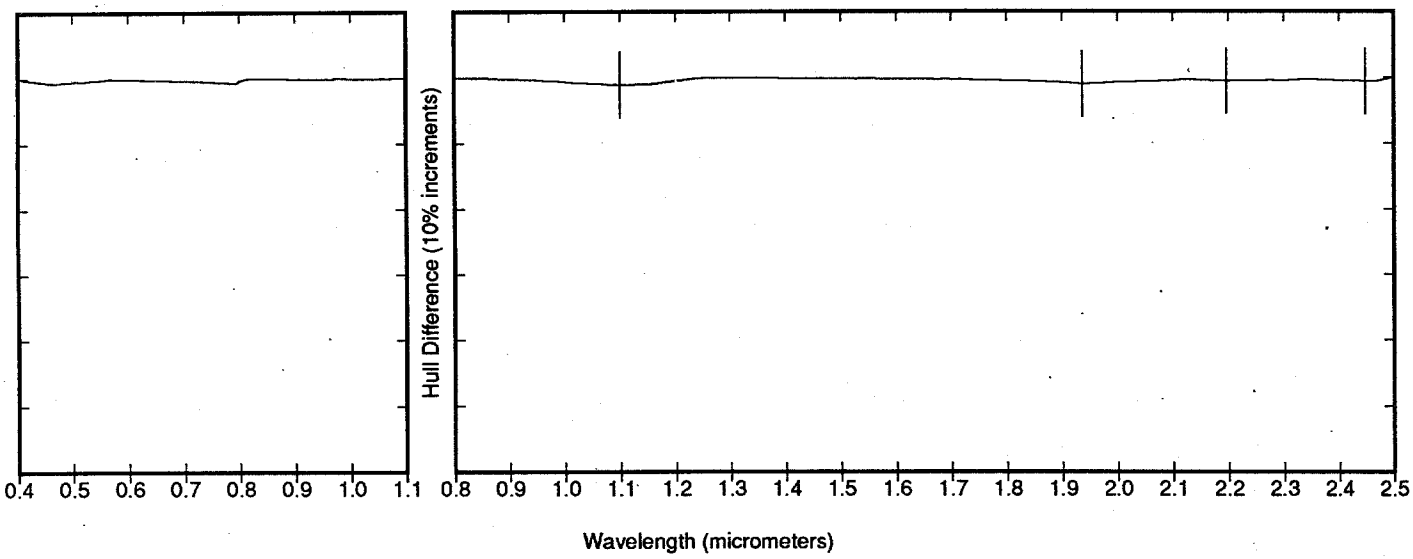
171



DESCRIPTION: ANGLESITE
SAMPLE_NUM: SO-10A
COUNTRY: USA
POLITICAL_SUBDIVISION: ARIZONA
GEOGRAPHICAL_REGION: SANTA CRUZ COUNTY
SITE: GLOVE MINE
COLLECTOR: JPL
MINERALOGY: ANGLESITE(A),CERUSSITE(M)
CHEMICAL FORMULA: $PbSO_4$

172

ANGLESITE (SO-10A)

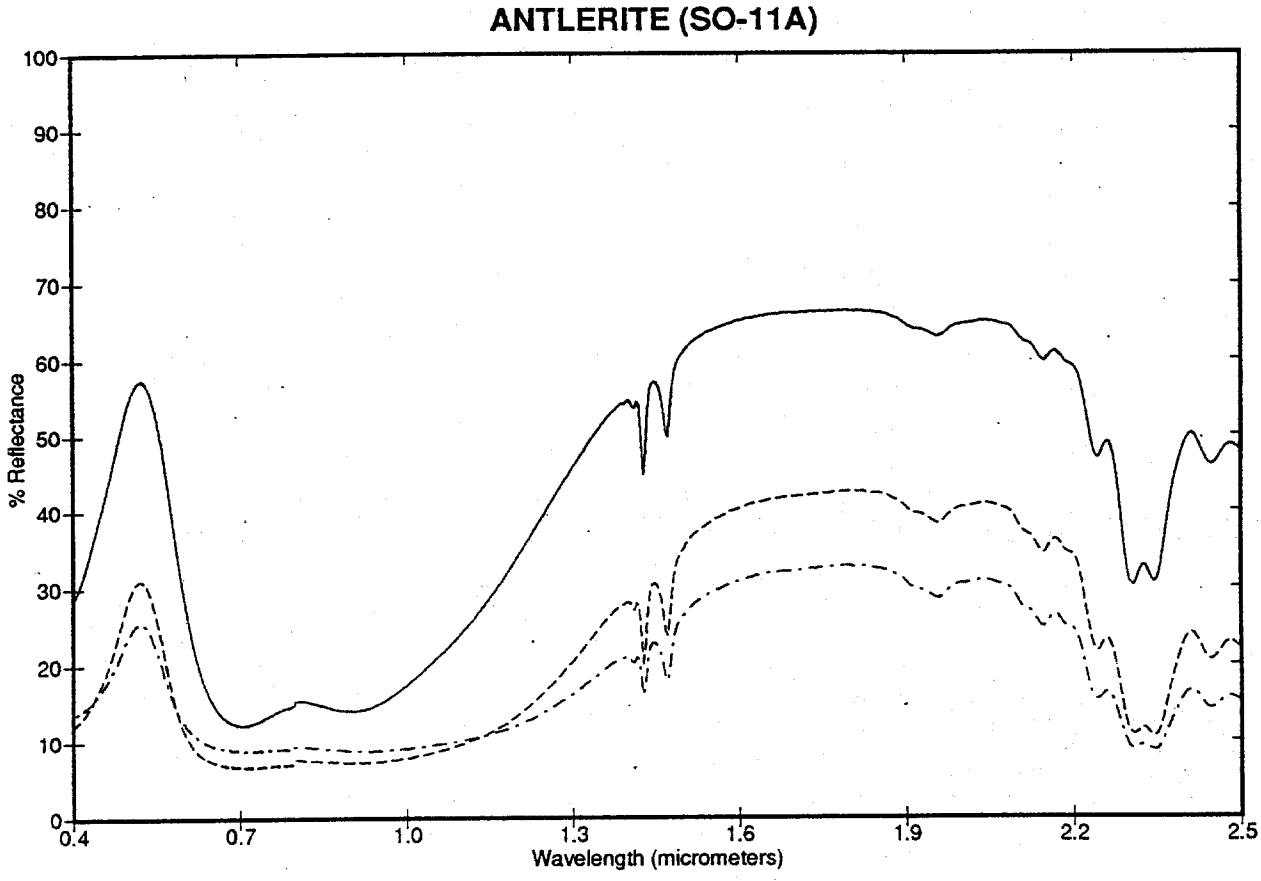


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 6.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.1000	1.0866	0.2187	1.1353
1.9360	0.9723	0.2485	0.9502
2.4480	0.5780	0.0659	2.1873
2.1960	0.5452	0.0941	0.3666

173



DESCRIPTION: ANTLERITE
SAMPLE_NUM: SO-11A
COUNTRY: USA
POLITICAL_SUBDIVISION: ARIZONA
GEOGRAPHICAL_REGION: GREENLEE COUNTY
SITE: MORENCI
COLLECTOR: BURMINCO
MINERALOGY: ANTLERITE(A),QUARTZ(M),POSSIBLE CHRYSOCOLLA(T)
CHEMICAL FORMULA: $Cu_3(SO_4)\ (OH)_4$

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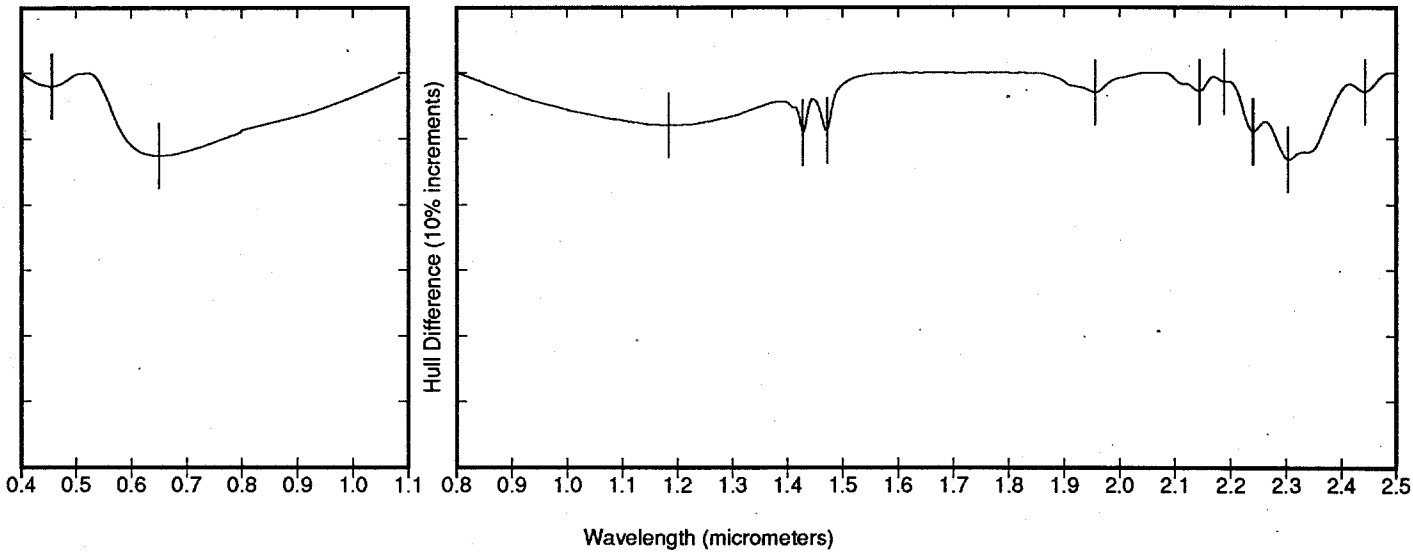
ANTLERITE (SO-11A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6500	12.5908	4.1471	0.3198
0.4560	2.0318	0.1343	1.2482

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3040	13.1858	1.4097	0.4627
1.4280	9.1418	0.3615	1.9566
2.2400	8.9170	0.3753	1.2559
1.4720	8.8605	0.3272	0.8763
1.1840	8.0317	3.2534	1.4318
1.9560	3.0689	0.2594	1.5707
2.4440	2.9157	0.1261	1.1415
2.1440	2.9088	0.1366	2.1717
2.1880	1.3938	0.0308	1.8071

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SULPHIDES

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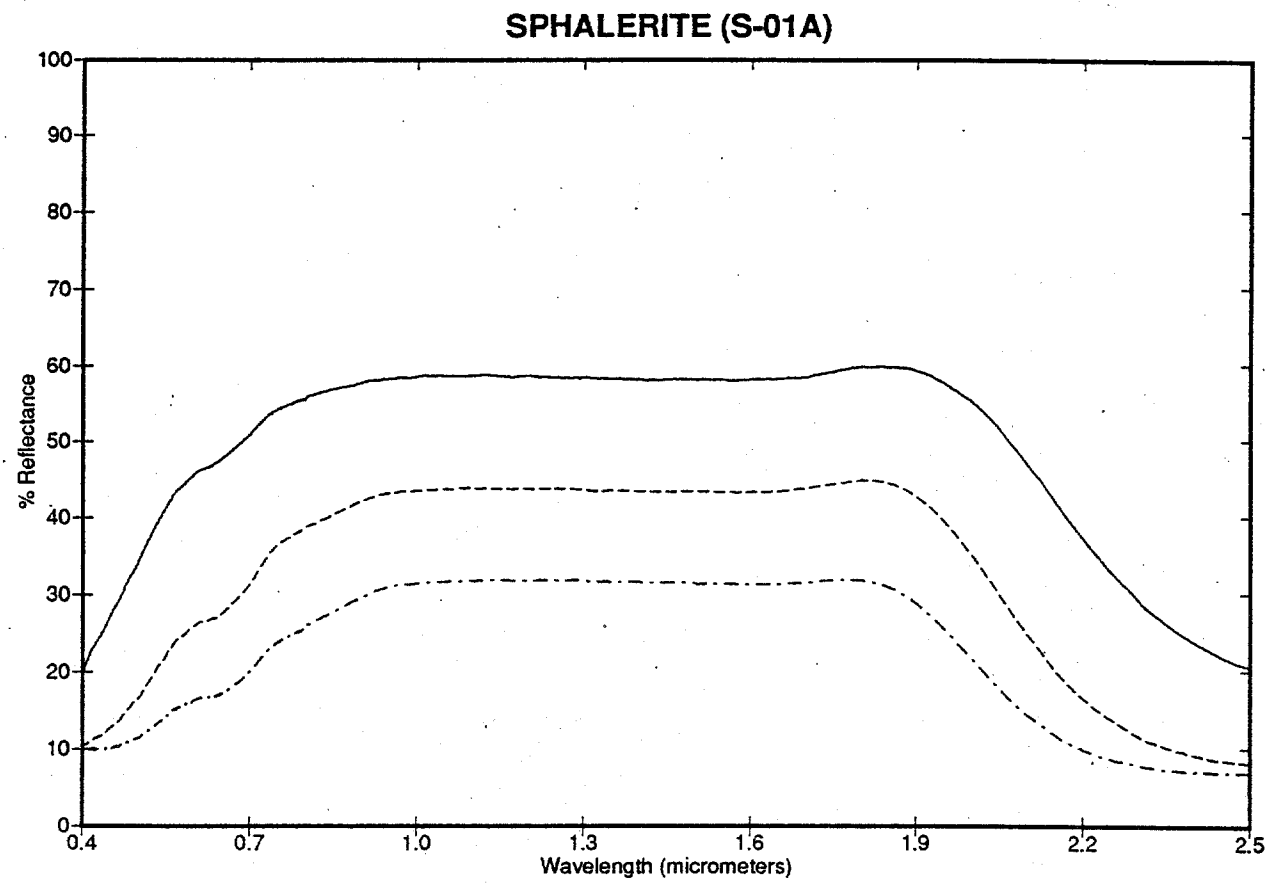
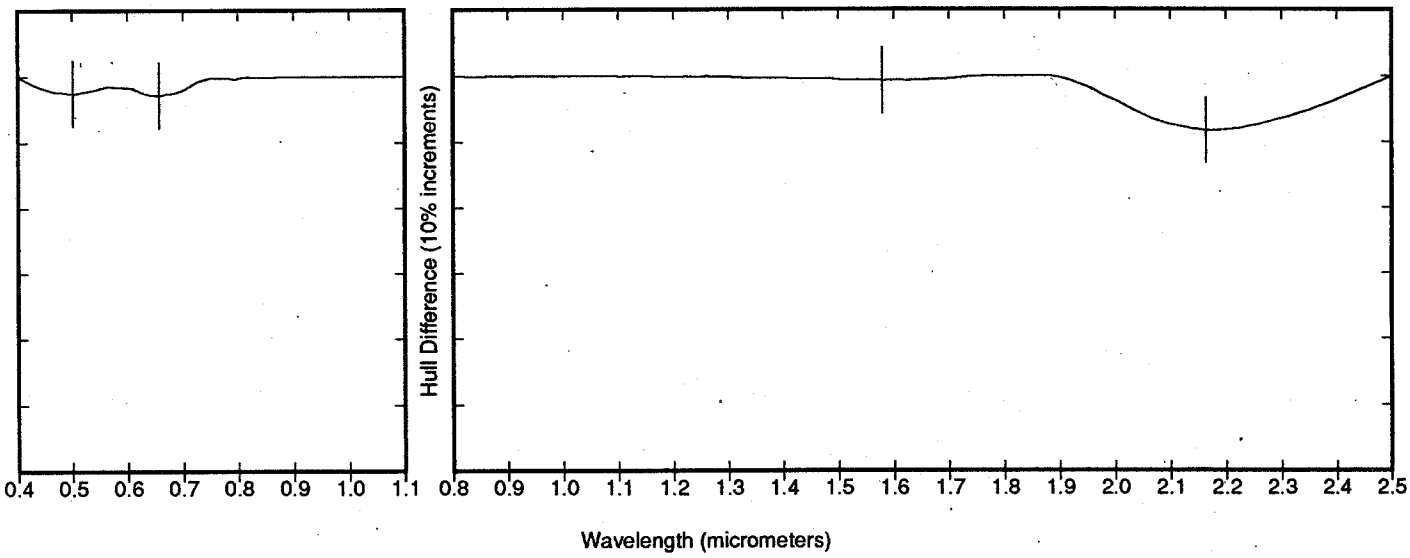


DESCRIPTION: SPHALERITE
SAMPLE_NUM: S-01A
COUNTRY: USA
POLITICAL_SUBDIVISION: OKLAHOMA
GEOGRAPHICAL_REGION: OTTAWA COUNTY
SITE: PICHER
COLLECTOR: JPL
MINERALOGY: SPHALERITE(A),WURTZITE(M)
CHEMICAL FORMULA: (Zn,Fe) S

SPHALERITE (S-01A)



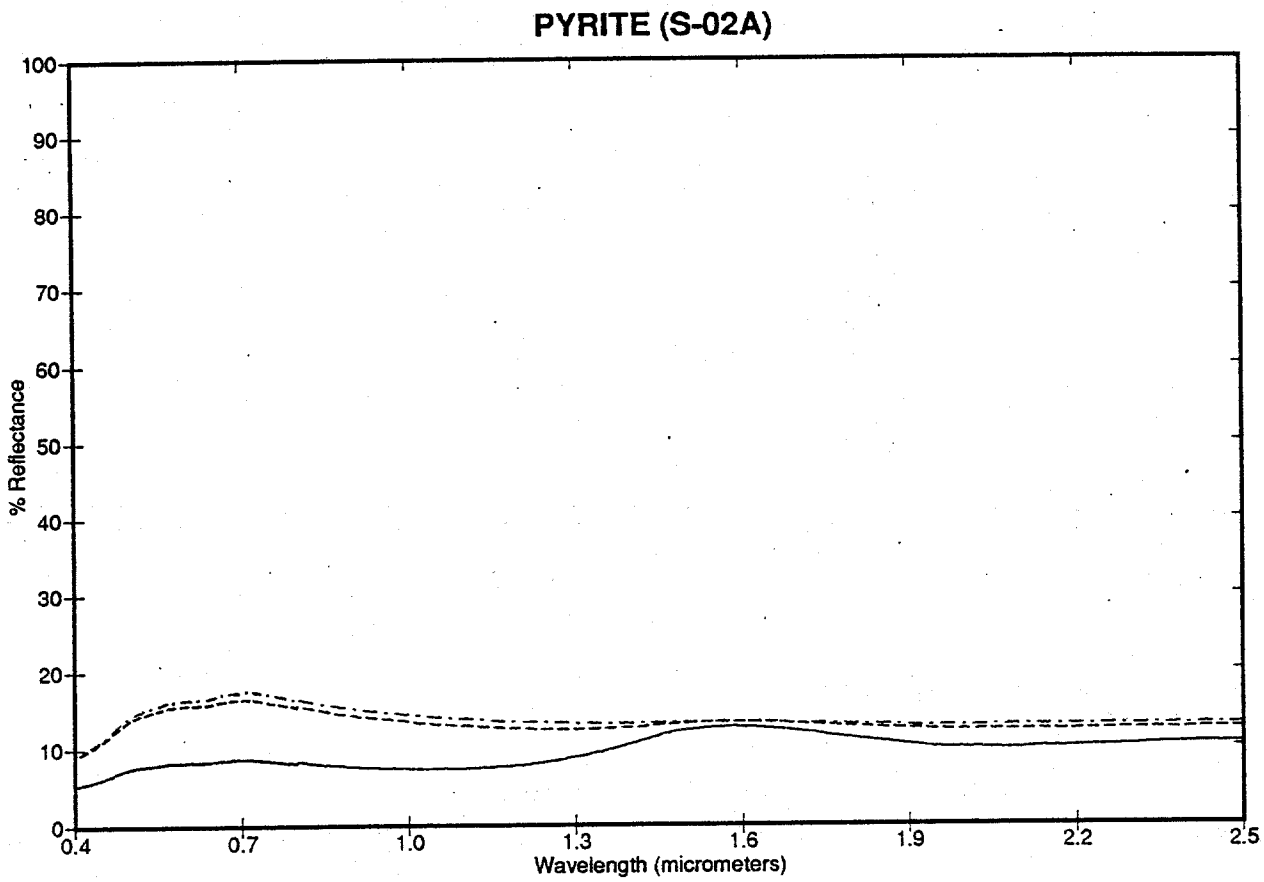
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 15.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6570	2.7811	0.3431	1.2104
0.5010	2.5628	0.2964	1.2798

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.1640	8.2725	2.9925	0.7278
1.5800	0.6629	0.1985	1.3503

178



DESCRIPTION: PYRITE
SAMPLE_NUM: S-02A
COUNTRY: ITALY
POLITICAL_SUBDIVISION: TUSCANY
GEOGRAPHICAL_REGION: ELBA
SITE: RIO MARINA ISLE
COLLECTOR: WARD'S
MINERALOGY: PYRITE(A)
CHEMICAL FORMULA: FeS_2

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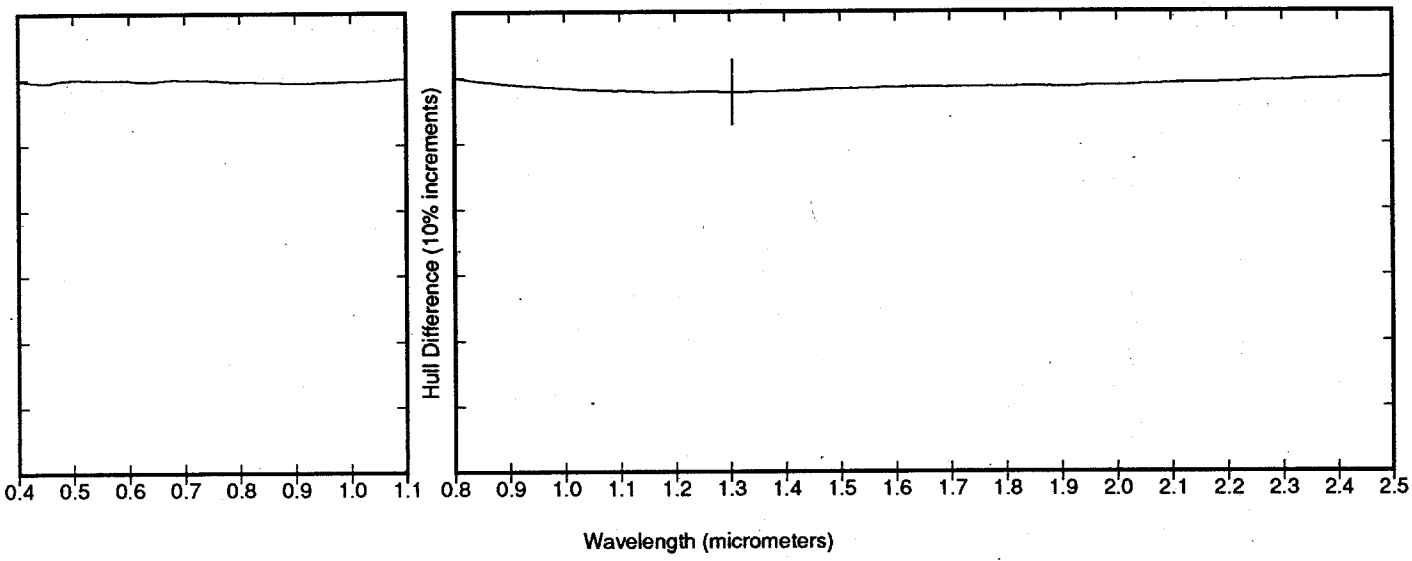
PYRITE (S-02A)

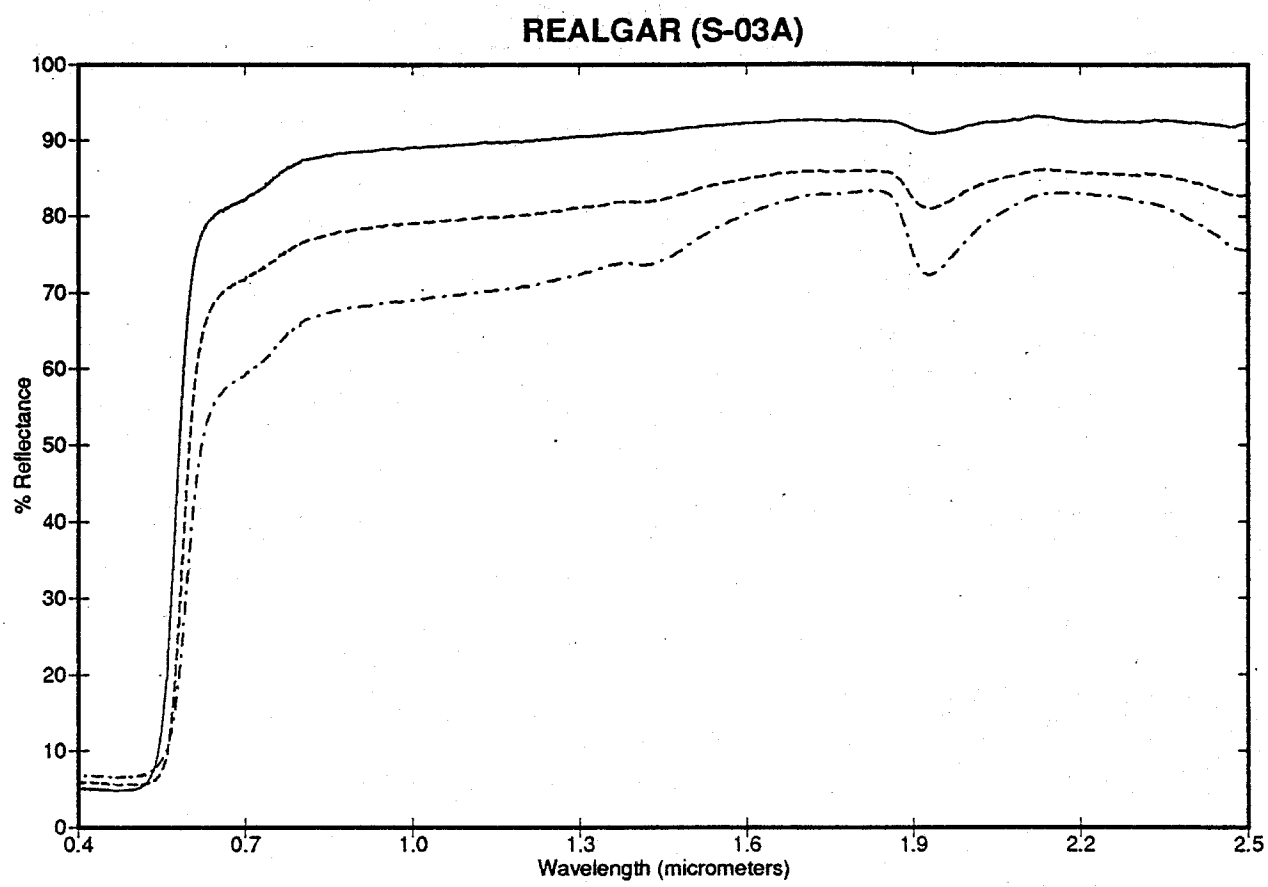


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3040	2.2433	2.2637	0.5609

180



DESCRIPTION: REALGAR
SAMPLE_NUM: S-03A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: REALGAR(A)
CHEMICAL FORMULA: AsS

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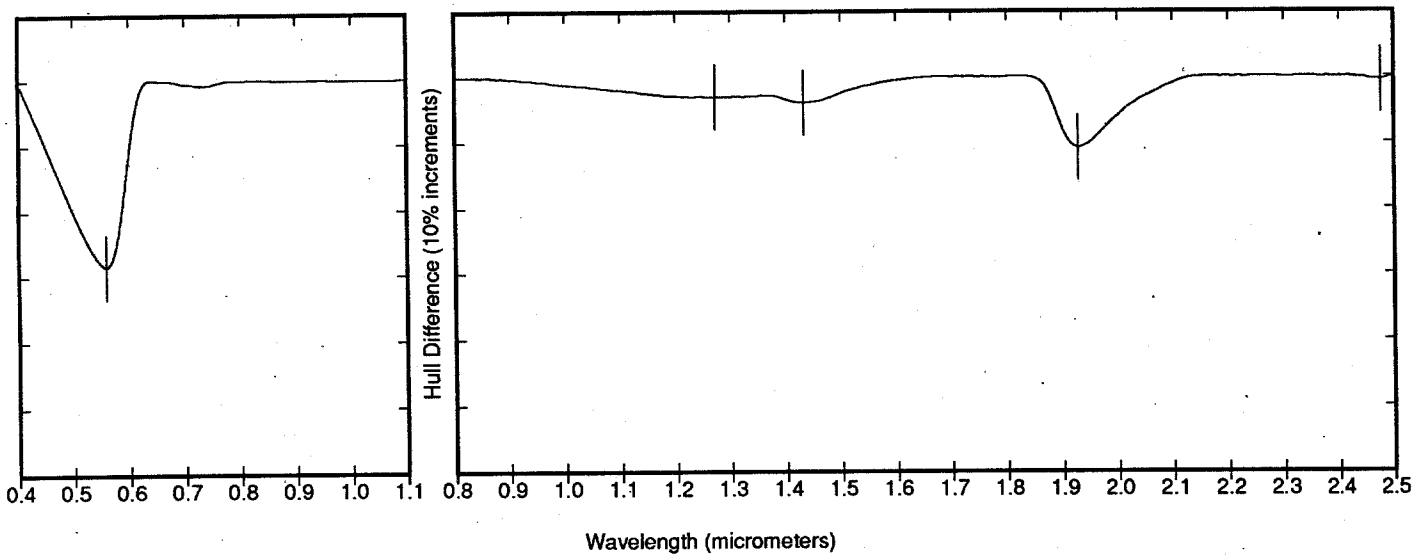
REALGAR (S-03A)



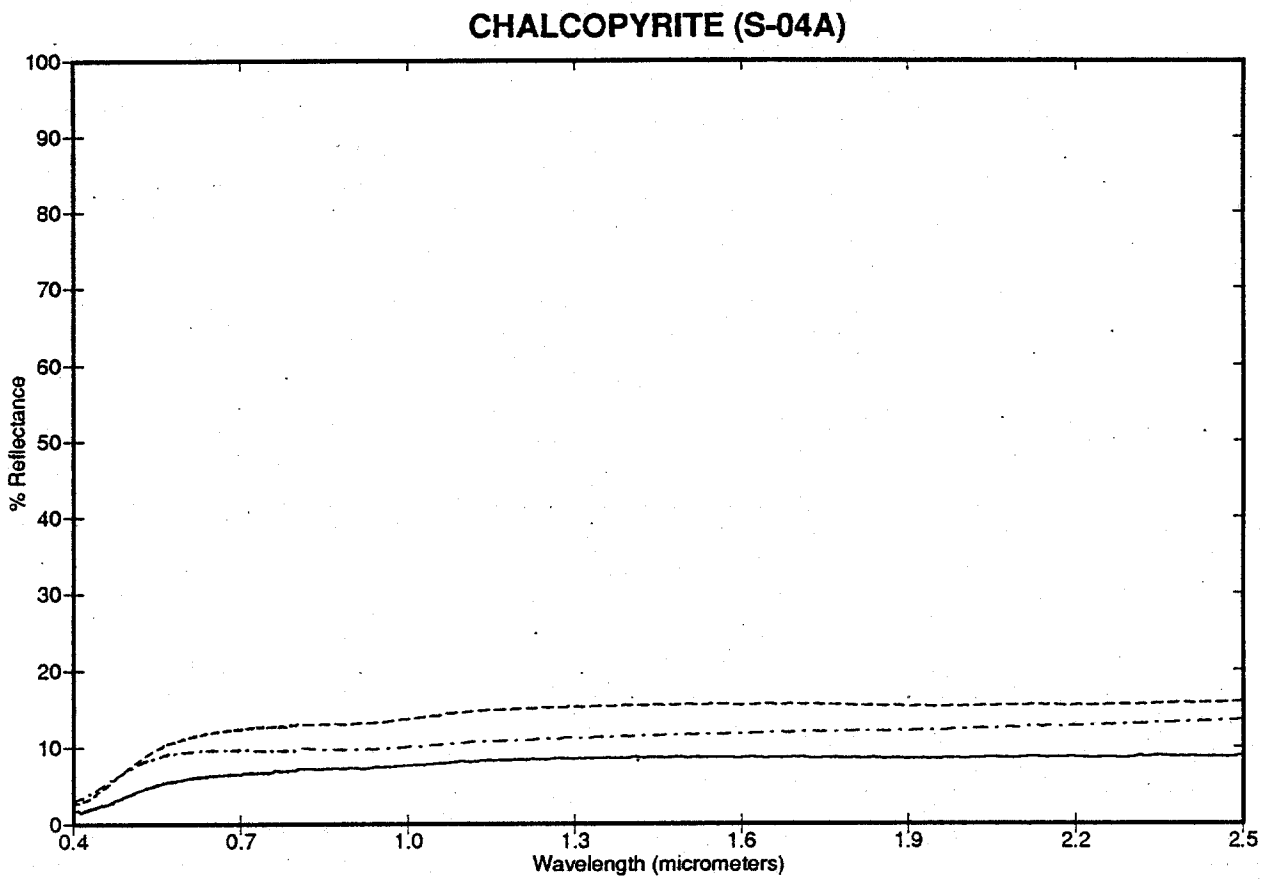
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5580	28.3838	3.5153	2.3400

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9280	10.8863	1.4155	0.4503
1.4320	3.9525	0.6408	0.6424
1.2720	3.0395	0.9386	2.7781
2.4760	0.5613	0.0259	2.4492

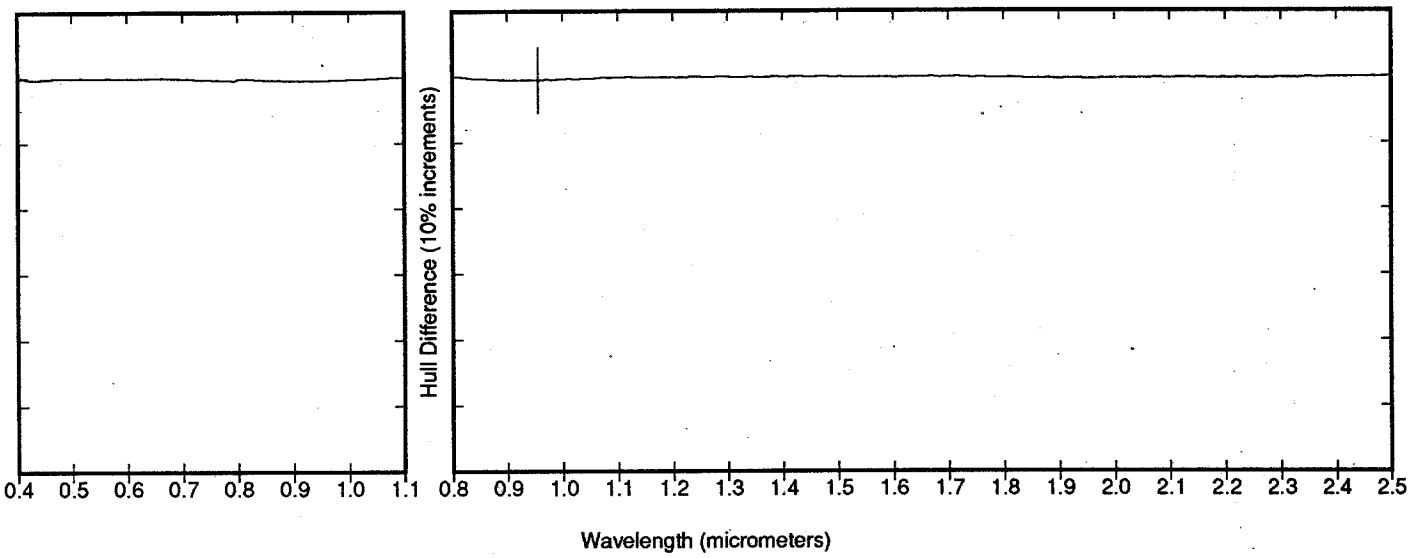
182



DESCRIPTION: CHALCOPYRITE
SAMPLE_NUM: S-04A
COUNTRY: CANADA
POLITICAL_SUBDIVISION: QUEBEC
GEOGRAPHICAL_REGION: ROUYN DISTRICT
SITE: NULL
COLLECTOR: JPL
MINERALOGY: CHALCOPYRITE(A),PYRRHOTITE(M)
CHEMICAL FORMULA: $CuFeS_2$

183

CHALCOPYRITE (S-04A)

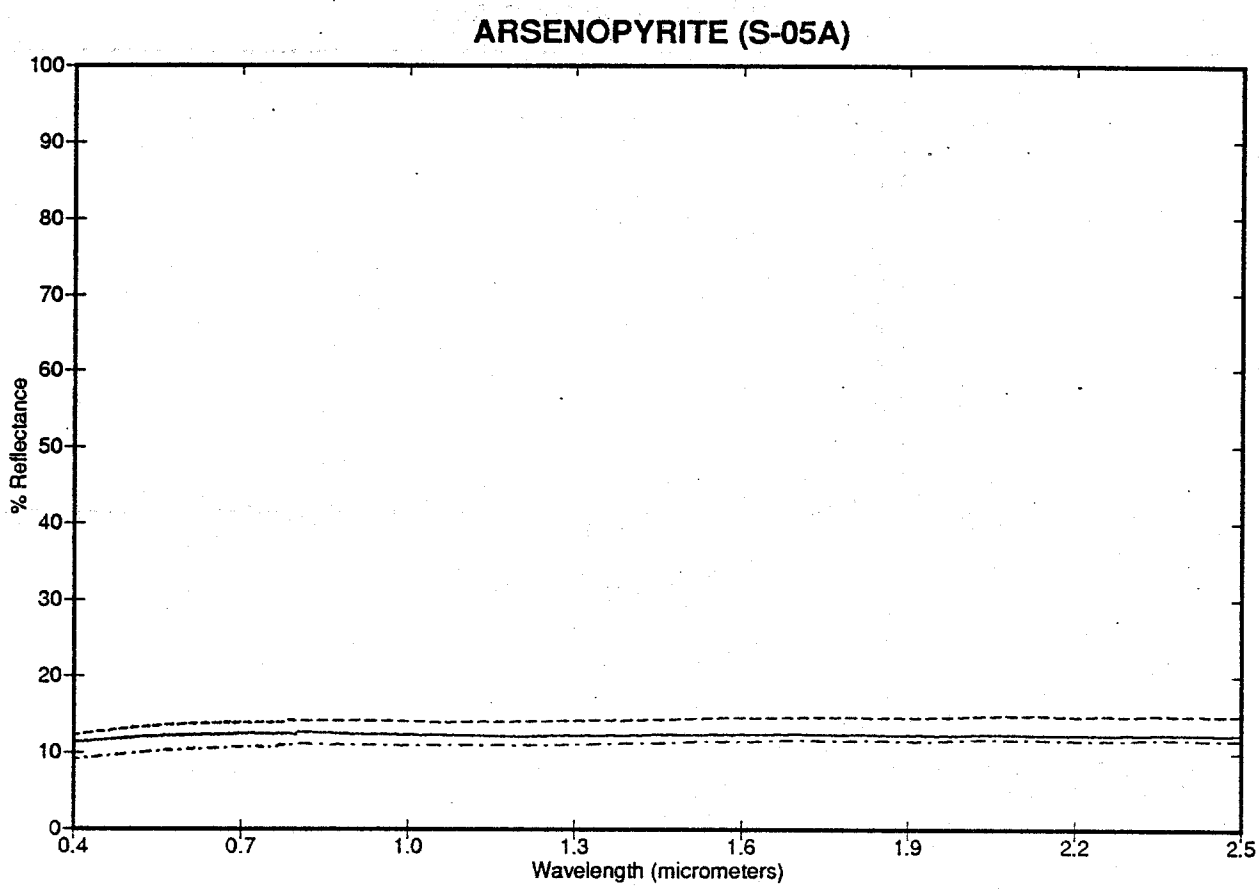


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9560	0.5276	0.0544	4.8342

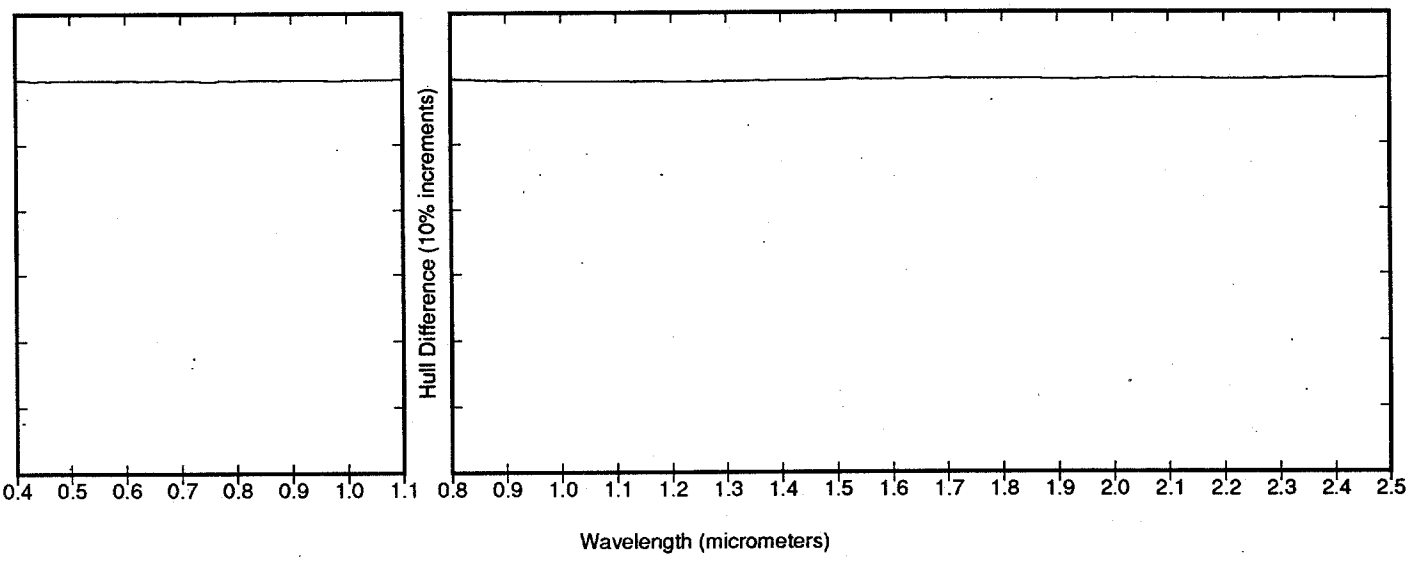
189



DESCRIPTION: ARSENOPYRITE
SAMPLE_NUM: S-05A
COUNTRY: USA
POLITICAL_SUBDIVISION: UTAH
GEOGRAPHICAL_REGION: TOOELE COUNTY
SITE: GOLD HILL
COLLECTOR: BURMINCO
MINERALOGY: ARSENOPYRITE(A),QUARTZ(M)
CHEMICAL FORMULA: FeAsS

185

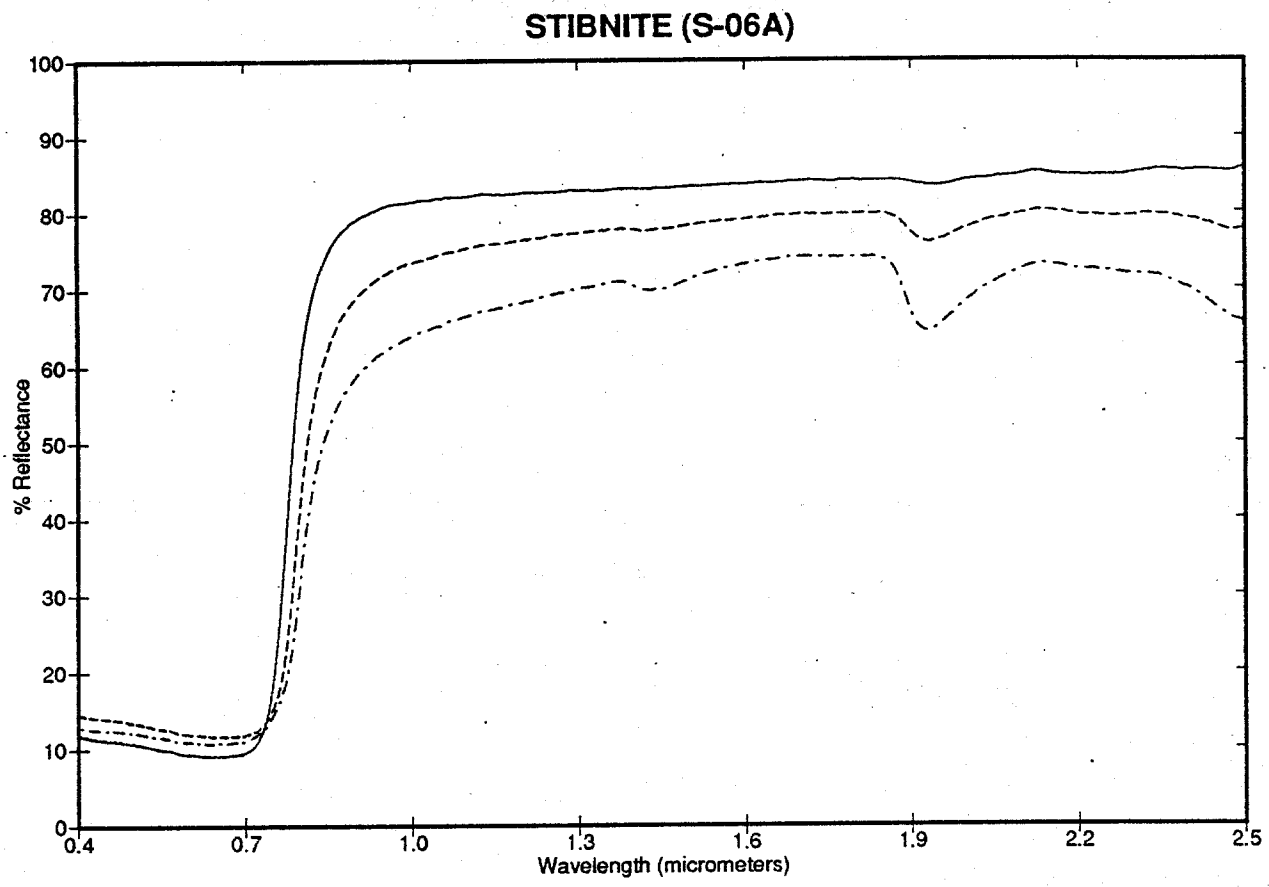
ARSENOPYRITE (S-05A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

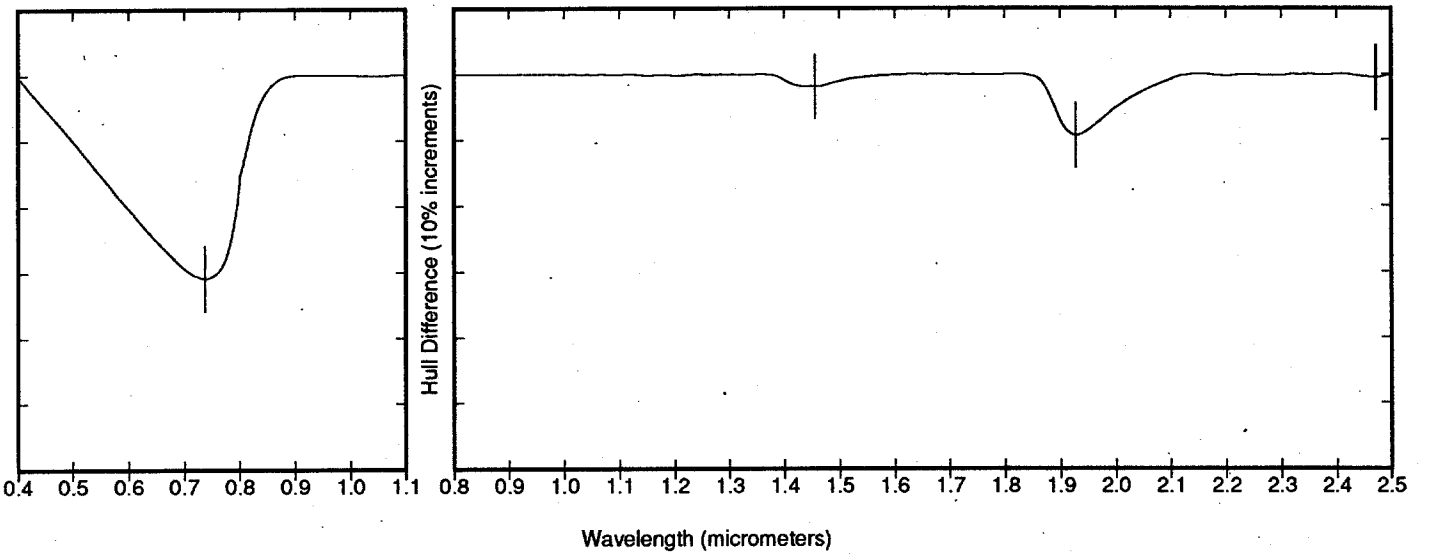
126



DESCRIPTION: STIBNITE
SAMPLE_NUM: S-06A
COUNTRY: USA
POLITICAL_SUBDIVISION: NEVADA
GEOGRAPHICAL_REGION: LANDER COUNTY
SITE: AUSTIN
COLLECTOR: BURMINCO
MINERALOGY: STIBNITE(A),QUARTZ(M)
CHEMICAL FORMULA: Sb_2S_3

187

STIBNITE (S-06A)

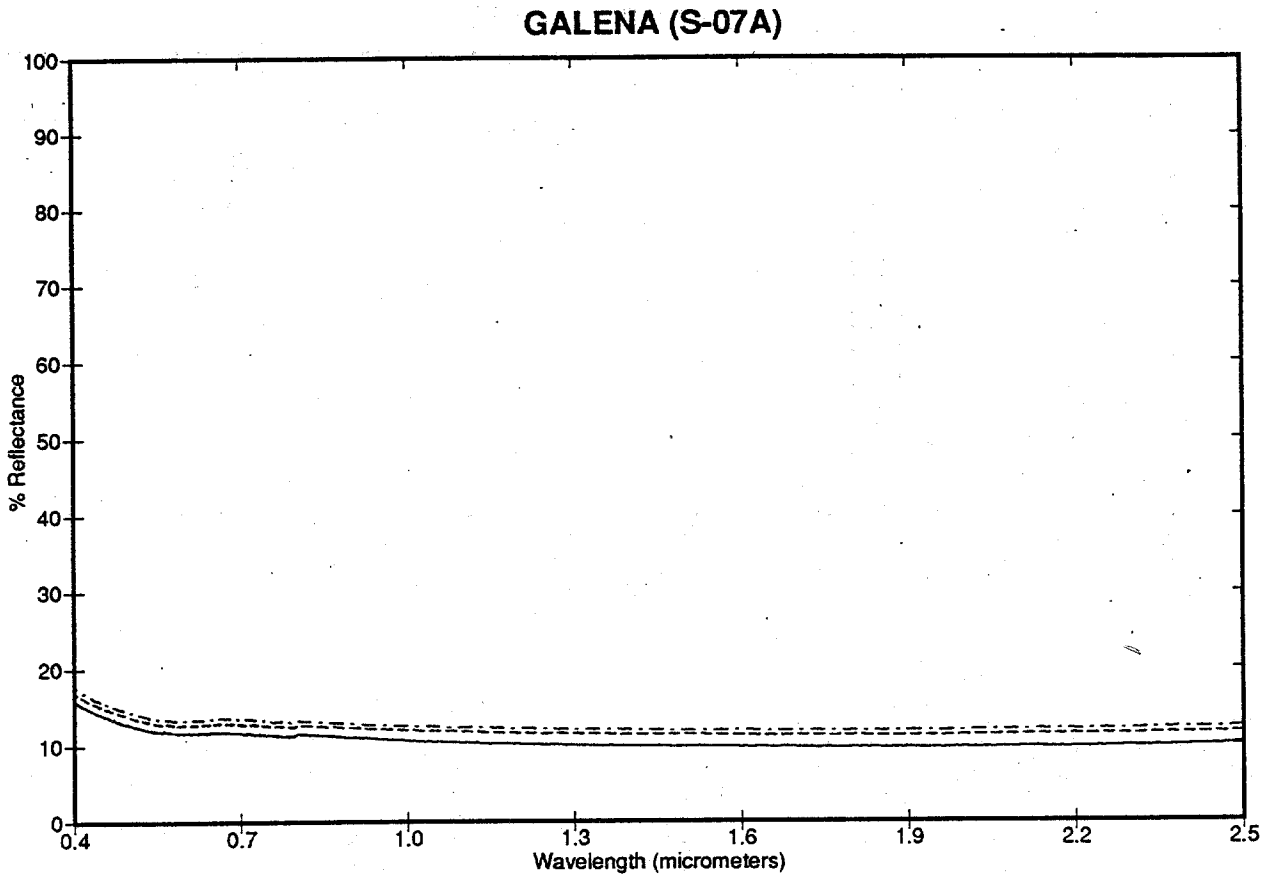


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7370	30.7989	7.7835	2.6447

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

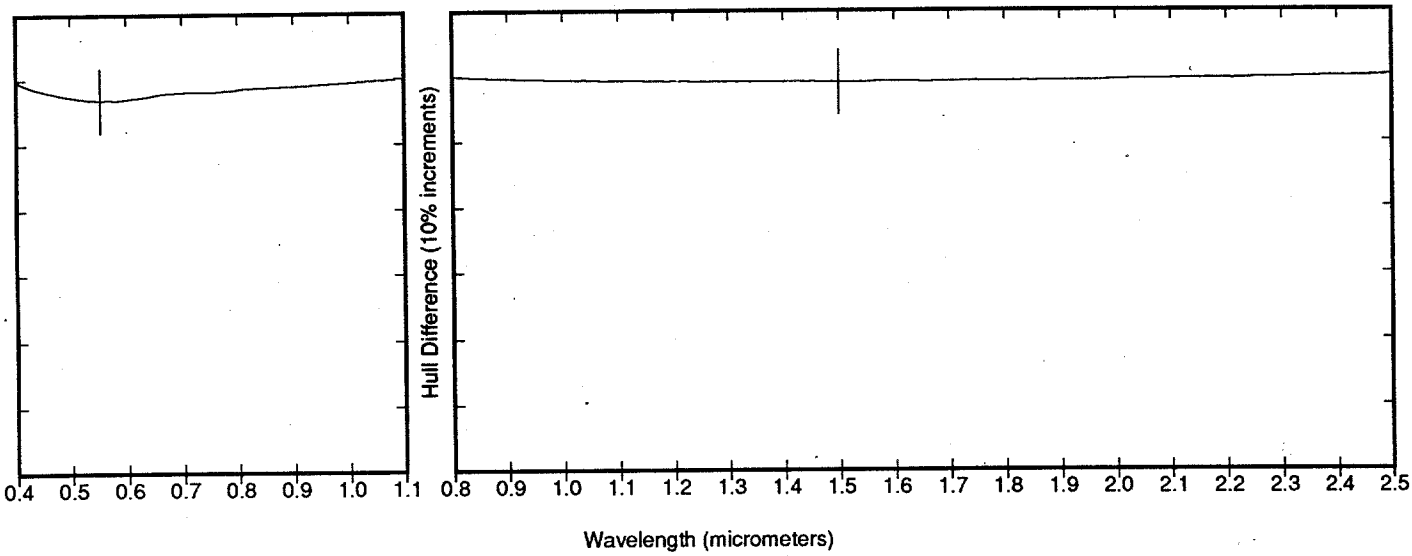
WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9280	9.3883	1.2187	0.4574
1.4560	1.9133	0.2241	0.8685
2.4720	0.5701	0.0267	1.9123



DESCRIPTION: GALENA
SAMPLE_NUM: S-07A
COUNTRY: USA
POLITICAL_SUBDIVISION: KANSAS
GEOGRAPHICAL_REGION: CHEROKEE COUNTY
SITE: GALENA
COLLECTOR: GRIEGER'S INC
MINERALOGY: GALENA(A)
CHEMICAL FORMULA: PbS

189

GALENA (S-07A)



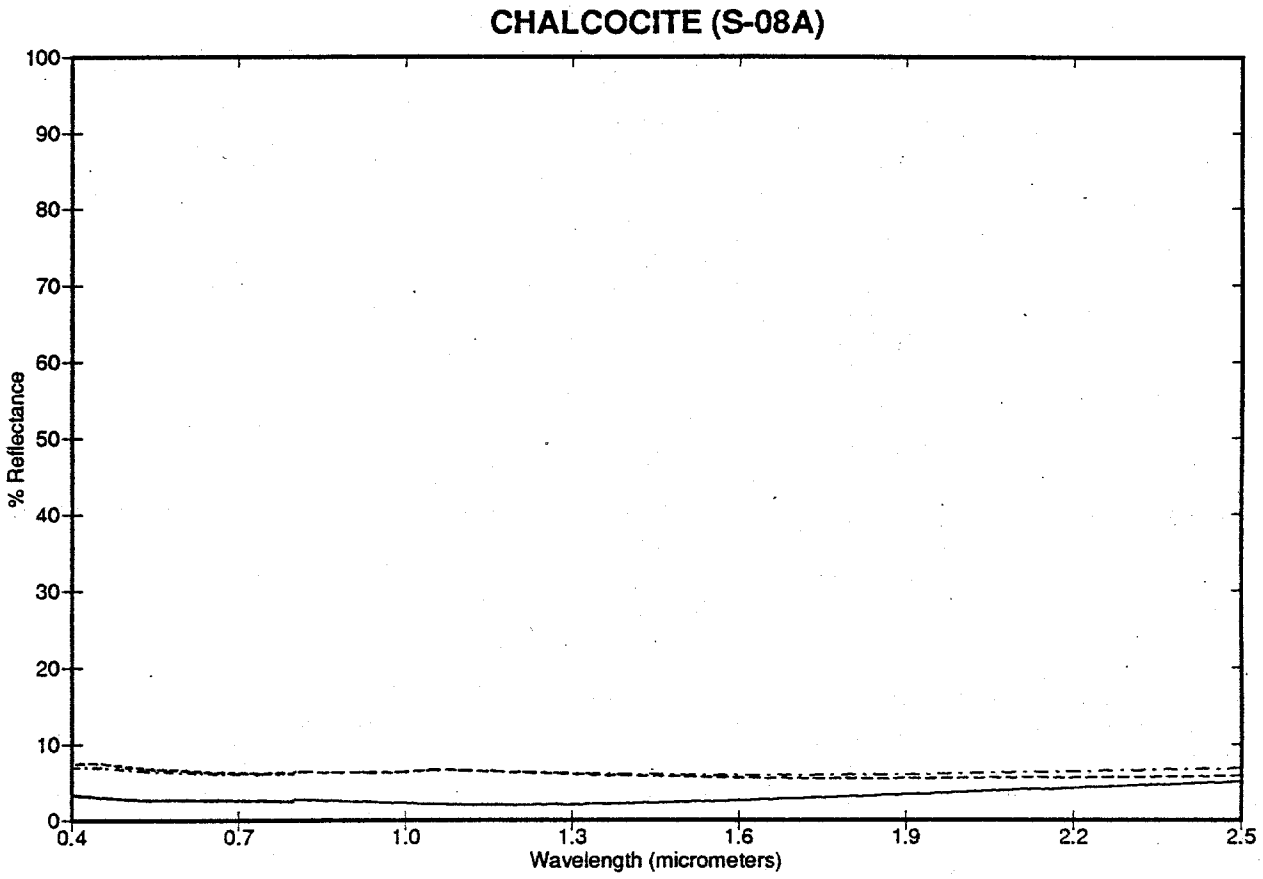
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 19.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5520	3.0443	1.0570	0.3953

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.5000	0.9921	1.1176	0.7757

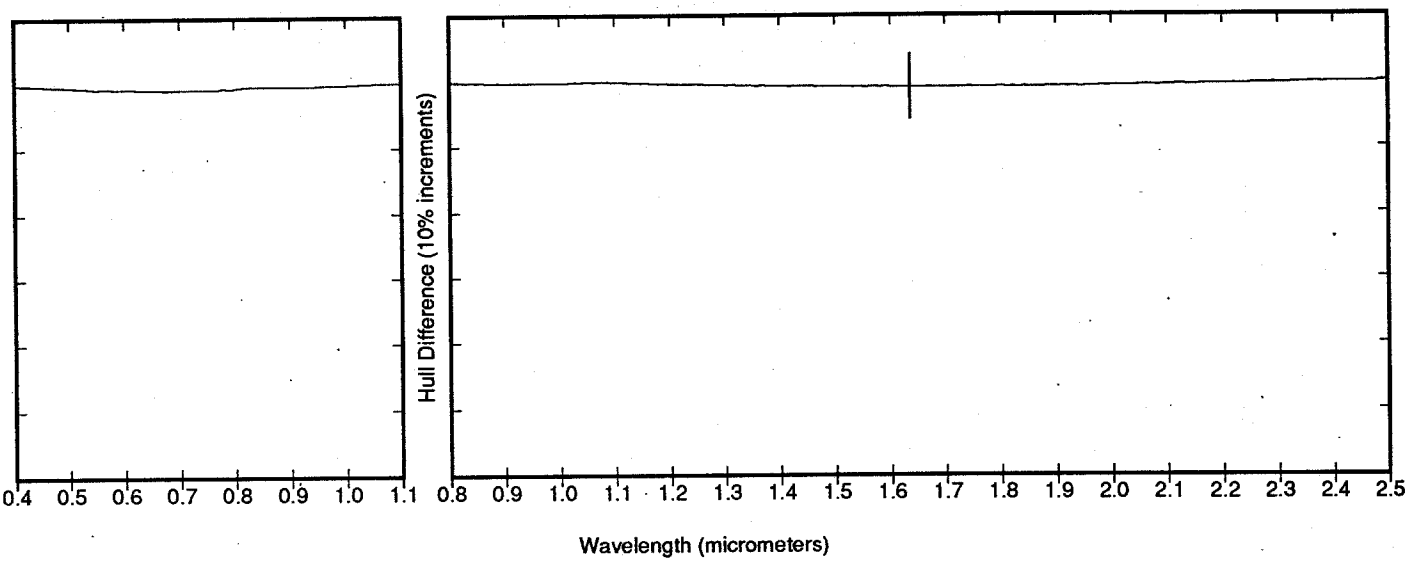
190



DESCRIPTION: CHALCOCITE
SAMPLE_NUM: S-08A
COUNTRY: USA
POLITICAL_SUBDIVISION: ALASKA
GEOGRAPHICAL_REGION: KENNECOTT
SITE: KENNECOTT
COLLECTOR: BURMINCO
MINERALOGY: CHALCOCITE(A)
CHEMICAL FORMULA: Cu_2S

191

CHALCOCITE (S-08A)

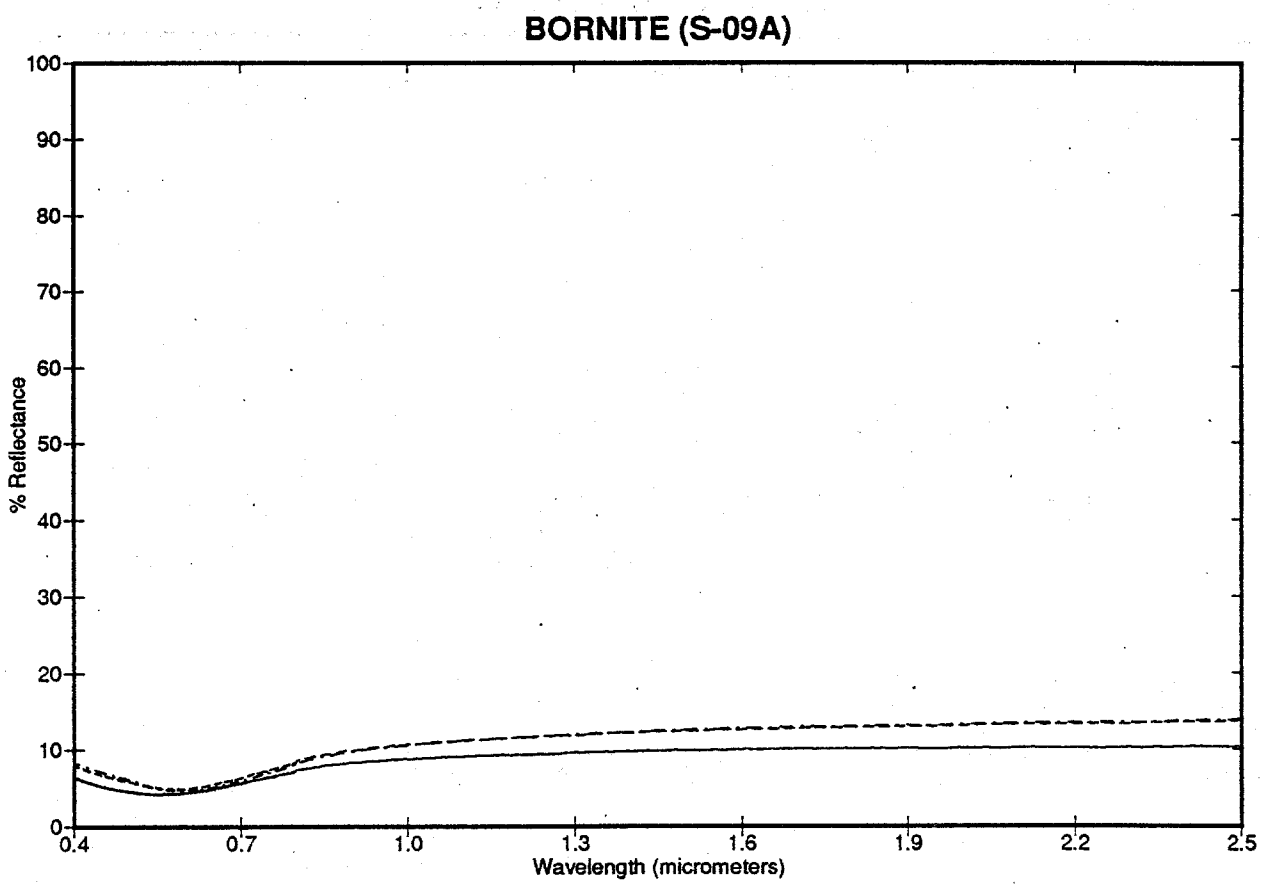


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 14.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.6360	0.9062	0.8264	0.6180

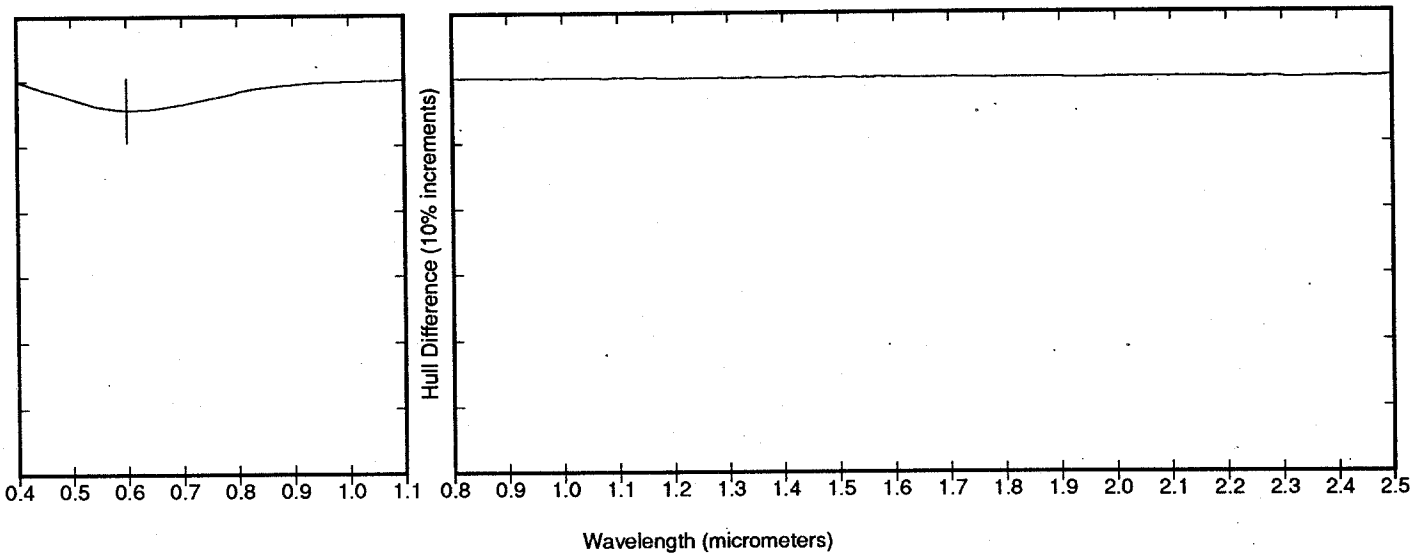
192



DESCRIPTION: BORNITE
SAMPLE_NUM: S-09A
COUNTRY: USA
POLITICAL_SUBDIVISION: ARIZONA
GEOGRAPHICAL_REGION: PINAL COUNTY
SITE: SUPERIOR,MAGMA MINE
COLLECTOR: BURMINCO
MINERALOGY: BORNITE(A)
CHEMICAL FORMULA: Cu_5FeS_4

193

BORNITE (S-09A)

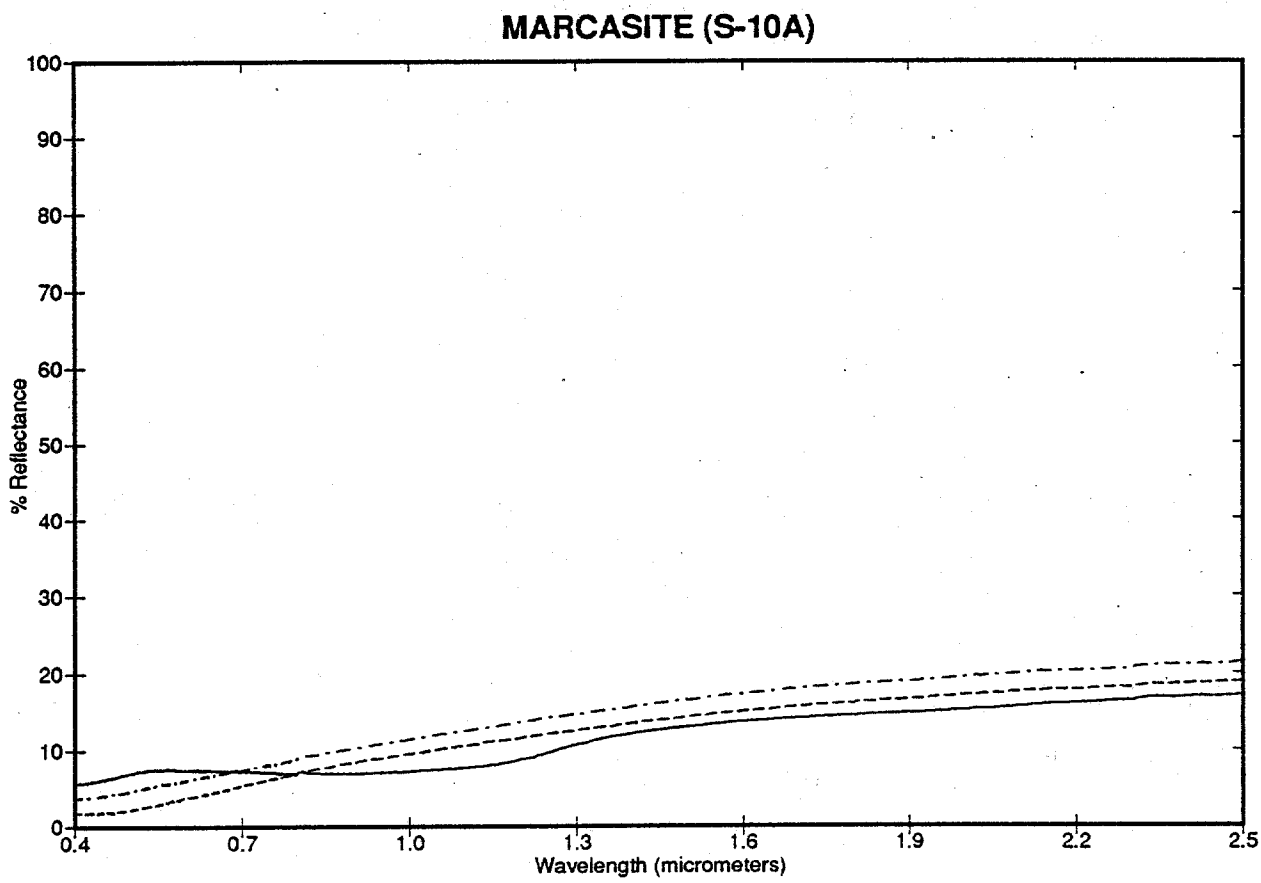


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 19.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6000	4.4169	1.3241	0.6213

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

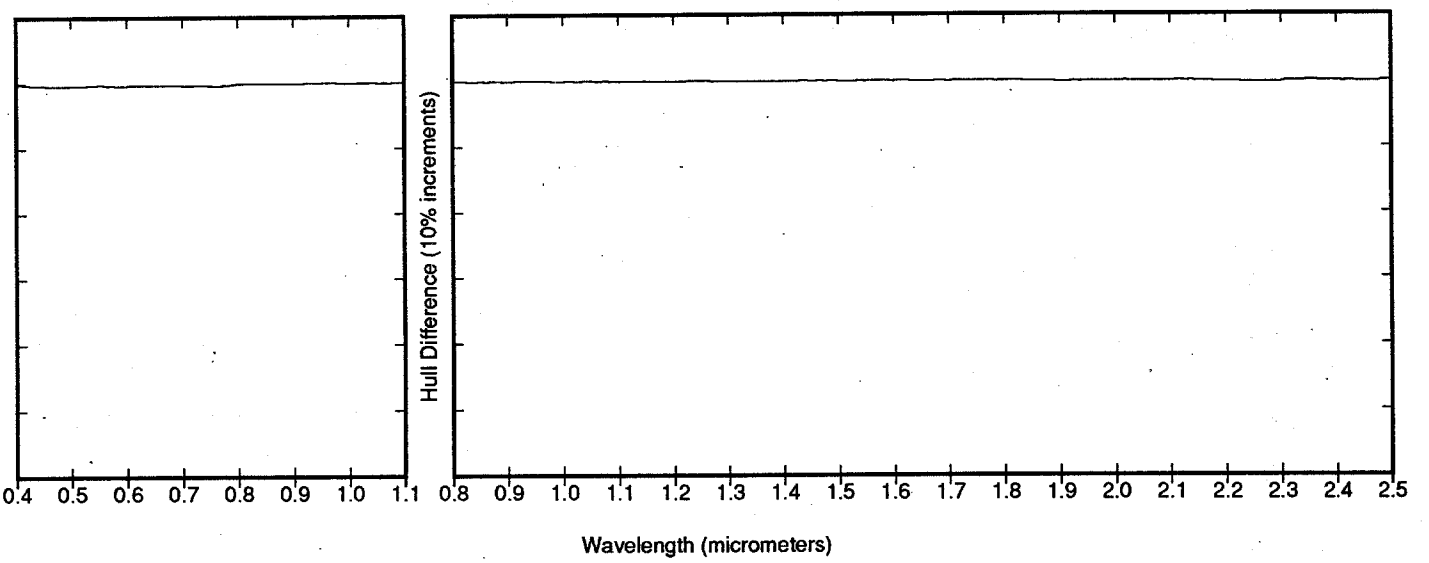
194



DESCRIPTION: MARCASITE
SAMPLE_NUM: S-10A
COUNTRY: USA
POLITICAL_SUBDIVISION: INDIANA
GEOGRAPHICAL_REGION: JASPER COUNTY
SITE: RENSSELAER,PLEASANT RIDGE QUARRY
COLLECTOR: WARD'S
MINERALOGY: MARCASITE(A),PYRITE(M)
CHEMICAL FORMULA: FeS_2

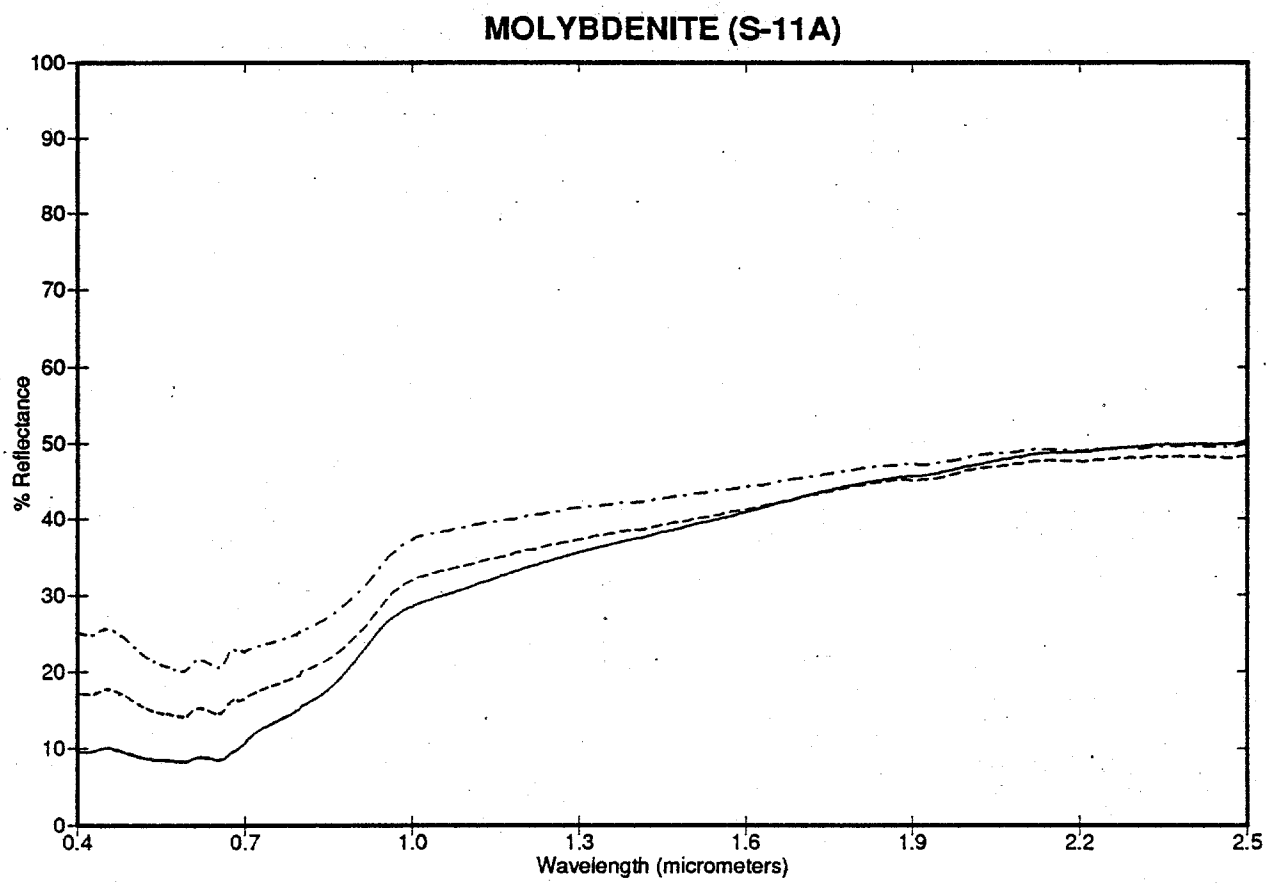
195

MARCASITE (S-10A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

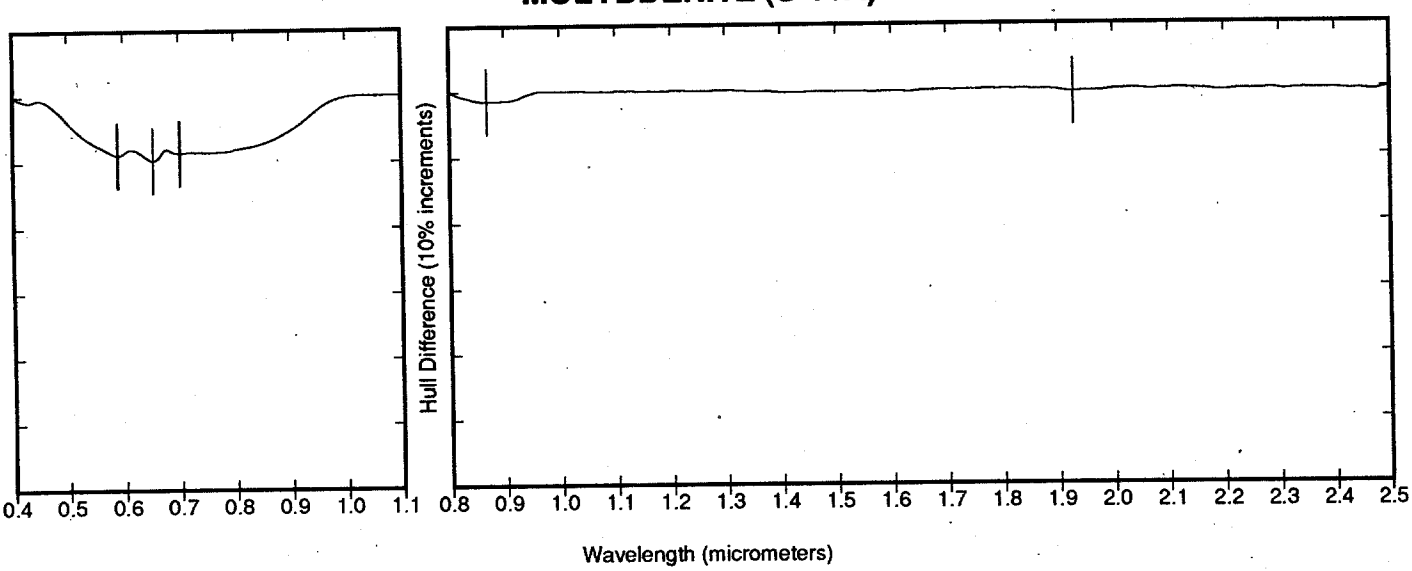
SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000



DESCRIPTION: MOLYBDENITE
SAMPLE_NUM: S-11A
COUNTRY: NORWAY
POLITICAL_SUBDIVISION: ARENDAL
GEOGRAPHICAL_REGION: FROLAND
SITE: FROLAND
COLLECTOR: JPL
MINERALOGY: MOLYBDENITE(A)
CHEMICAL FORMULA: MoS_2

197

MOLYBDENITE (S-11A)



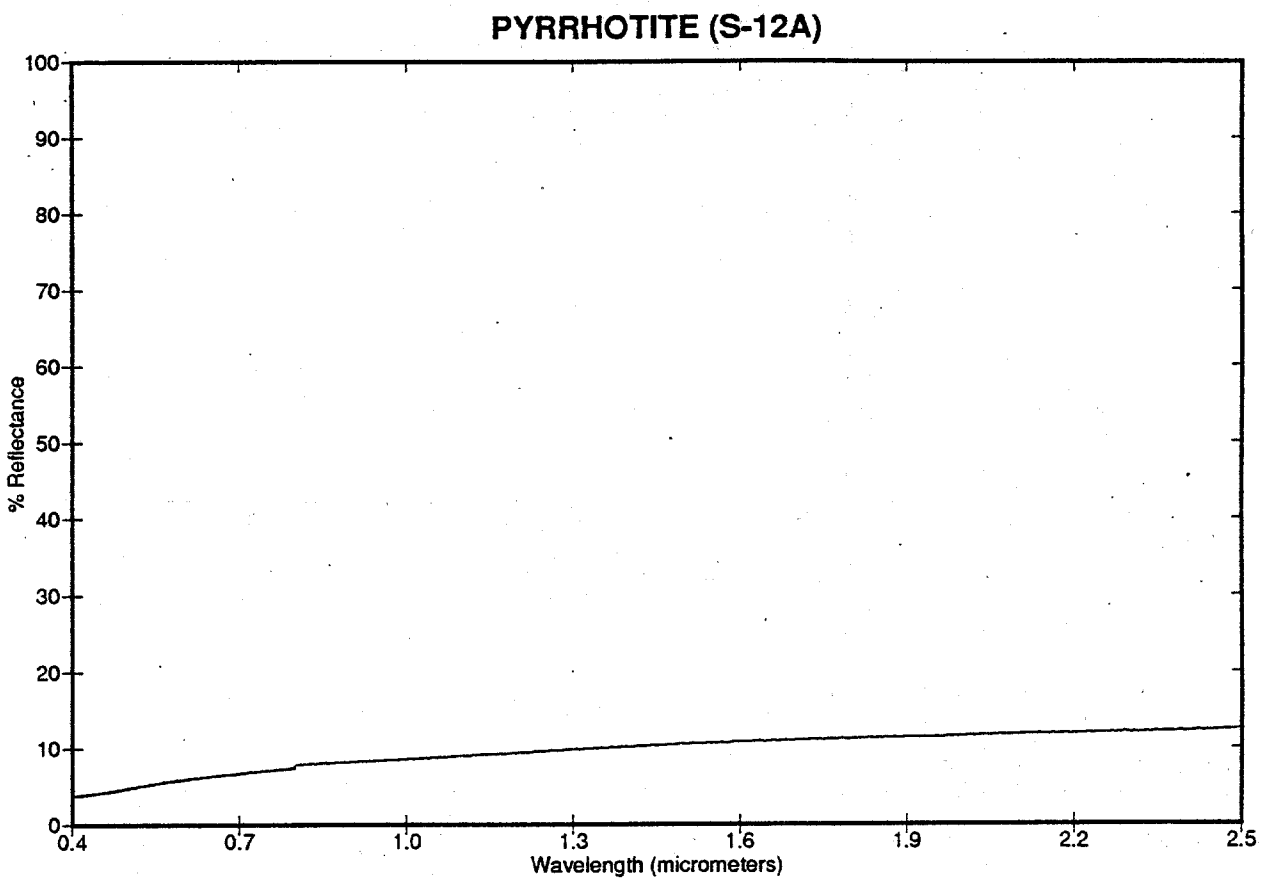
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 16.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6530	9.7243	0.5995	1.6917
0.5890	8.9269	0.8836	3.9171
0.7010	8.6156	1.9728	0.1085

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.8680	1.4869	0.1587	0.6645
1.9280	0.5323	0.0504	0.6036

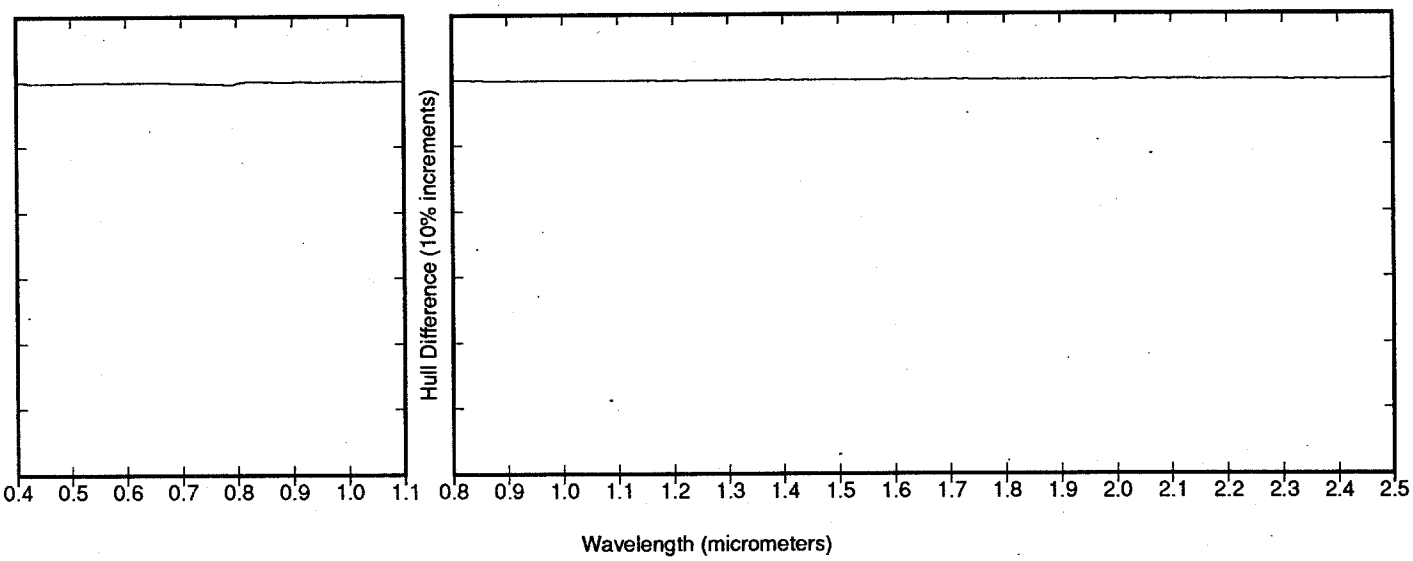
198



DESCRIPTION: PYRRHOTITE
SAMPLE_NUM: S-12A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: CHIHUAHUA
GEOGRAPHICAL_REGION: SANTA EULALIA
SITE: SANTA EULALIA
COLLECTOR: JPL
MINERALOGY: PYRRHOTITE(A),PYRITE(T)
CHEMICAL FORMULA: $Fe_{1-x}S$

199

PYRRHOTITE (S-12A)



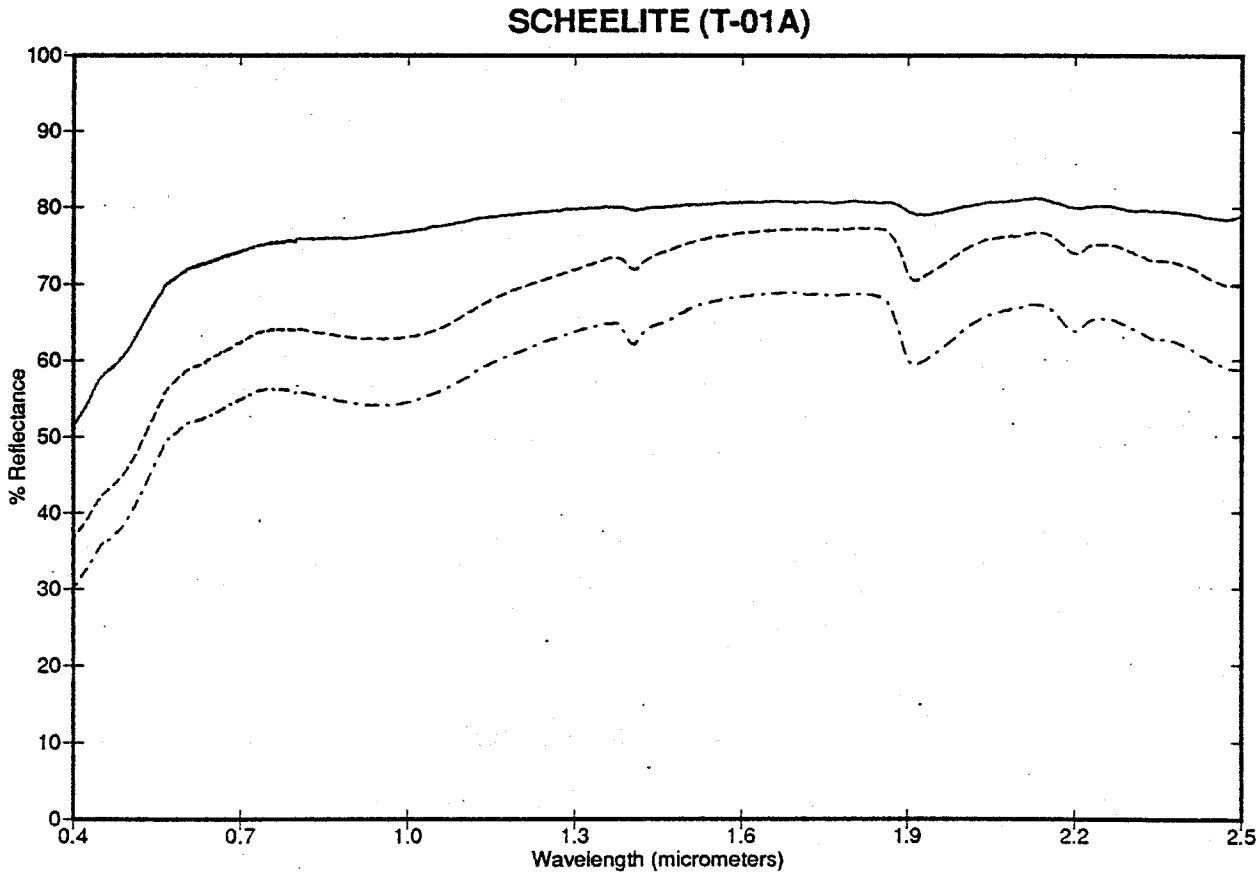
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

200

TUNGSTATES

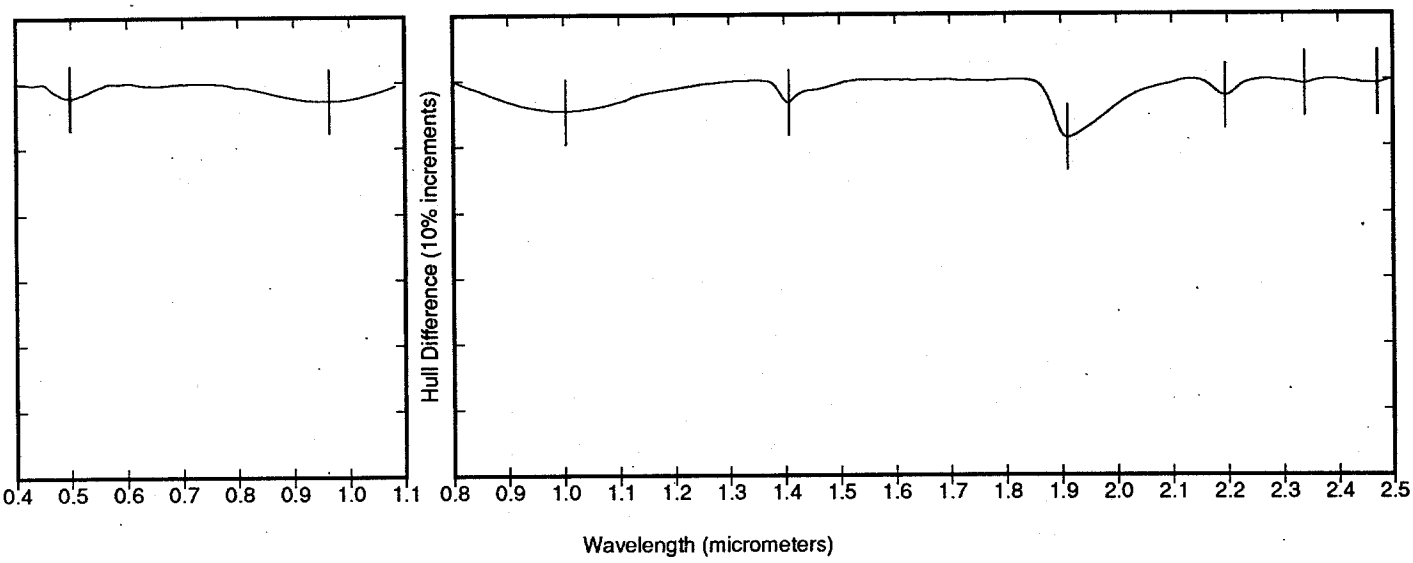
201



DESCRIPTION: SCHEELITE
SAMPLE_NUM: T-01A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: KERN COUNTY
SITE: ATOLIA
COLLECTOR: BURMINCO
MINERALOGY: SCHEELITE(A),QUARTZ(M)
CHEMICAL FORMULA: $CaWO_4$

202

SCHEELITE (T-01A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9640	2.8496	0.5641	1.3369
0.4980	2.1904	0.1498	0.7950

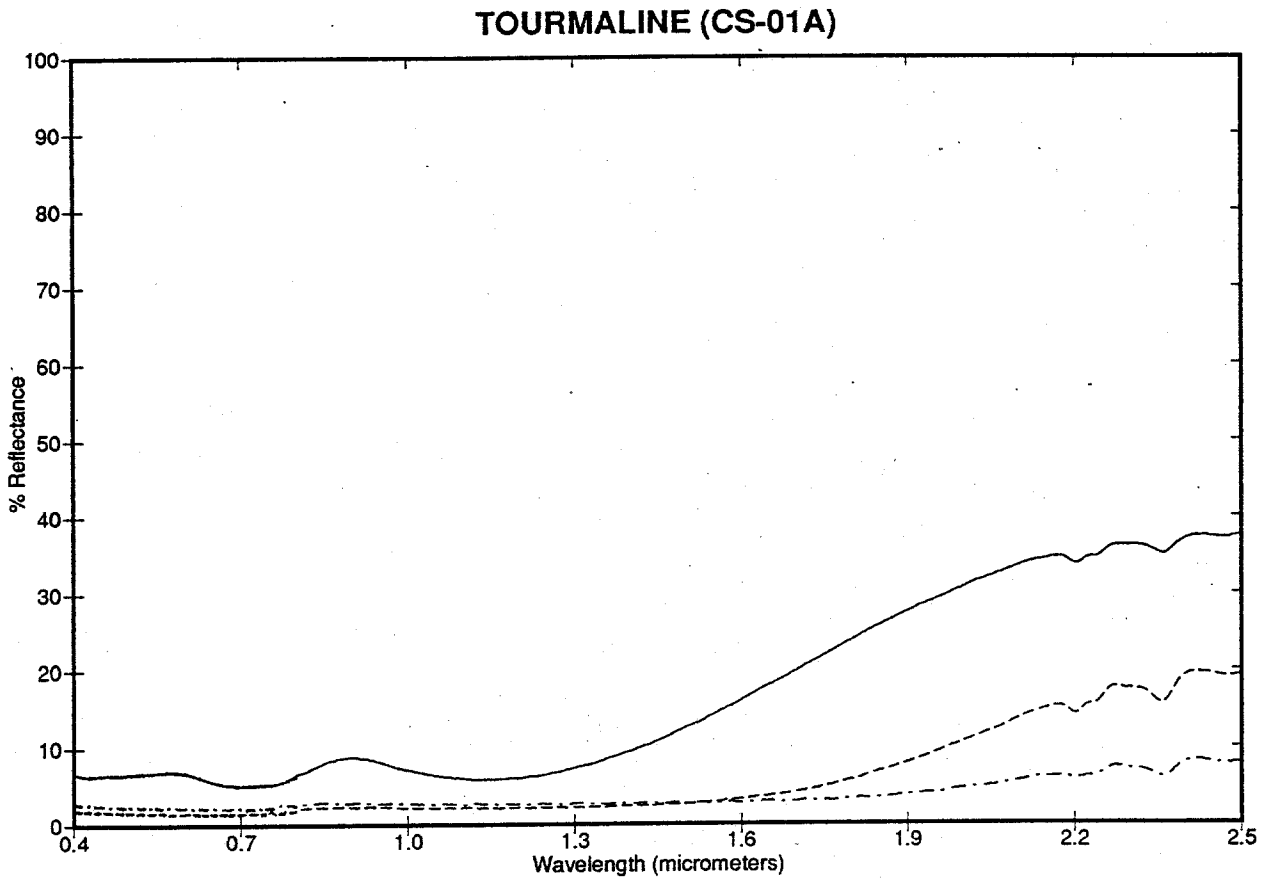
SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 6.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9120	8.8844	1.0548	0.3383
1.0040	4.7322	1.2901	0.8882
1.4080	3.3922	0.2226	0.4354
2.1960	2.5026	0.1268	0.9442
2.3400	0.6974	0.0340	1.7005
2.4720	0.6299	0.0390	3.3284

203

CYCLOSILICATES

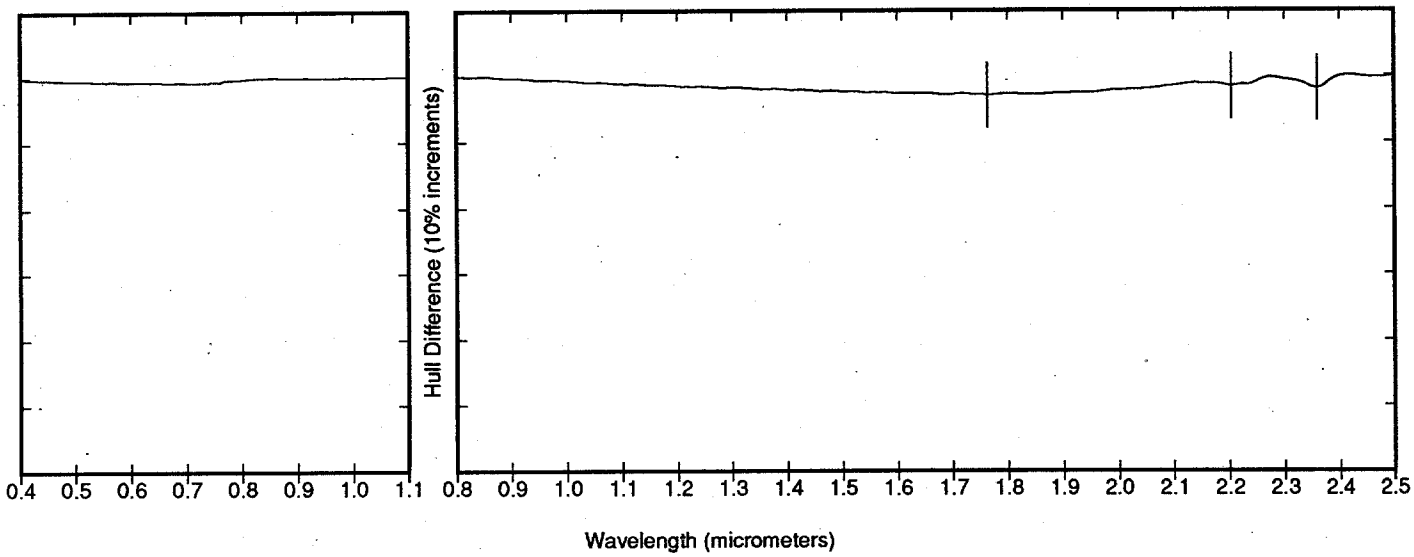
204



DESCRIPTION: TOURMALINE,DRAVITE-SCHORL SERIES
SAMPLE_NUM: CS-01A
COUNTRY: USA
POLITICAL_SUBDIVISION: NEW YORK
GEOGRAPHICAL_REGION: OVERLOOK
SITE: OVERLOOK
COLLECTOR: WARD'S
MINERALOGY: TOURMALINE(A)
CHEMICAL FORMULA: $Na(Mg_3,Fe_3^{2+})\ Al_6(BO_3)_3\ Si_6O_{18}(OH)_4$

205

TOURMALINE (CS-01A)

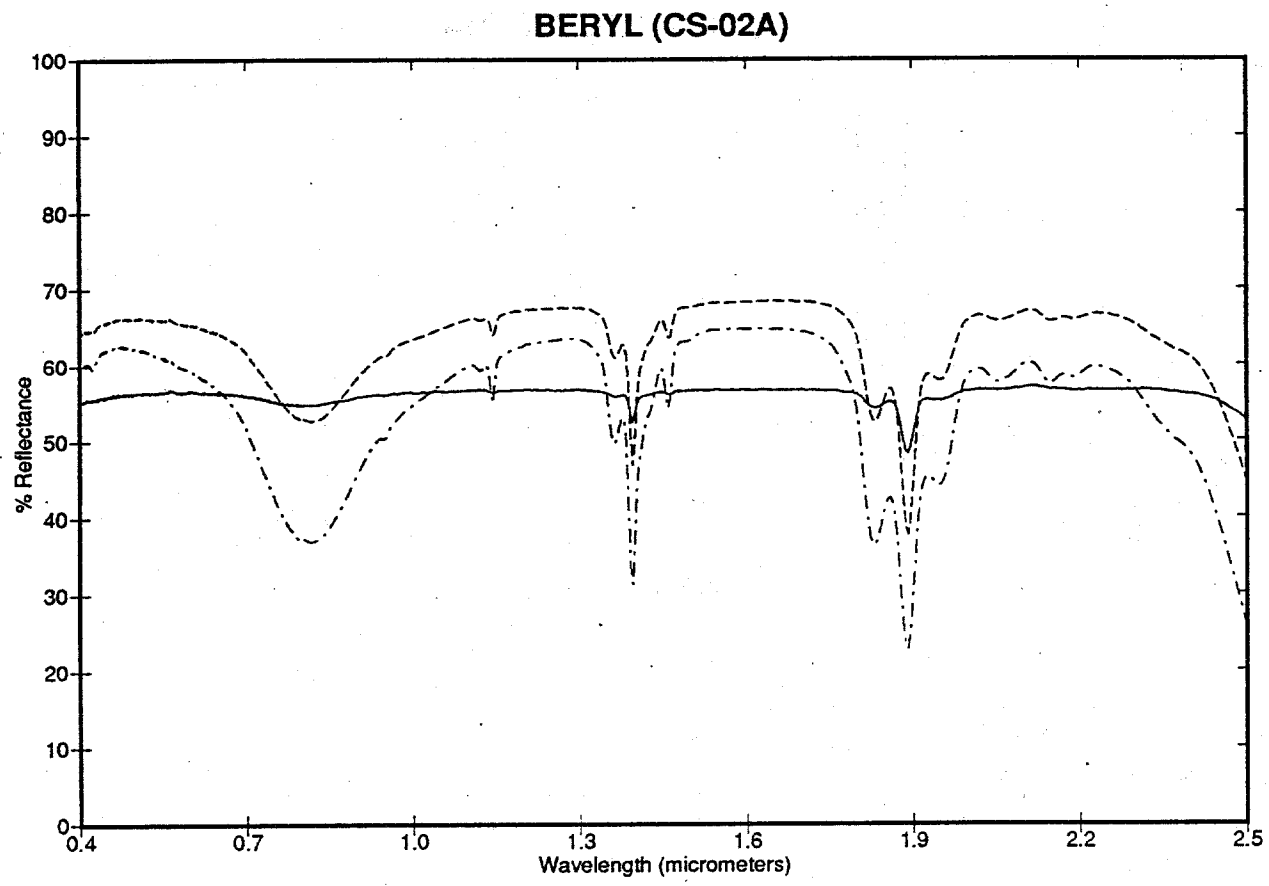


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.7640	3.0174	2.5647	1.6759
2.3600	1.9939	0.1511	1.3661
2.2040	1.6454	0.1099	0.3827

206



DESCRIPTION: BERYL
SAMPLE_NUM: CS-02A
COUNTRY: BRAZIL
POLITICAL_SUBDIVISION: MINAS GERAIS
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: BERYL(A)
CHEMICAL FORMULA: $Be_3Al_2Si_6O_{18}$

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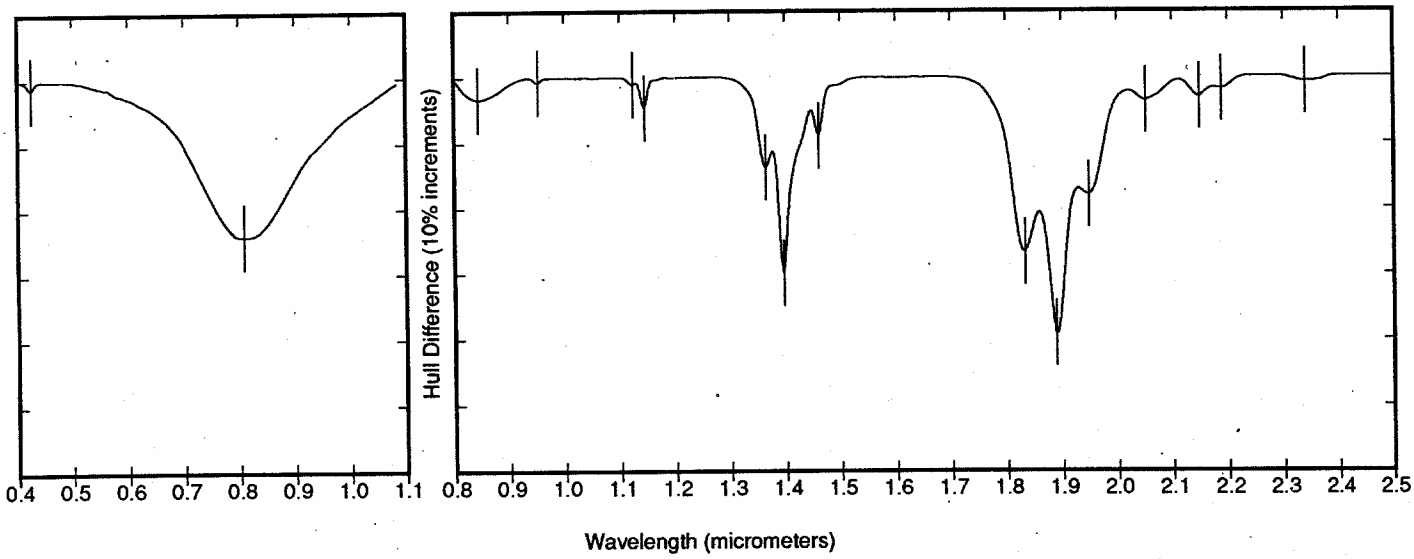
BERYL (CS-02A)



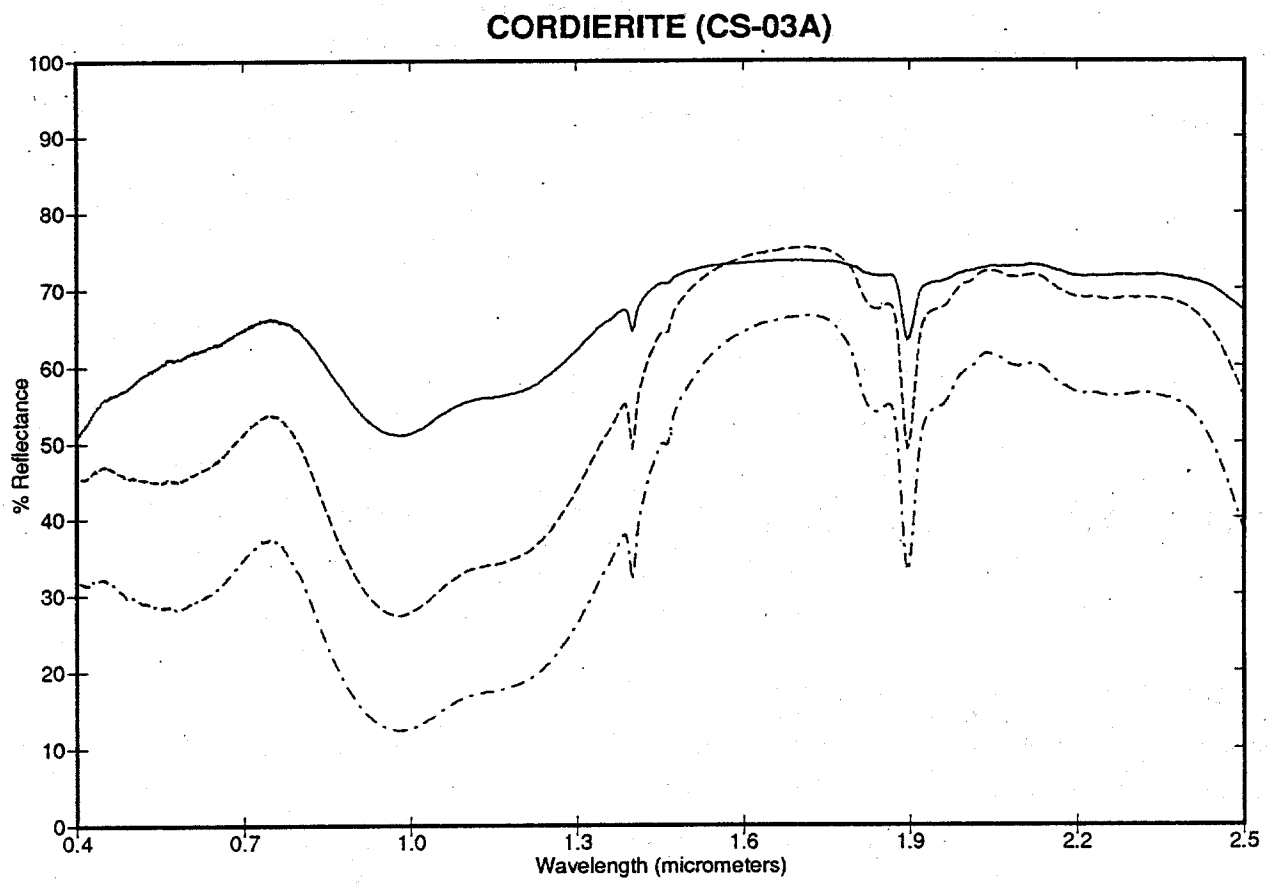
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 14.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.8080	23.9862	5.8218	0.8511
0.4250	1.2740	0.0186	1.2766

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.8880	39.0984	1.8782	0.7426
1.3960	29.8989	1.0792	0.5664
1.8320	26.7177	1.5432	1.3494
1.9480	18.0244	0.9831	0.5571
1.3640	13.8433	0.4231	1.7858
1.4600	8.9400	0.2250	0.5958
1.1440	4.6415	0.0776	1.0070
2.0520	3.5953	0.2115	0.6631
0.8440	3.3000	0.2427	0.6350
2.1480	3.0356	0.1279	1.0140
2.1880	1.9052	0.0633	0.5426
1.1240	1.0590	0.0153	2.8938
2.3400	0.8169	0.0483	0.7229
0.9520	0.7300	0.0114	1.0474

208



DESCRIPTION: CORDIERITE
SAMPLE_NUM: CS-03A
COUNTRY: CANADA
POLITICAL_SUBDIVISION: NORTHWEST TERRITORIES
GEOGRAPHICAL_REGION: MACKENZIE DISTRICT
SITE: GREAT BEAR LAKE
COLLECTOR: WARD'S
MINERALOGY: CORDIERITE(A)
CHEMICAL FORMULA: $(Mg_{1.27}Fe_{0.73}Mn_{0.01})\ (Al_{2.97}Cr_{0.01})\ (Si_{4.99}Al_{1.01})\ O_{18}$ *

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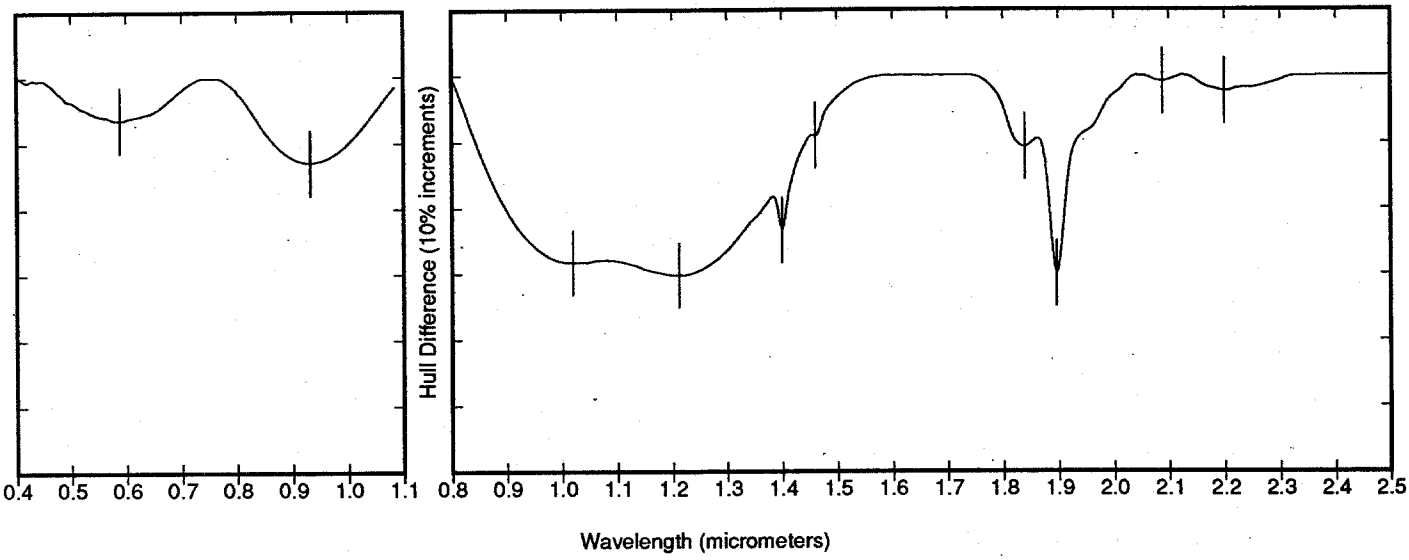
CORDIERITE (CS-03A)



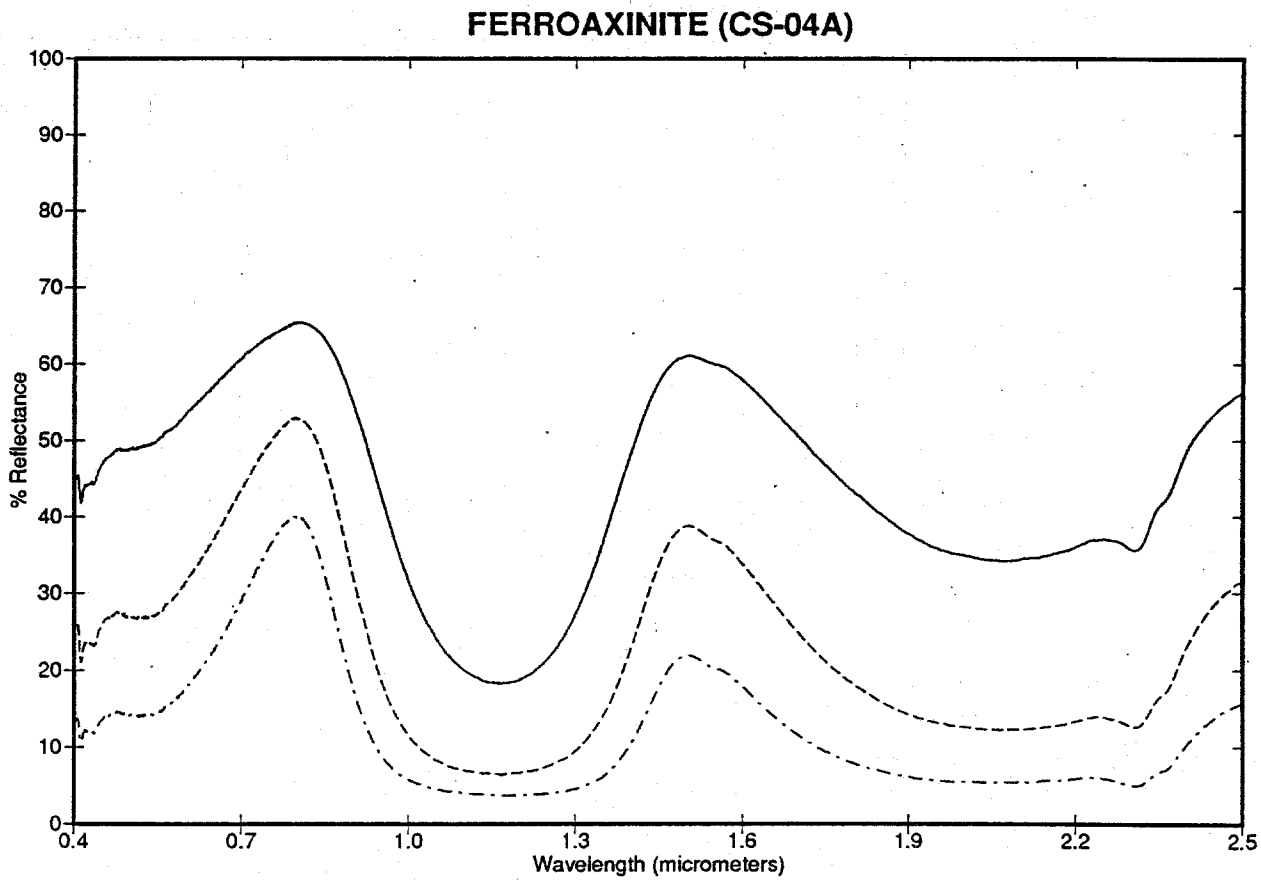
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9320	12.8625	2.5074	0.9365
0.5880	6.3996	1.1418	1.0184

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.2120	30.2017	8.2503	0.8685
1.8960	29.9712	1.7664	0.4822
1.0200	28.2572	5.8716	2.4830
1.4000	23.3715	1.1077	0.4179
1.8400	10.7349	0.6822	1.8185
1.4600	9.0917	0.3620	0.1107
2.2000	2.3690	0.2819	0.5321
2.0880	0.8760	0.0364	1.1192

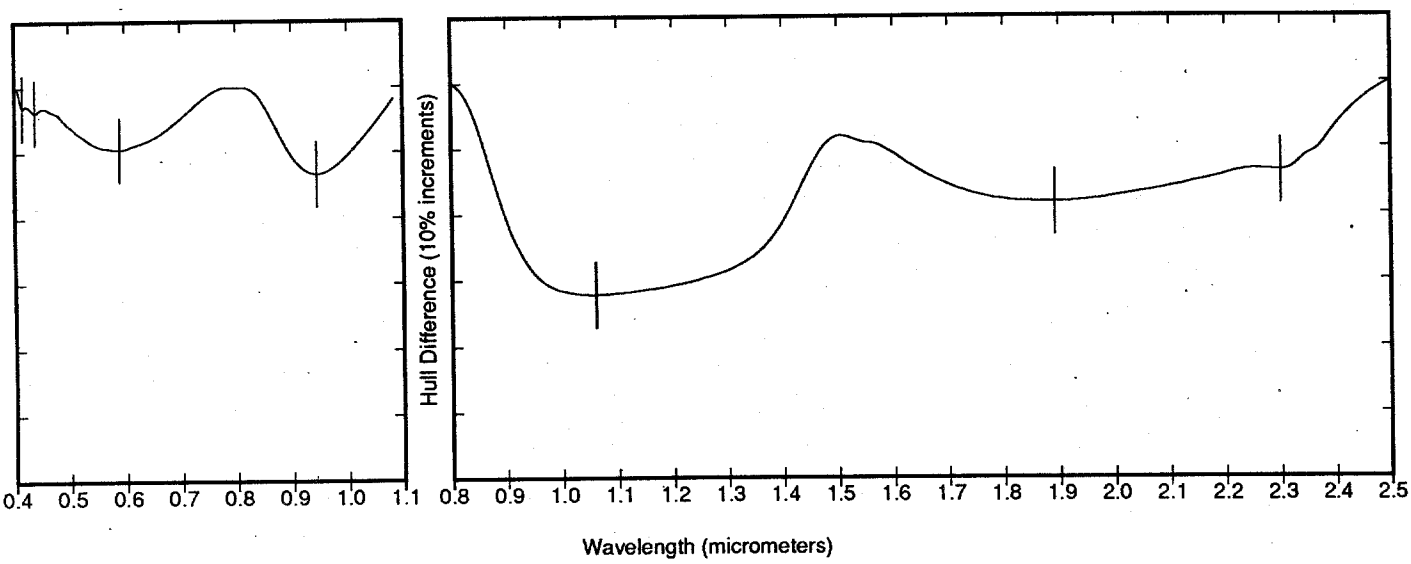
210



DESCRIPTION: FERROAXINITE
SAMPLE_NUM: CS-04A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: BAJA CALIFORNIA NORTE
GEOGRAPHICAL_REGION: LOS GAVELONTOS
SITE: LOS GAVELONTOS
COLLECTOR: WARD'S
MINERALOGY: FERROAXINITE(A)
CHEMICAL FORMULA: $Ca_2Fe^{2+}Al_2B\ Si_4O_{15}(OH)$

211

FERROAXINITE (CS-04A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9440	13.3531	2.1549	0.7608
0.5900	9.5217	1.9551	0.9490
0.4370	3.7700	0.1092	0.8979
0.4150	3.0587	0.0344	0.9985

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.0600	32.0211	16.8814	0.4889
1.8920	18.1948	11.4570	0.9342
2.3000	13.5316	1.9054	0.3921

212

INOSILICATES

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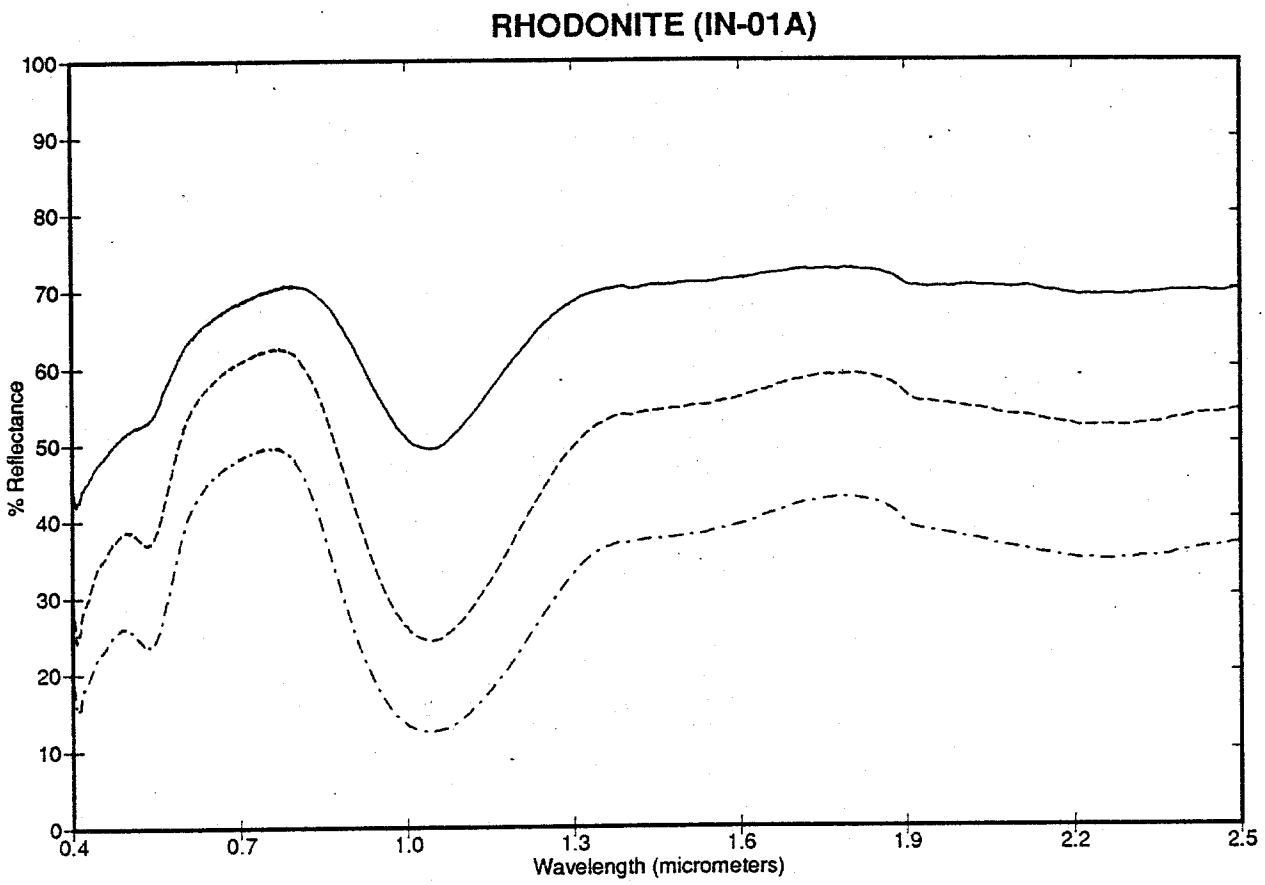

DESCRIPTION: RHODONITE
SAMPLE_NUM: IN-01A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: FRESNO COUNTY
SITE: NULL
COLLECTOR: BURMINCO
MINERALOGY: RHODONITE(A)
CHEMICAL FORMULA: $(Ca_{0.24}Mn_{0.76})(Mn_{0.85}Fe_{0.08}Mg_{0.06})\ Si_2O_6$*

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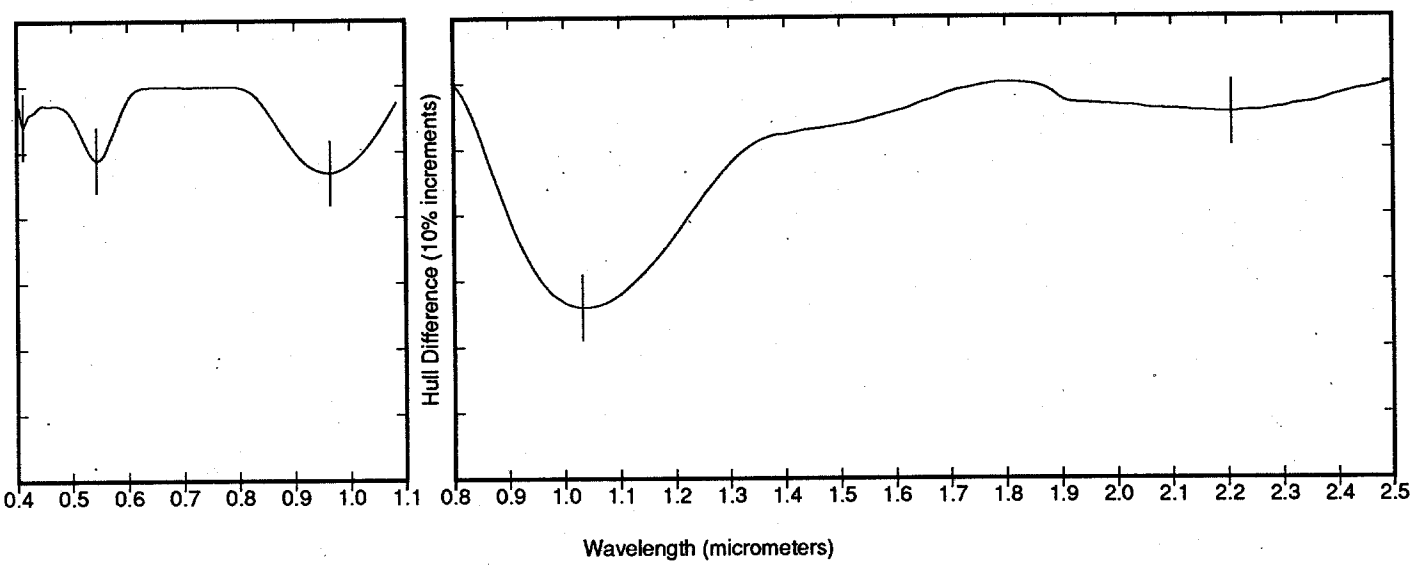
RHODONITE (IN-01A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 27.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9640	13.2322	2.3202	1.0809
0.5440	11.1158	0.9572	1.2452
0.4110	6.0217	0.1743	0.2375

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.0320	33.9213	14.1472	0.5177
2.2080	4.6123	2.0142	1.5334

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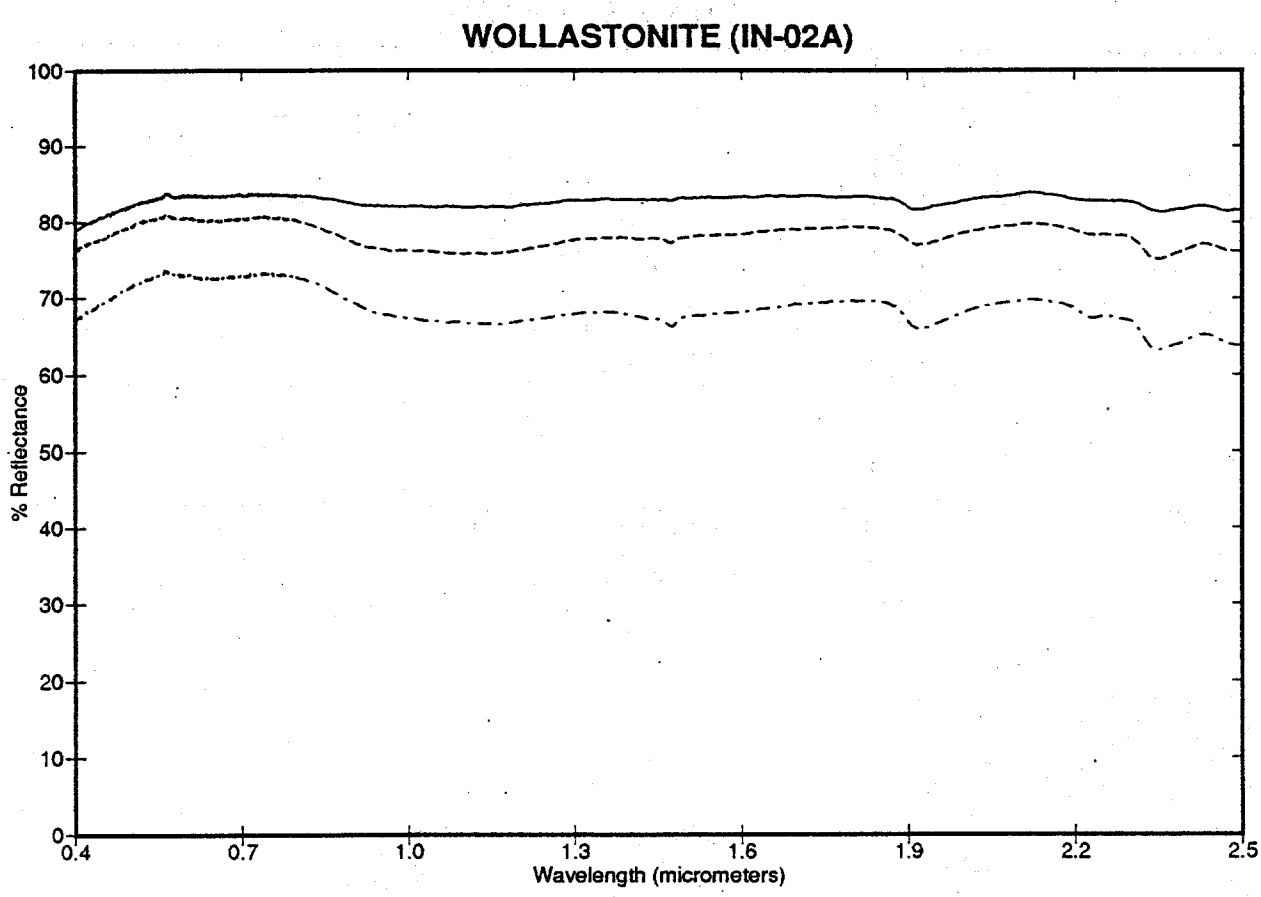

DESCRIPTION: WOLLASTONITE
SAMPLE_NUM: IN-02A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: INYO COUNTY
SITE: PANAMINT MOUNTAINS
COLLECTOR: BURMINCO
MINERALOGY: WOLLASTONITE(A),CALCITE(T),QUARTZ(T)
CHEMICAL FORMULA: $CaSiO_3$

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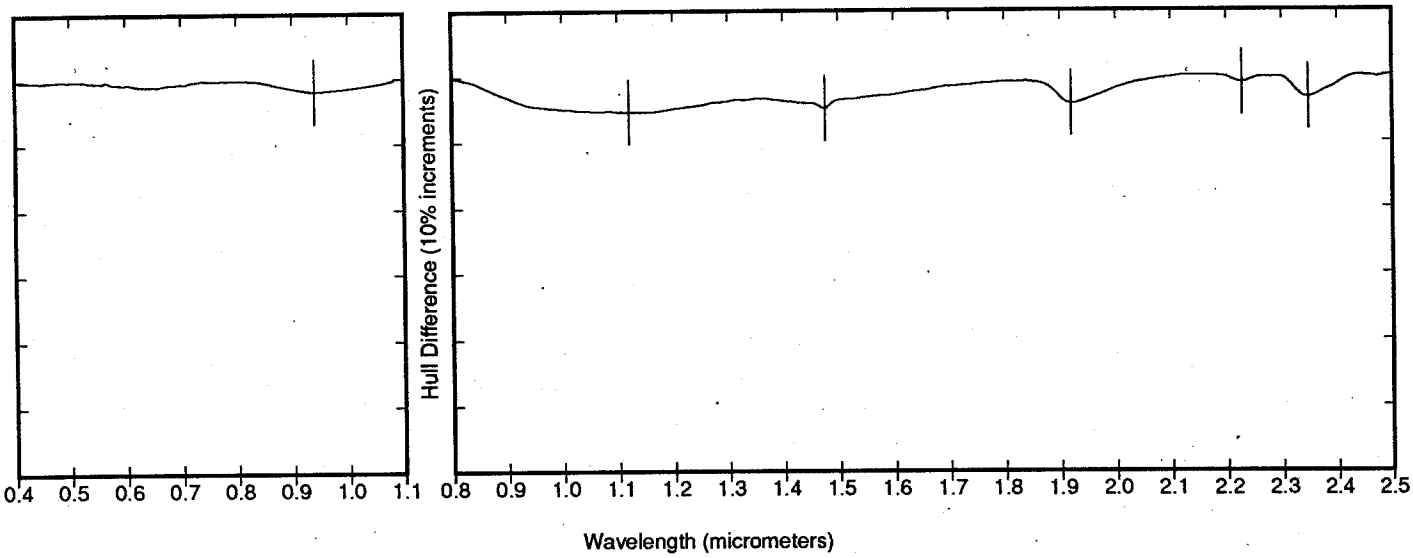
WOLLASTONITE (IN-02A)



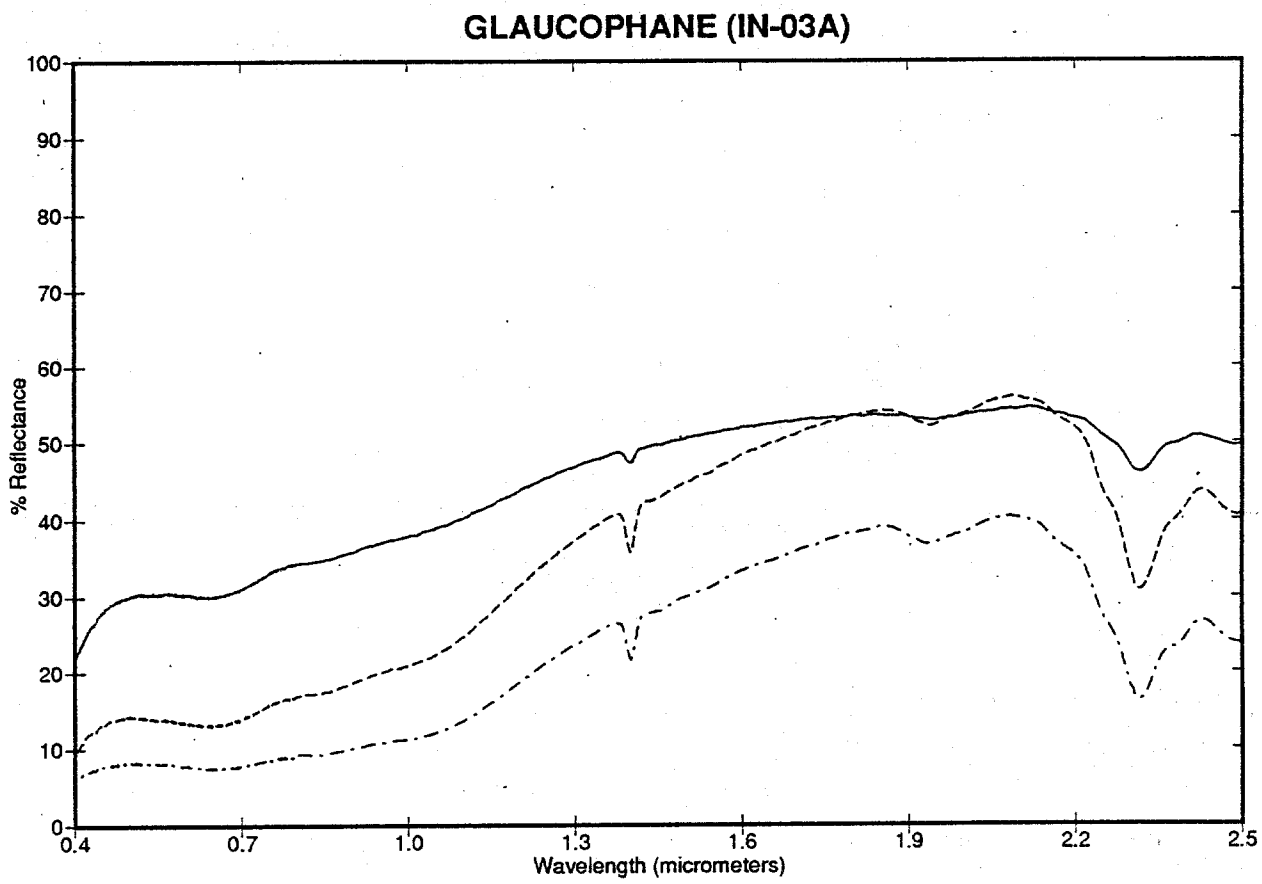
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9400	1.7755	0.2736	0.6798

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.1200	5.3749	2.2863	1.0801
1.4760	4.8716	1.2187	0.5082
1.9200	4.2356	0.5089	0.4397
2.3480	3.3291	0.2510	0.6663
2.2280	1.0454	0.0549	0.7693

217



DESCRIPTION: GLAUCOPHANE
SAMPLE_NUM: IN-03A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: GLAUCOPHANE(A),CHLORITE(M)
CHEMICAL FORMULA: $Na_2(Mg,Fe^{2+})_3\ Al_2Si_8O_{22}(OH)_2$

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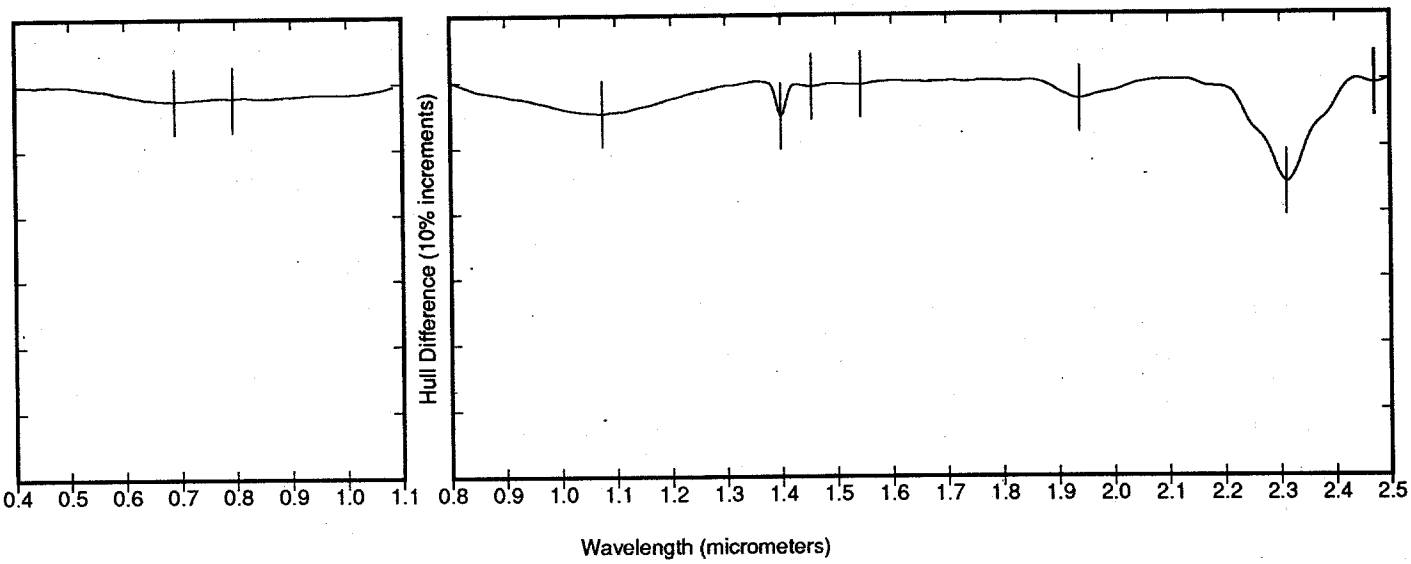
GLAUCOPHANE (IN-03A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 18.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6900	2.3827	0.4256	1.5489
0.7950	2.0925	0.5073	0.1161

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 8.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3120	15.5578	1.7519	1.0511
1.4000	5.2738	0.1212	0.8306
1.0760	4.7686	1.4184	1.1616
1.9400	2.7980	0.3060	0.6297
1.4560	0.8362	0.0409	0.8343
2.4720	0.6477	0.0213	1.0077
1.5440	0.5324	0.0466	0.9314

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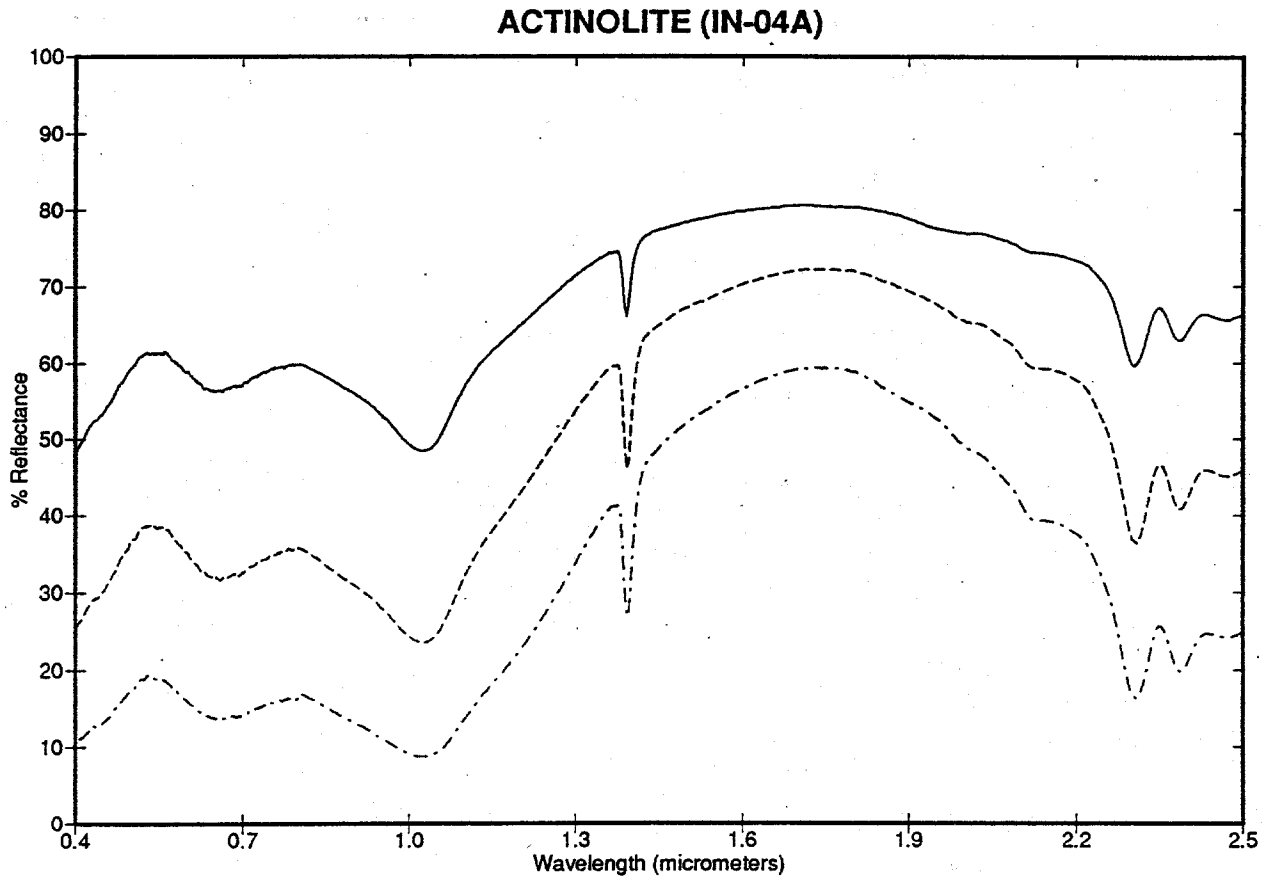

DESCRIPTION: ACTINOLITE
SAMPLE_NUM: IN-04A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: SAN BERNADINO COUNTY
SITE: WRIGHTWOOD
COLLECTOR: BURMINCO
MINERALOGY: ACTINOLITE(A)
CHEMICAL FORMULA: $Ca_2\ (Mg,Fe^{2+})_5\ Si_8O_{22}\ (OH)_2$

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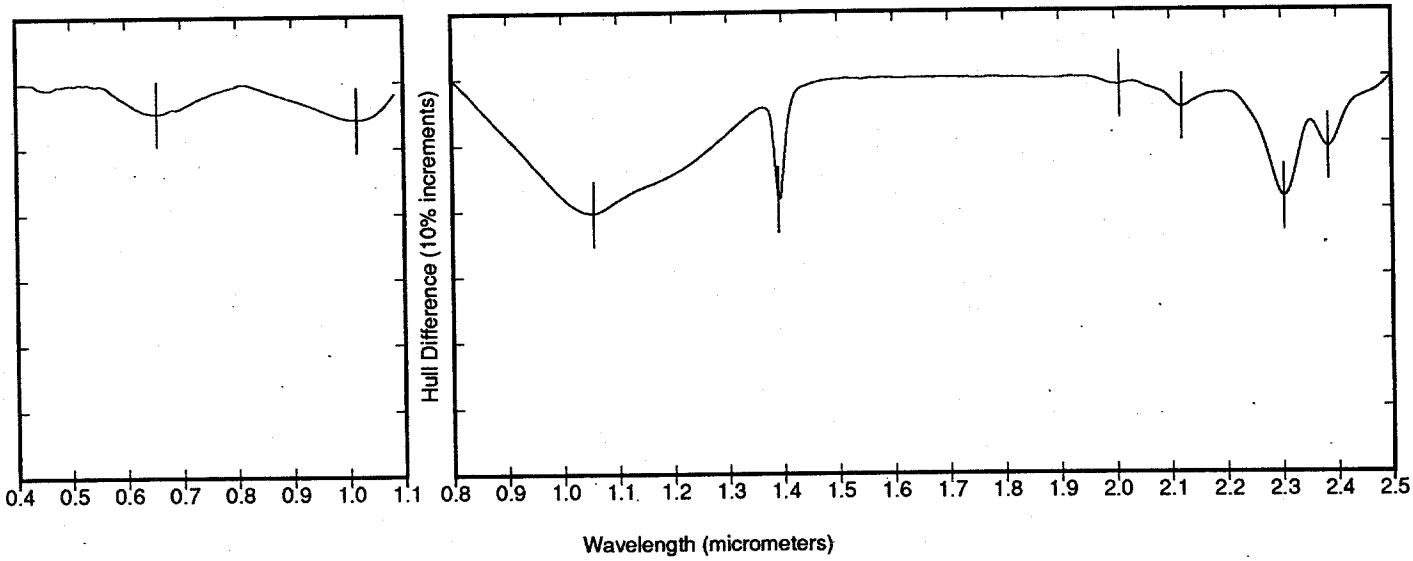
ACTINOLITE (IN-04A)

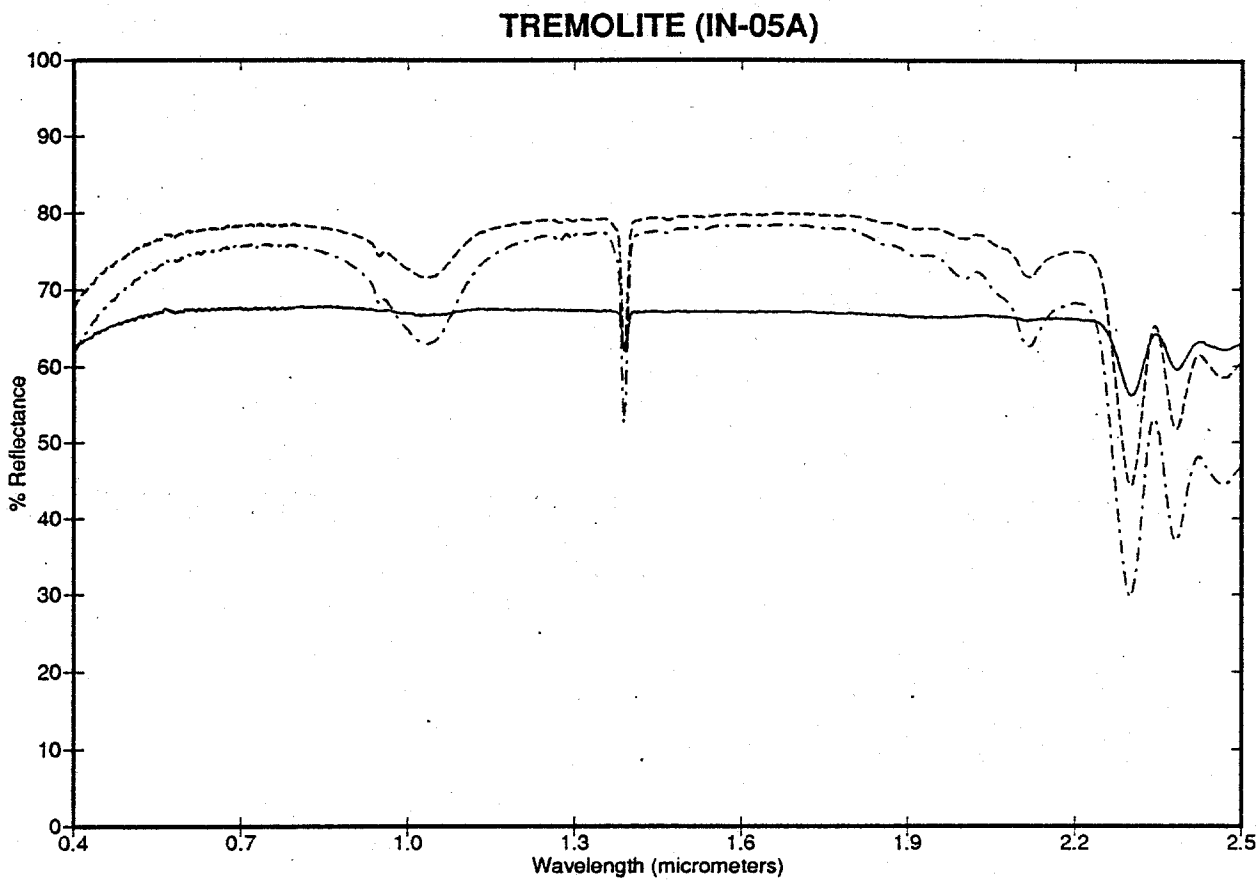


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 18.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.0160	5.7163	0.9278	2.0727
0.6560	4.5516	0.6490	0.7935

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.0560	20.3791	6.9173	0.7071
1.3920	18.3884	0.5895	0.6421
2.3040	18.3351	1.4909	1.4406
2.3840	10.8274	0.7821	0.5716
2.1200	4.6526	0.4742	0.8645
2.0080	1.2340	0.0616	2.6487



DESCRIPTION: TREMOLITE
SAMPLE_NUM: IN-05A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: TREMOLITE(A)
CHEMICAL FORMULA: $Ca_2(Mg,Fe^{2+})_5\ Si_8O_{22}(OH)_2$

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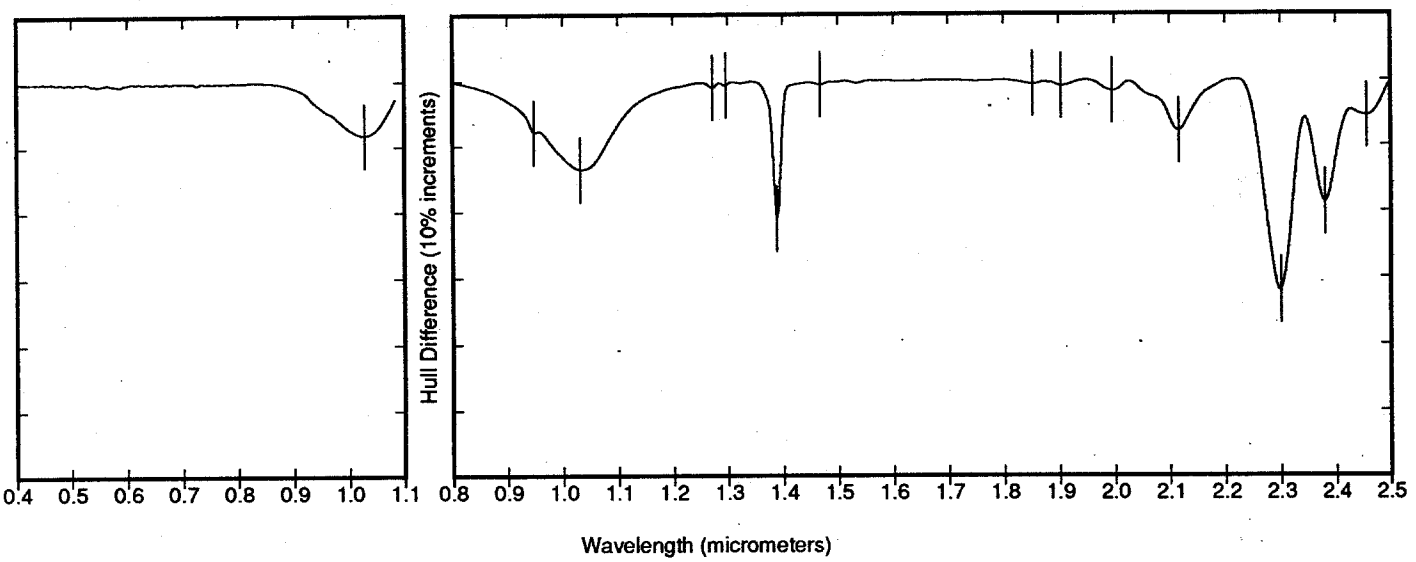
TREMOLITE (IN-05A)



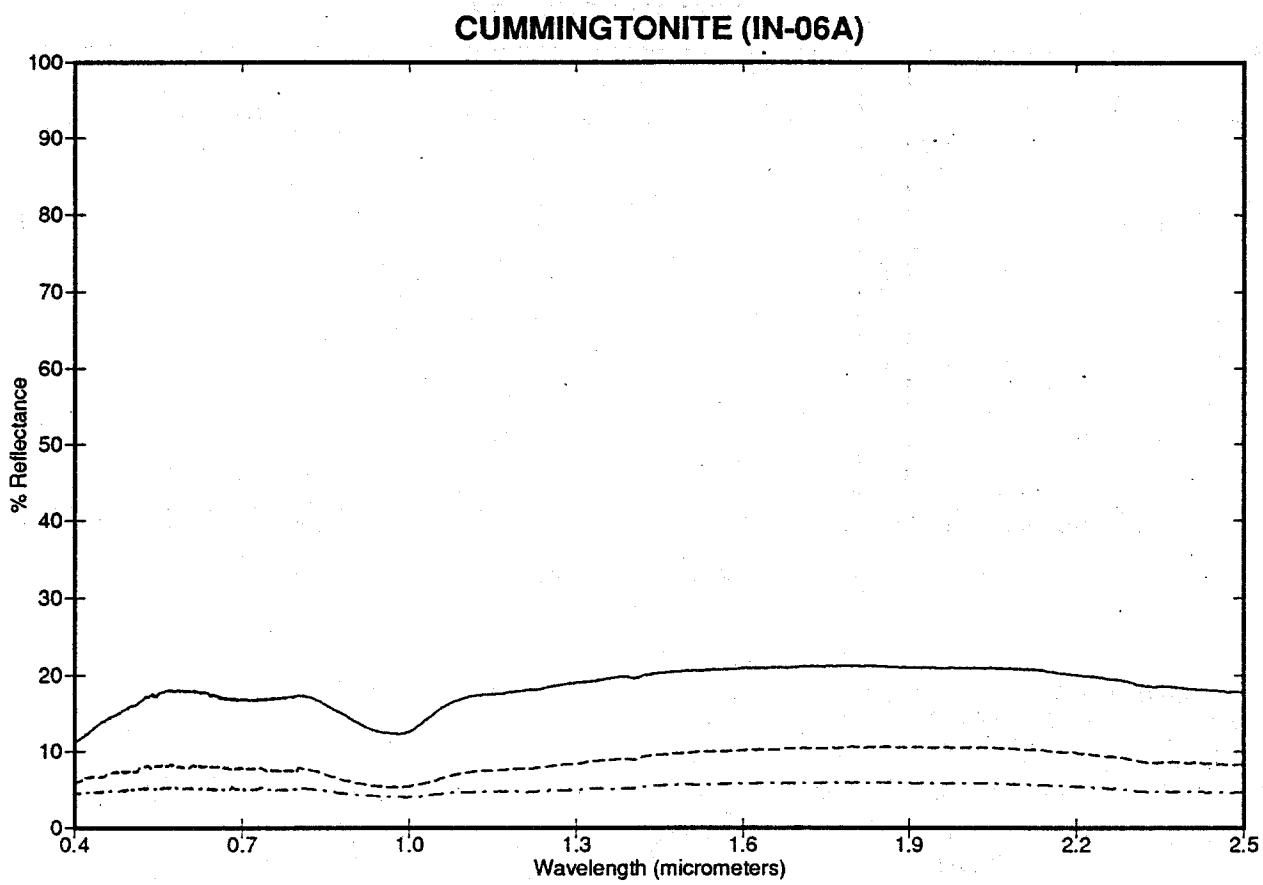
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.0280	8.2314	0.9736	1.7769

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3000	31.8551	1.8627	1.3008
1.3880	21.1339	0.4106	0.8265
2.3800	18.7017	0.9639	0.8513
1.0320	13.5988	1.9170	0.7707
0.9480	7.8999	0.4202	5.7163
2.1160	7.7796	0.5567	1.1000
2.4560	5.4967	0.2956	0.9637
1.9960	1.6317	0.0673	1.1705
1.2720	1.0604	0.0191	1.2993
1.9040	0.8658	0.0362	0.8574
1.2960	0.6839	0.0106	1.4547
1.4680	0.6289	0.0162	1.2049
1.8520	0.6171	0.0243	1.4995

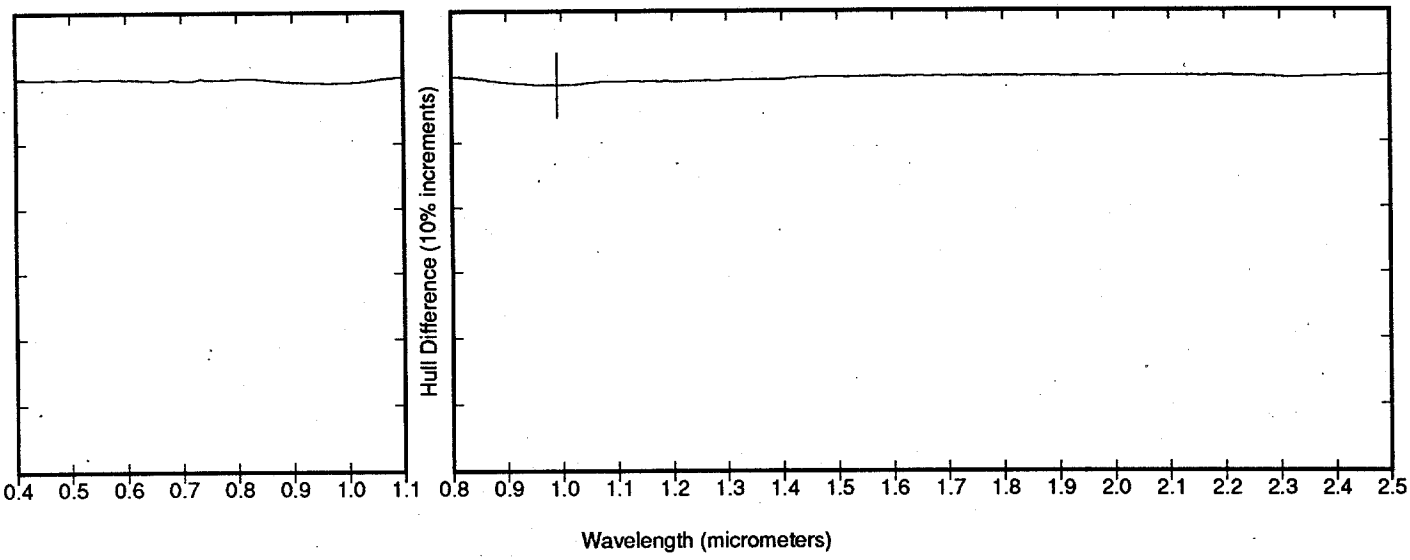
223



DESCRIPTION: CUMMINGTONITE
SAMPLE_NUM: IN-06A
COUNTRY: USA
POLITICAL_SUBDIVISION: SOUTH DAKOTA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: CUMMINGTONITE(A),MICA(M),FELDSPAR(M),CHLORITE(M)
CHEMICAL FORMULA: $(Mg,Fe^{2+})_7\ Si_8O_{22}(OH)_2$

224

CUMMINGTONITE (IN-06A)

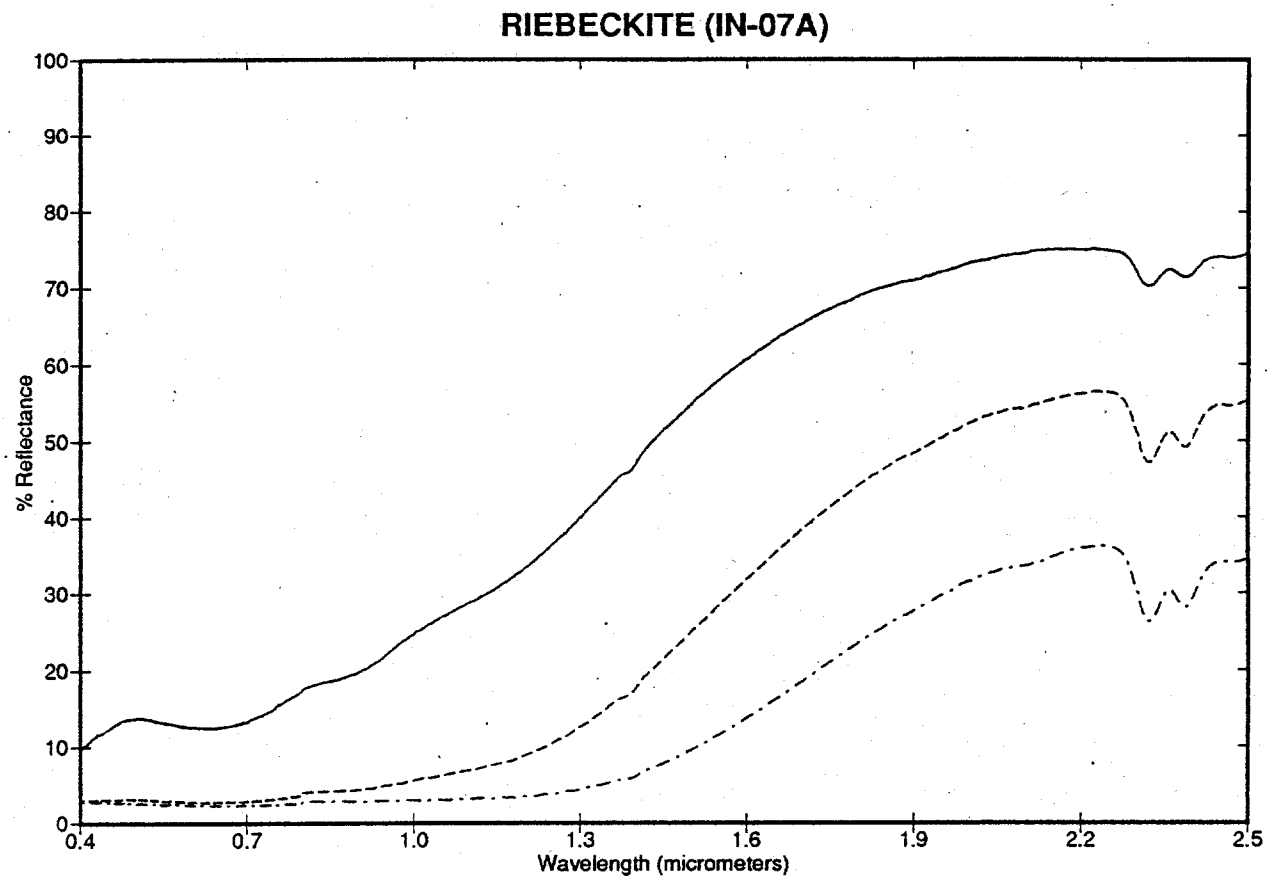


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9920	1.3282	0.4933	0.4339

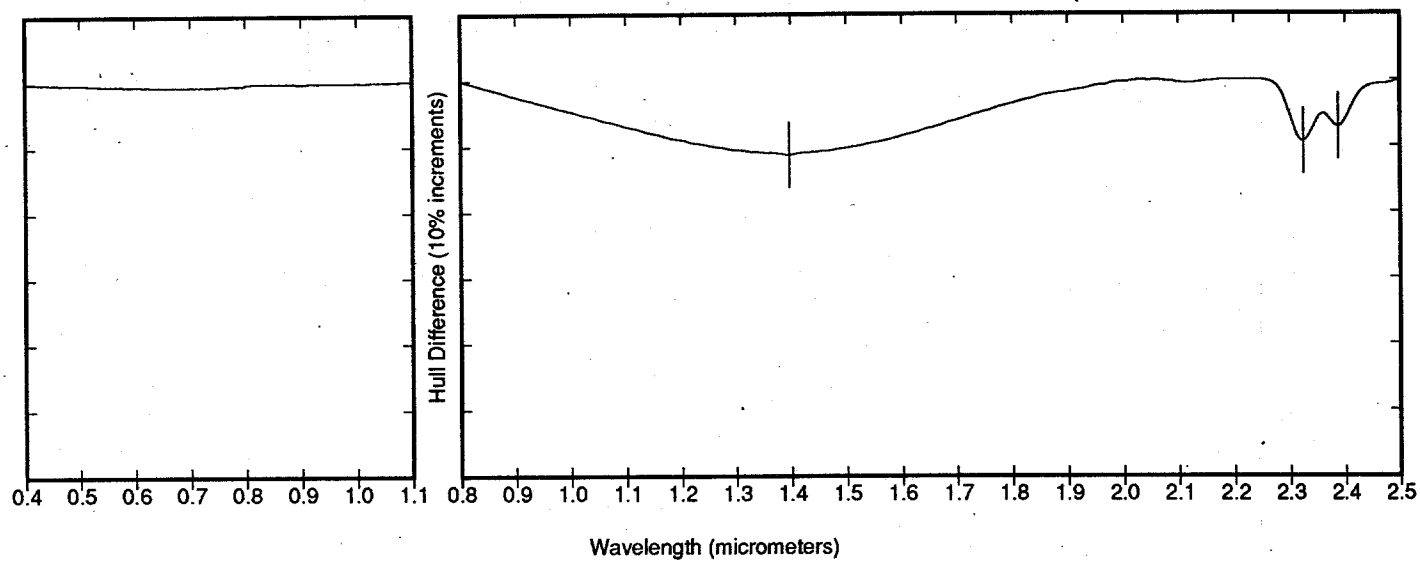
225



DESCRIPTION: RIEBECKITE
SAMPLE_NUM: IN-07A
COUNTRY: CANADA
POLITICAL_SUBDIVISION: ONTARIO
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: RIEBECKITE(A)
CHEMICAL FORMULA: $Na_2(Fe^{2+},Mg)_3\ Fe_2^{3+}Si_8O_{22}(OH)_2$

226

RIEBECKITE (IN-07A)

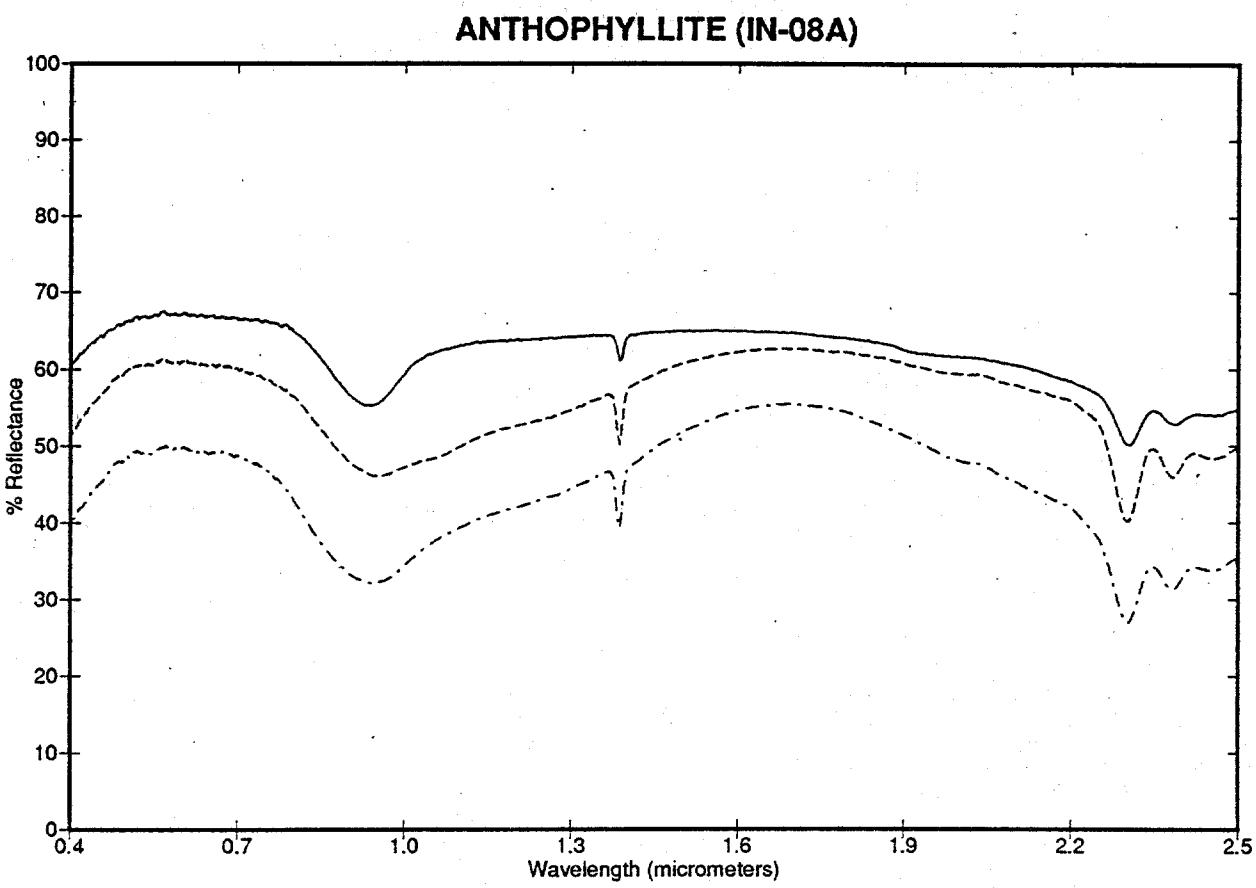


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3960	11.2816	7.4966	1.0774
2.3240	9.3380	0.5276	1.0199
2.3880	7.1332	0.4177	0.7153

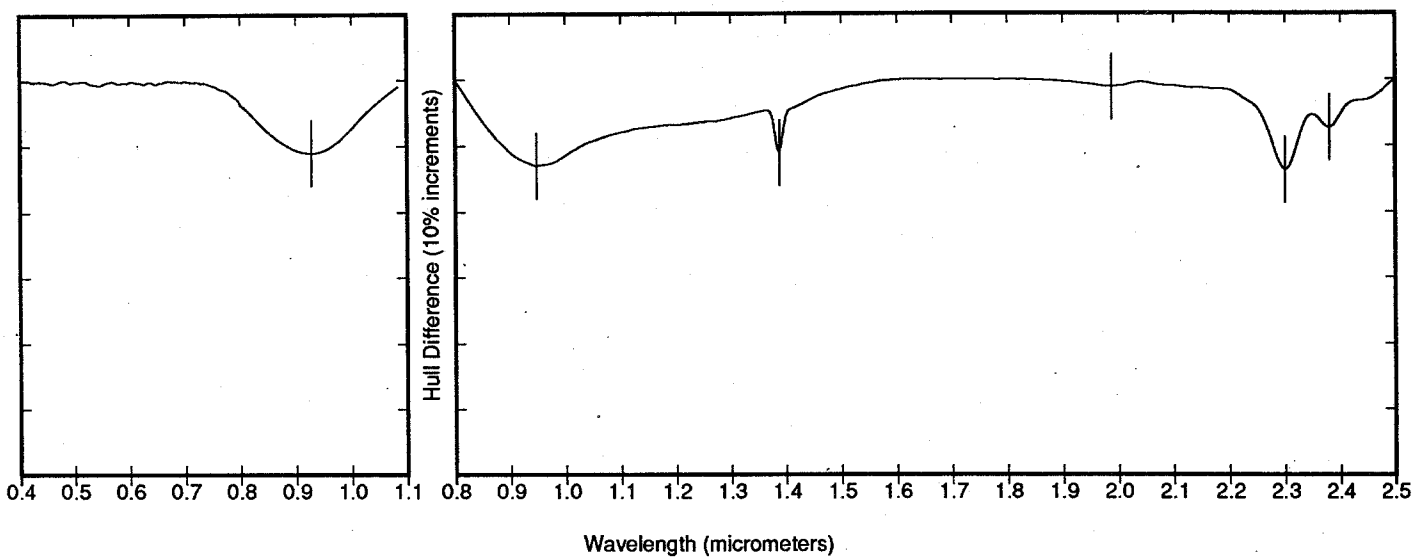
227



DESCRIPTION: ANTHOPHYLLITE
SAMPLE_NUM: IN-08A
COUNTRY: USA
POLITICAL_SUBDIVISION: NORTH CAROLINA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: ANTHOPHYLLITE(A),CHLORITE(M),SERPENTINE(M?)
CHEMICAL FORMULA: $(Mg,Fe^{2+})_7\ Si_8O_{22}(OH)_2$

228

ANTHOPHYLLITE (IN-08A)



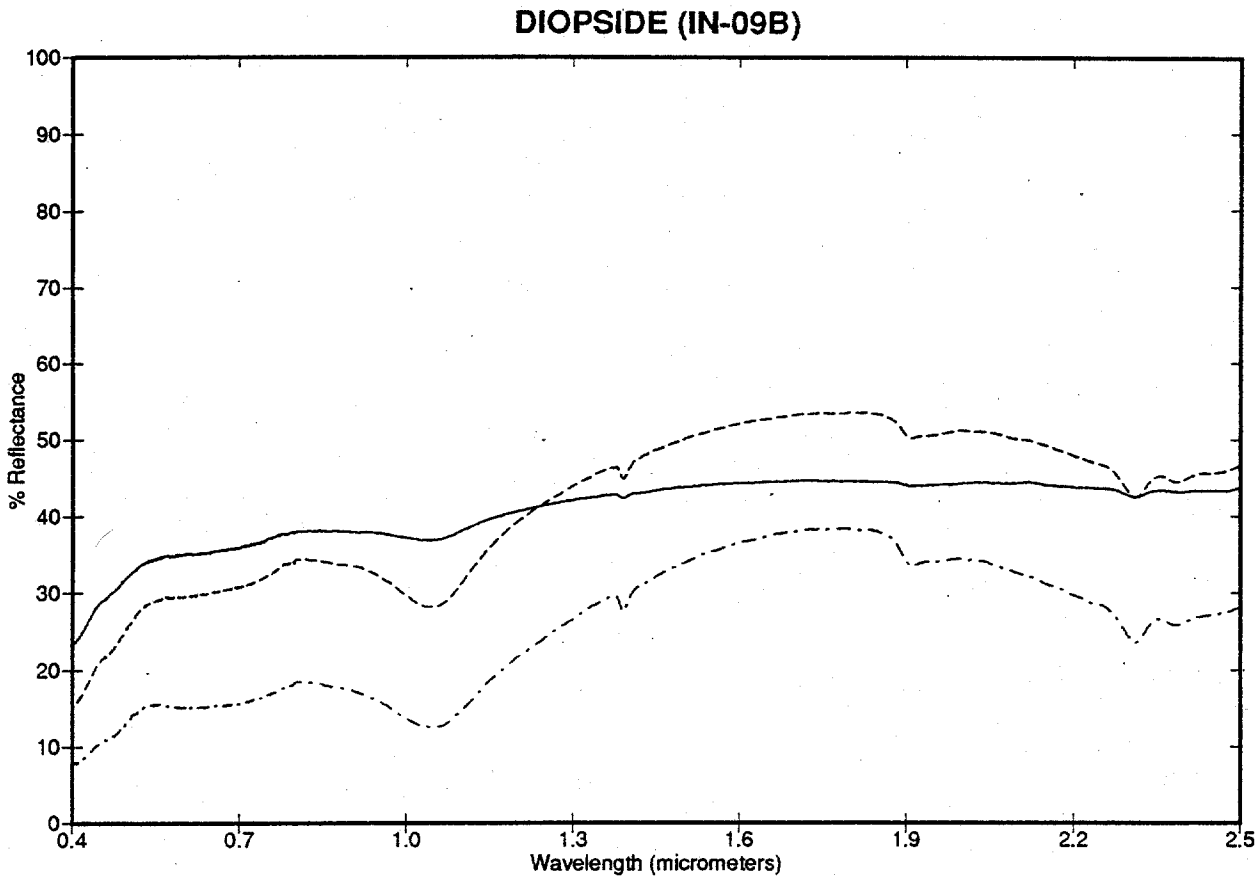
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9280	10.9730	2.1782	1.1287

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 8.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3000	13.7427	1.2621	1.6660
0.9480	13.0083	4.4931	0.3590
1.3880	11.1118	0.6175	0.3234
2.3800	7.2934	0.5793	0.4532
1.9880	1.1392	0.1195	1.9716

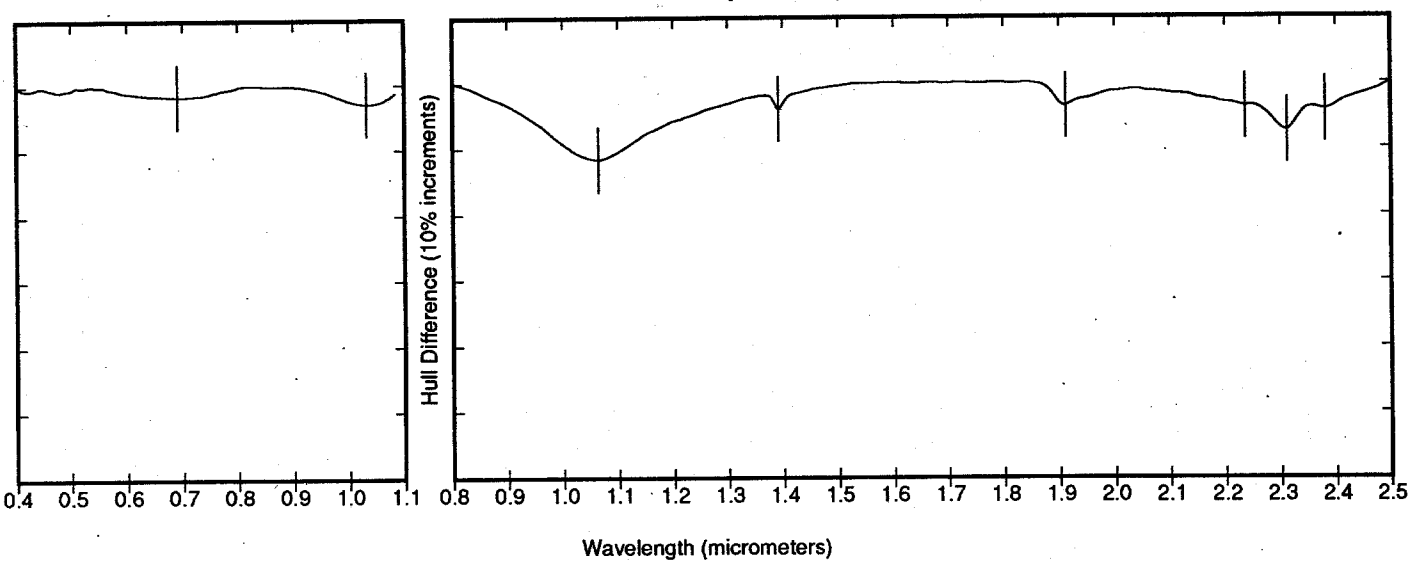
229



DESCRIPTION: DIOPSIDE
SAMPLE_NUM: IN-09B
COUNTRY: CANADA
POLITICAL_SUBDIVISION: QUEBEC
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: DIOPSIDE(A),MICA(A),TALC(M)
CHEMICAL FORMULA: $(Na_{0.02}Ca_{0.98})\ (Mg_{0.24}Fe_{0.05}Al_{0.02})\ Si_2O_6$*

230

DIOPSIDE (IN-09B)



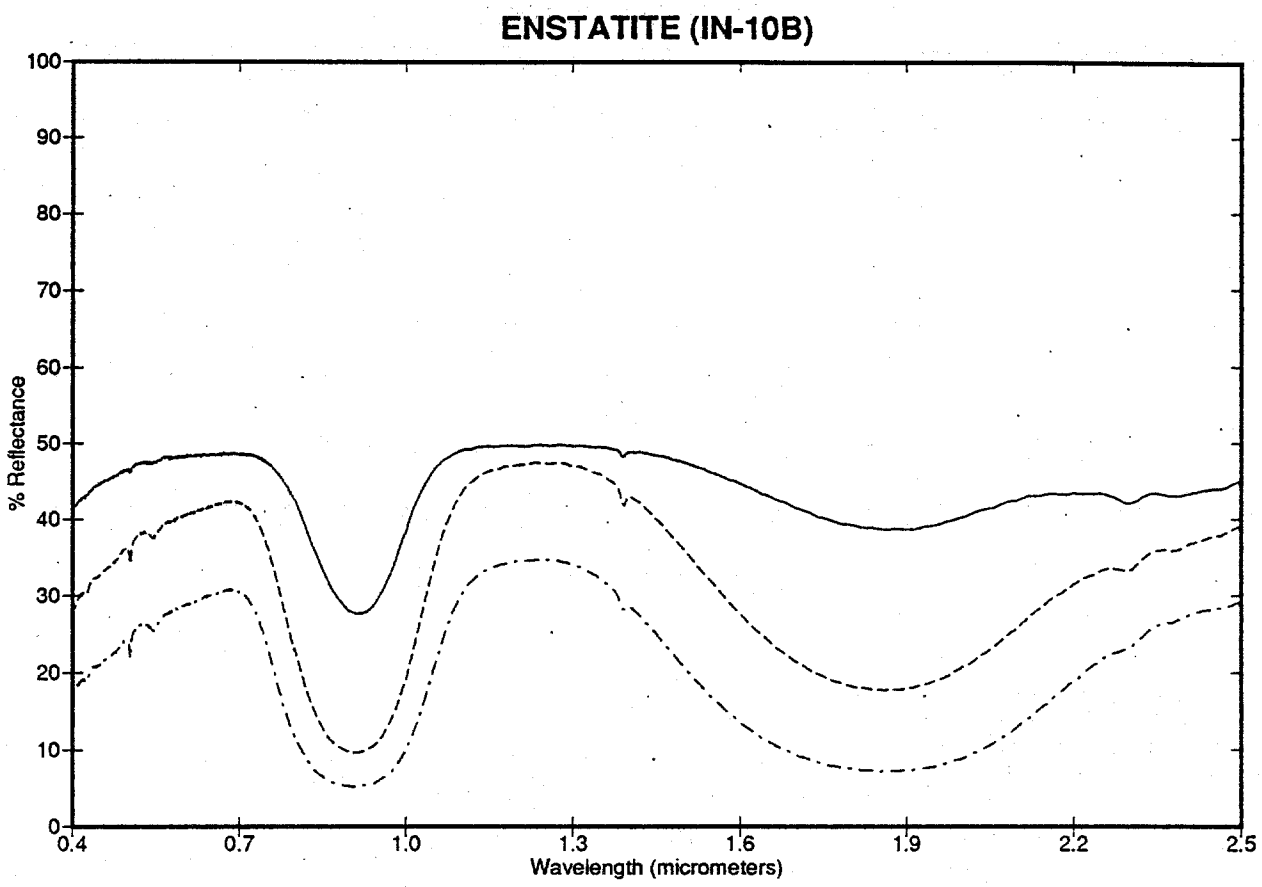
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.0320	2.9203	0.3209	1.5669
0.6910	1.6736	0.2789	1.2821

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.0640	11.6887	3.2441	0.8022
2.3120	7.3997	0.5926	1.3716
2.3800	4.1722	0.3370	0.3152
1.3920	3.9923	0.2233	0.4023
2.2360	3.6642	0.4757	9.8903
1.9120	3.5604	0.3416	0.3683

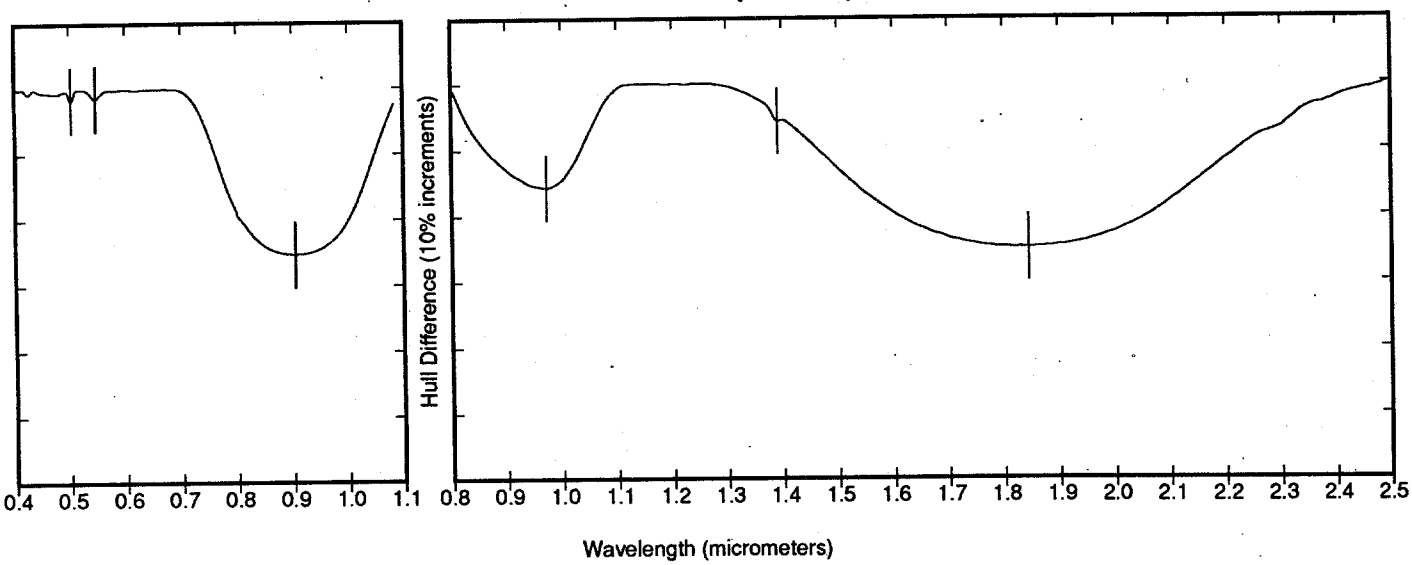
231



DESCRIPTION: ENSTATITE
SAMPLE_NUM: IN-10B
COUNTRY: NORWAY
POLITICAL_SUBDIVISION: TELEMARK
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: BURMINCO
MINERALOGY: ENSTATITE(A)
CHEMICAL FORMULA: $(Mg_{0.86}Fe_{0.14})\ SiO_3$*

232

ENSTATITE (IN-10B)

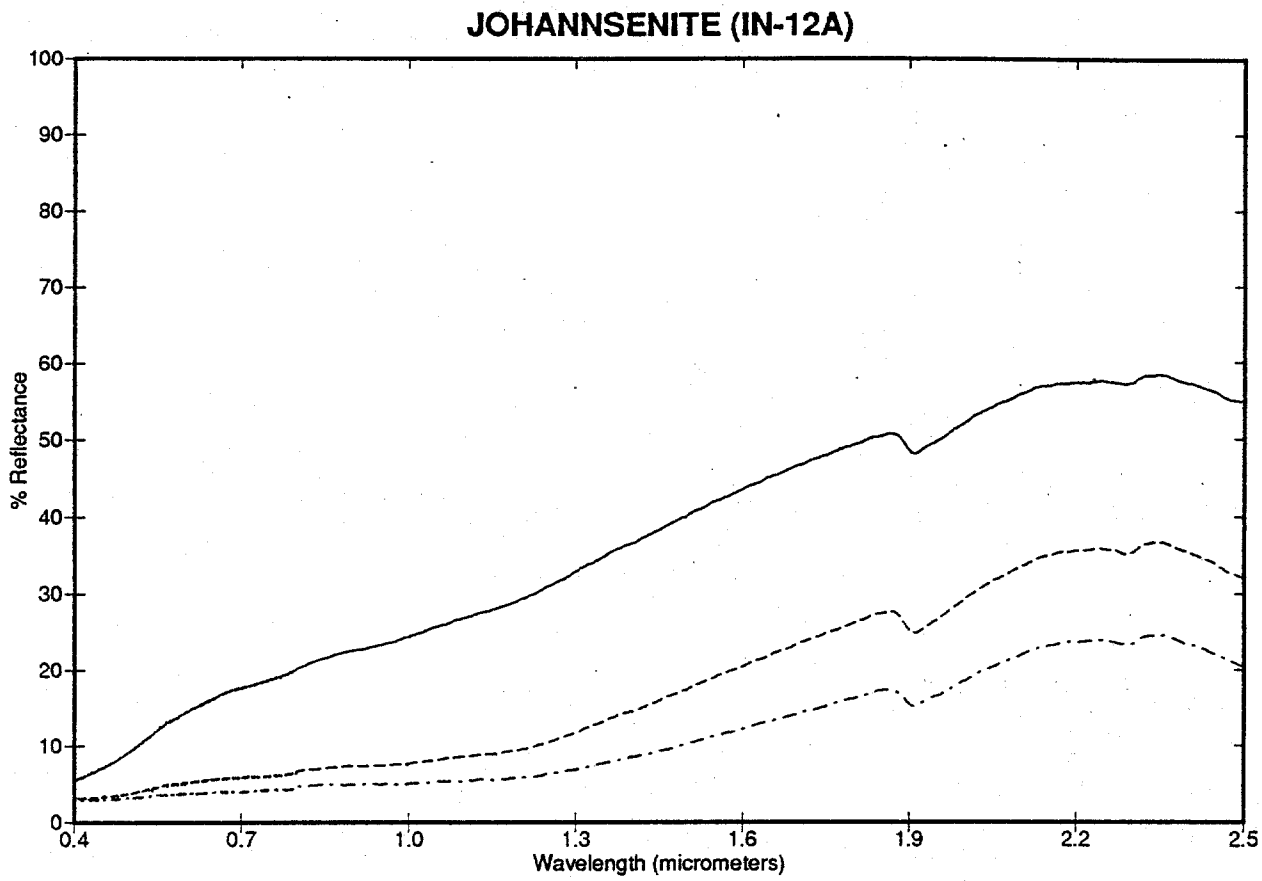


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9040	25.2209	6.5080	1.0017
0.5030	1.6367	0.0191	0.9437
0.5470	1.4545	0.0295	1.0290

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

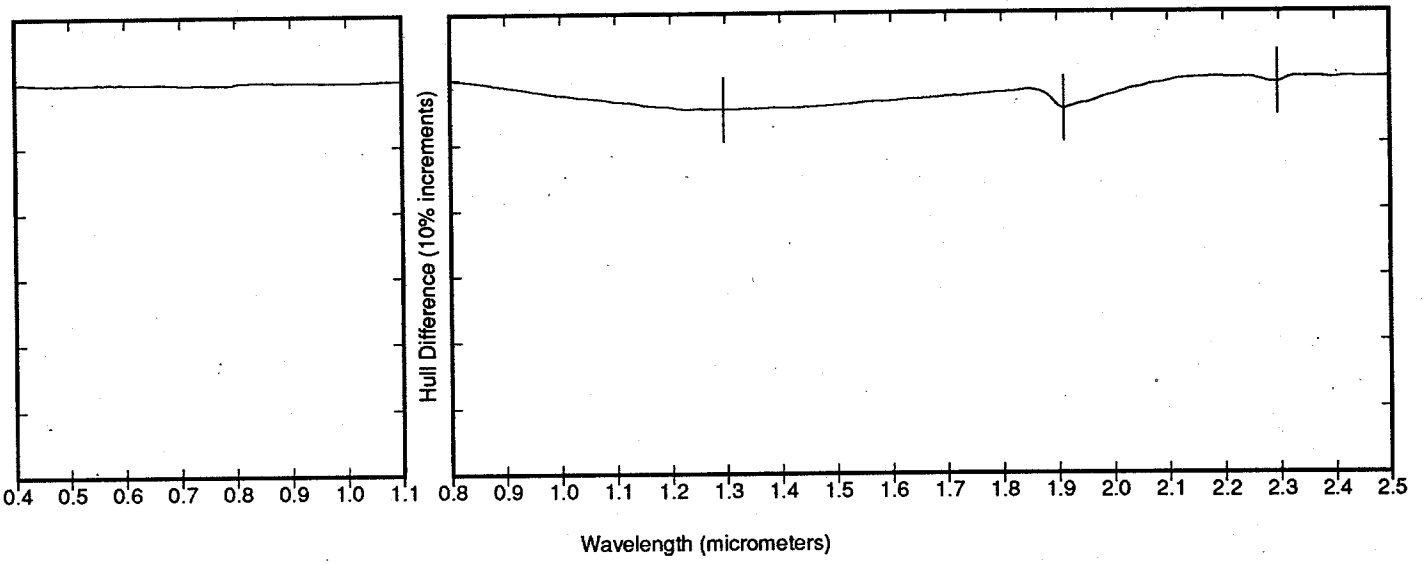
WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.8440	24.9163	16.9431	0.9470
0.9720	15.7114	3.0164	1.5793
1.3920	5.7513	0.2642	4.8698



DESCRIPTION: JOHANNSENITE
SAMPLE_NUM: IN-12A
COUNTRY: USA
POLITICAL_SUBDIVISION: ARIZONA
GEOGRAPHICAL_REGION: GRAHAM COUNTY
SITE: ARAVAIPA
COLLECTOR: BURMINCO
MINERALOGY: JOHANNSENITE(A)
CHEMICAL FORMULA: $(Na_{0.01}Ca_{0.99})\ (Mn_{0.48}Fe_{0.46}Mg_{0.05}Al_{0.01})\ Si_2O_6$*

234

JOHANNSENITE (IN-12A)

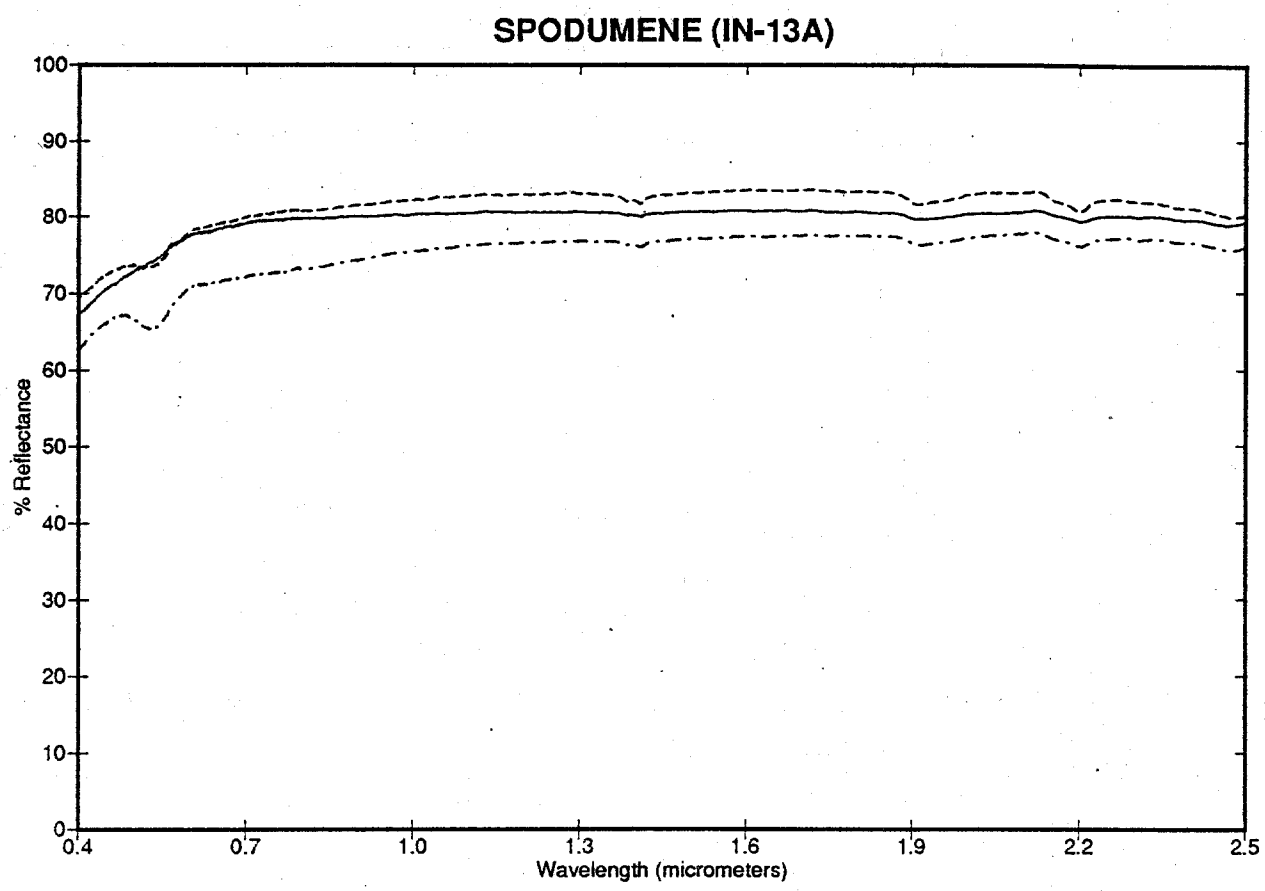


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 11.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9120	4.7828	0.7076	0.4104
1.2960	4.7239	3.3178	0.6994
2.2960	0.8997	0.0492	2.0581

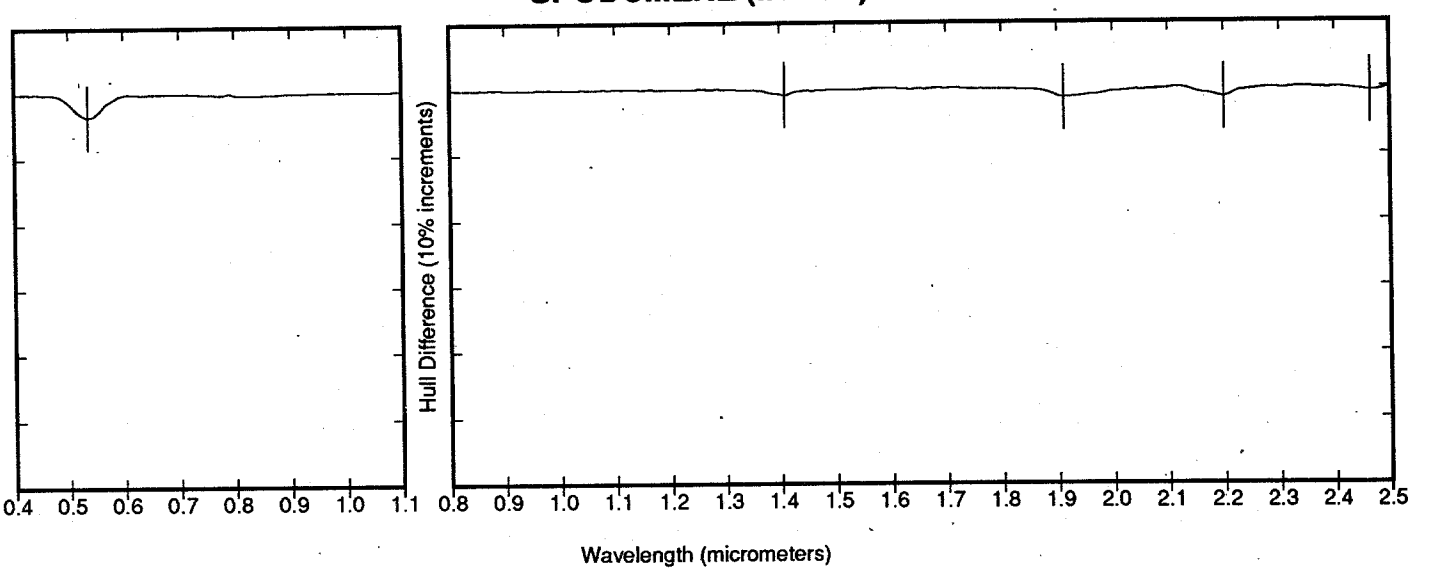
235



DESCRIPTION: SPODUMENE
SAMPLE_NUM: IN-13A
COUNTRY: BRAZIL
POLITICAL_SUBDIVISION: MINAS GERAIS
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: SPODUMENE(A)
CHEMICAL FORMULA: $LiAlSi_2O_6$

236

SPODUMENE (IN-13A)



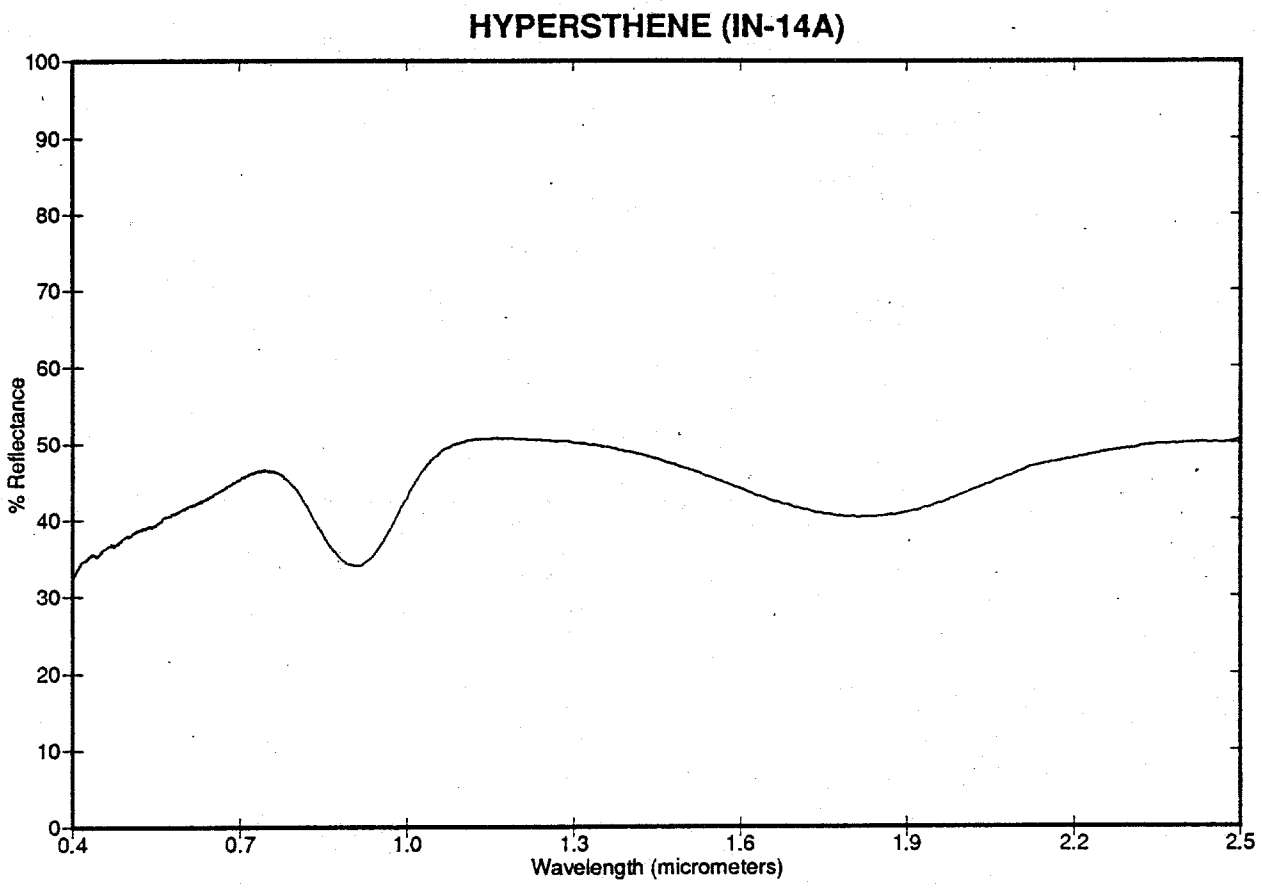
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5350	3.5635	0.2292	0.9575

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9120	1.5139	0.1945	0.4173
2.2000	1.4598	0.1064	1.3224
1.4080	1.0237	0.0609	1.5096
2.4640	0.5806	0.0353	1.3508

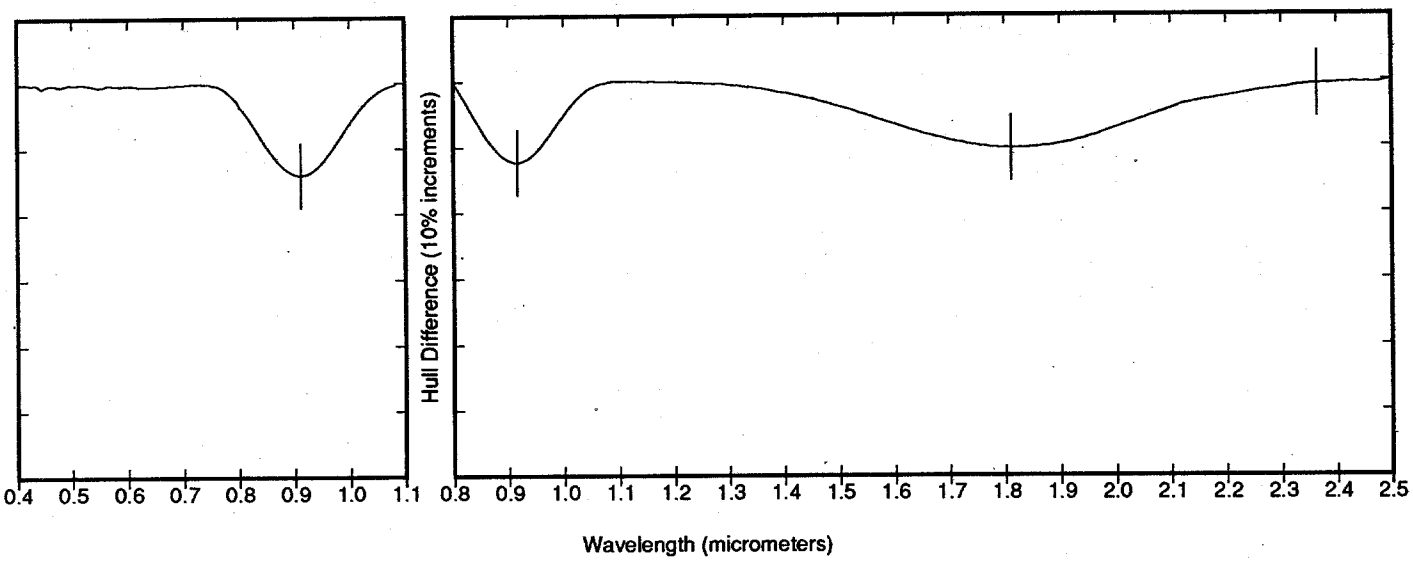
237



DESCRIPTION: HYPERSTHENE
SAMPLE_NUM: IN-14A
COUNTRY: FRANCE
POLITICAL_SUBDIVISION: MARTINIQUE
GEOGRAPHICAL_REGION: CARIBBEAN
SITE: MOUNT PELEE
COLLECTOR: JPL
MINERALOGY: HYPERSTHENE(A),AMPHIBOLE(M)
CHEMICAL_FORMULA: $(Mg,Fe^{2+})_2Si_2O_6$

238

HYPERSTHENE (IN-14A)



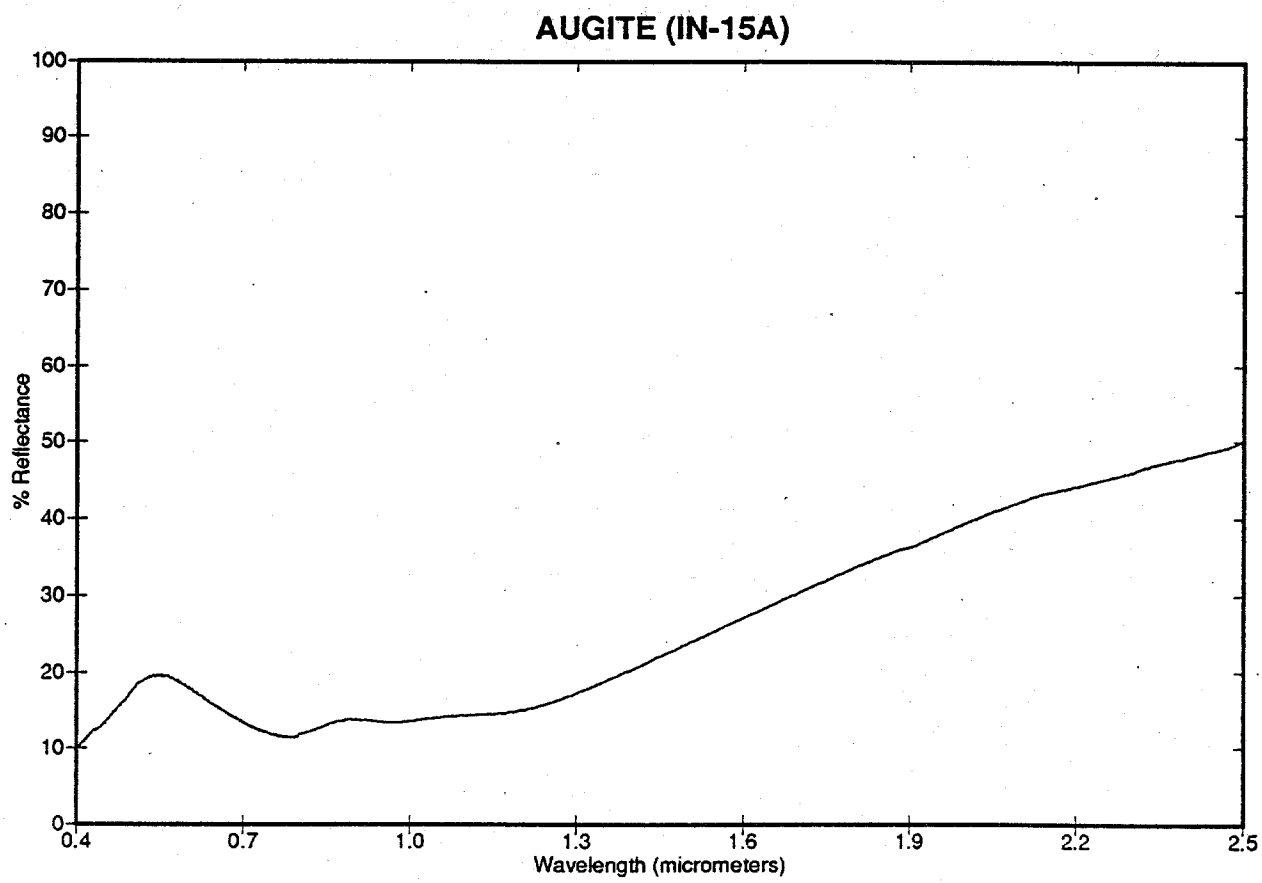
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9120	14.0423	2.3363	0.9911

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9160	12.3712	1.8301	0.9171
1.8120	10.3572	5.7584	0.9722
2.3640	0.7309	0.0436	0.0699

239



DESCRIPTION: AUGITE
SAMPLE_NUM: IN-15A
COUNTRY: USA
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: AUGITE(A)
CHEMICAL FORMULA: (Ca,Na) (Mg,Fe,Al,Ti) $(Si,Al)_2O_6$

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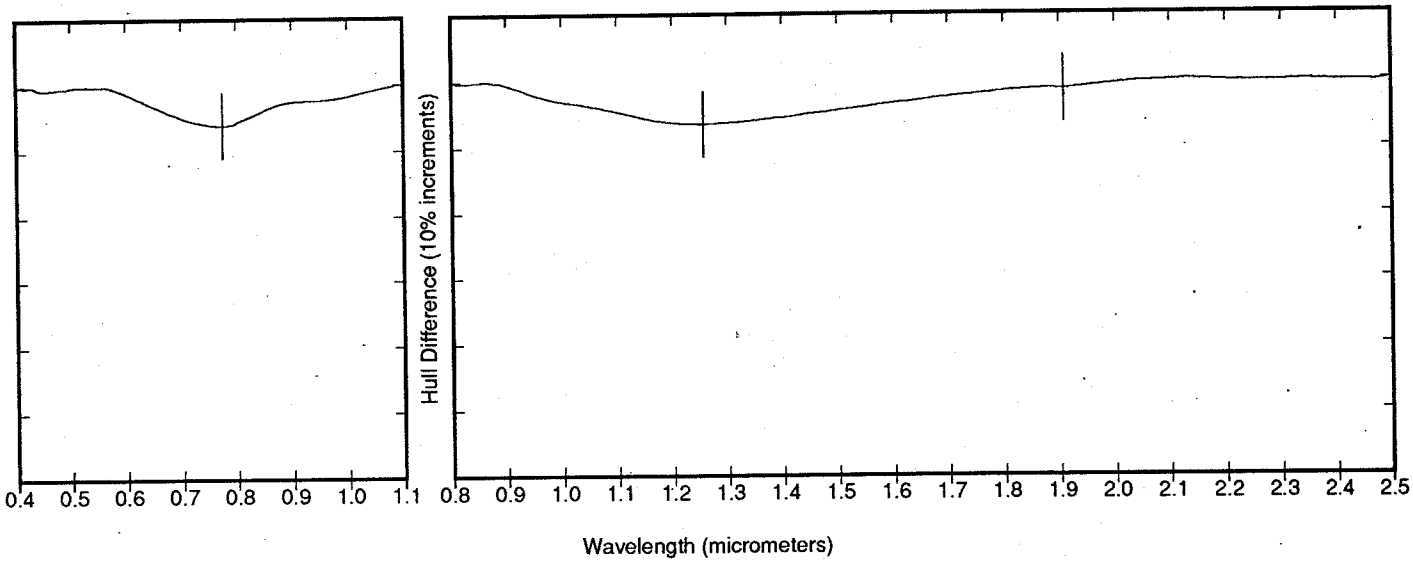
AUGITE (IN-15A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 11.0000

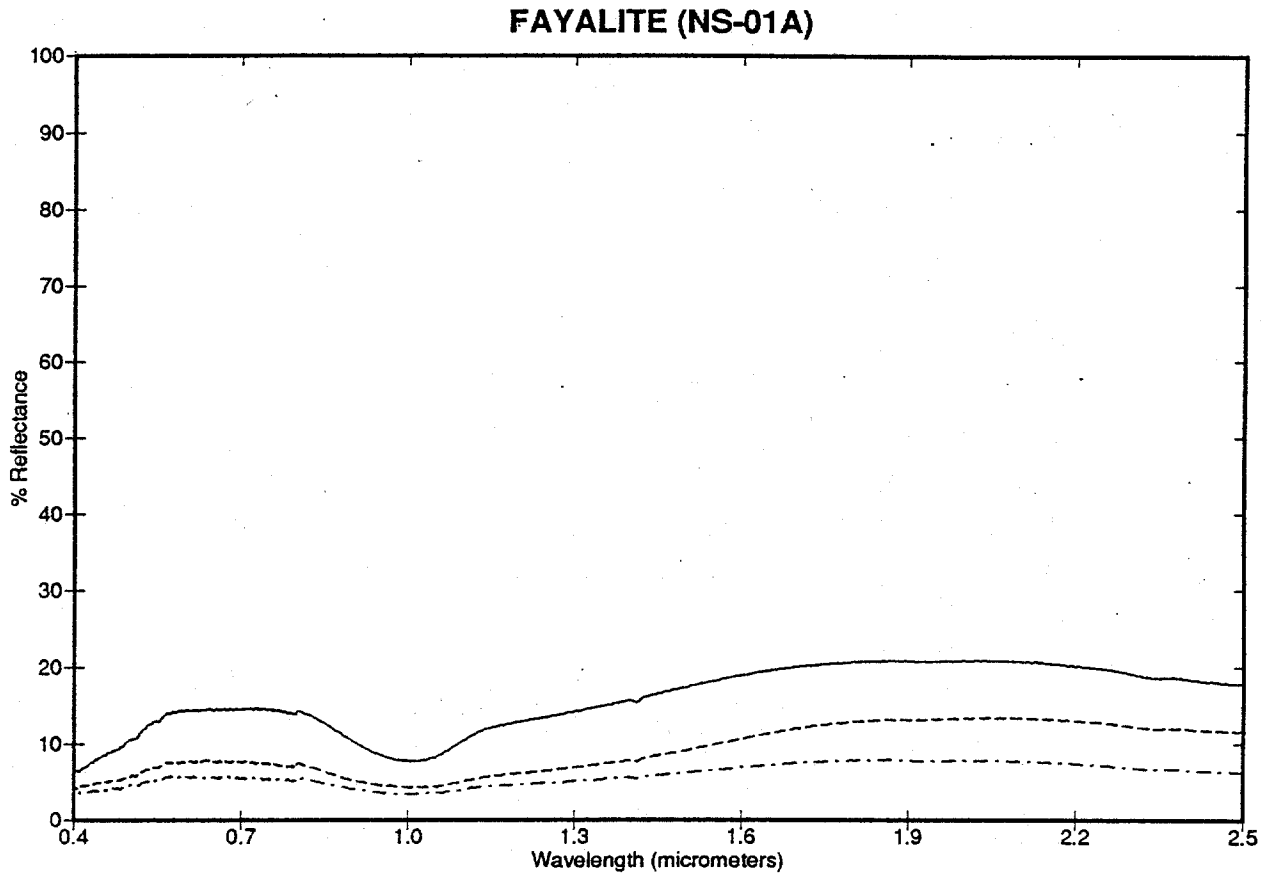
WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7740	5.9818	1.5485	0.8912

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.2560	6.4727	3.8933	0.6174
1.9080	1.3835	0.1501	0.2167

241

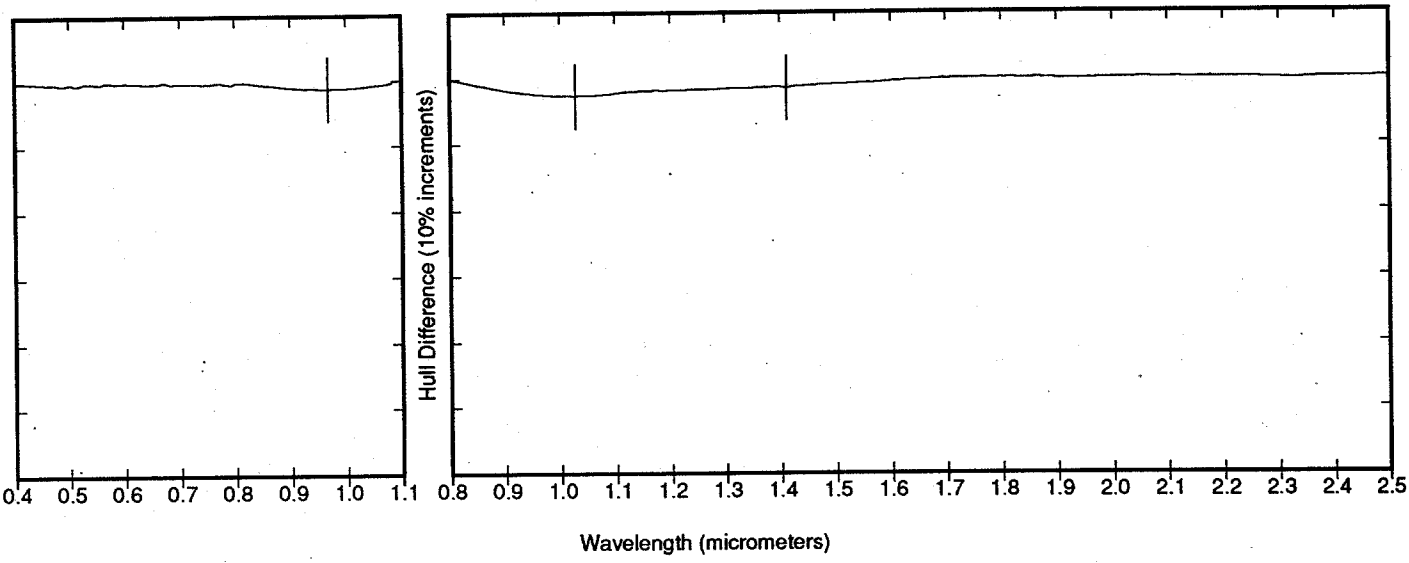
NESOSILICATES



DESCRIPTION: FAYALITE
SAMPLE_NUM: NS-01A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: FAYALITE(A)
CHEMICAL FORMULA: $(Fe_{1.89}Mn_{0.08}Ca_{0.03})\ SiO_4$*

243

FAYALITE (NS-01A)



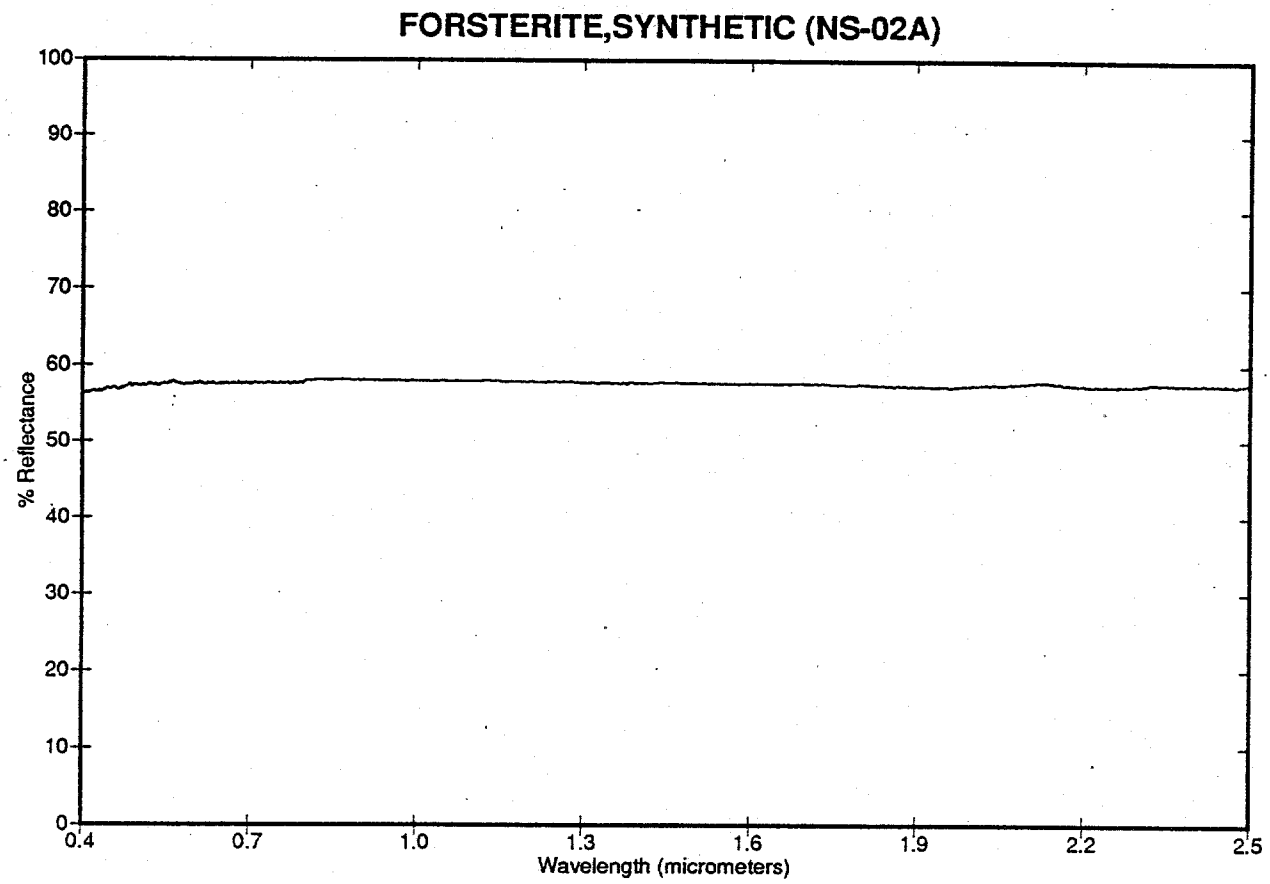
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9680	1.1720	0.2205	1.2296

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.0280	2.7021	1.1009	0.5563
1.4120	1.5561	0.2609	0.0992

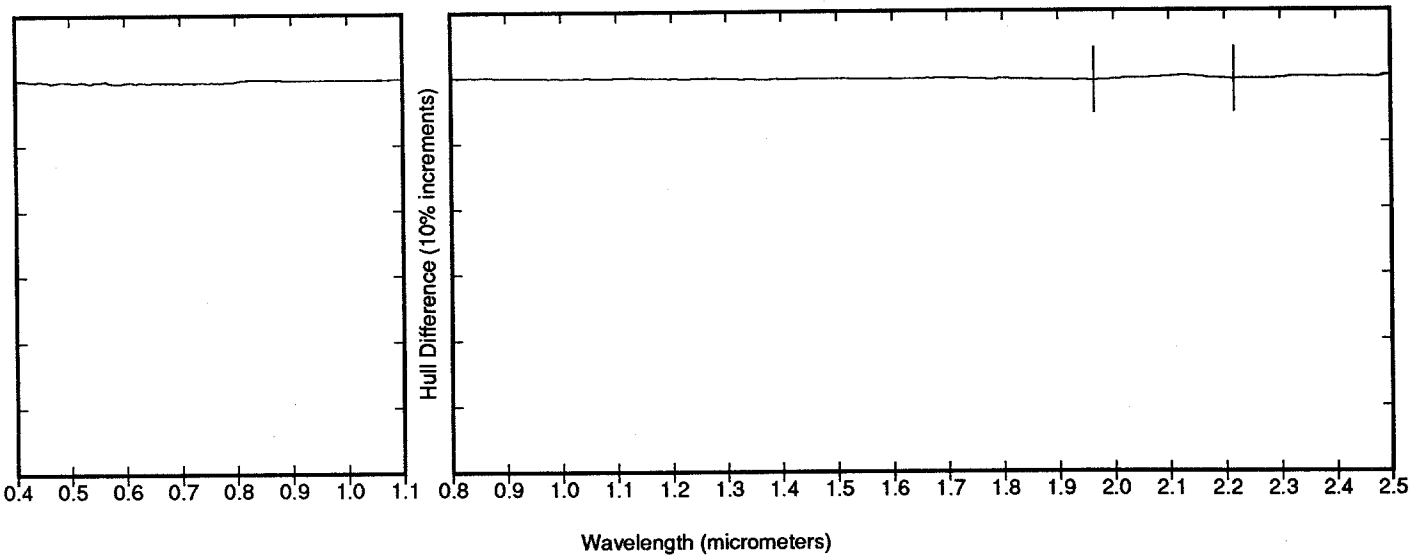
244



DESCRIPTION: FORSTERITE,SYNTHETIC
SAMPLE_NUM: NS-02A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: FORSTERITE(A)
CHEMICAL FORMULA: $(Mg_{1.99}Ca_{0.01})\ SiO_4$*

245

FORSTERITE,SYNTHETIC (NS-02A)

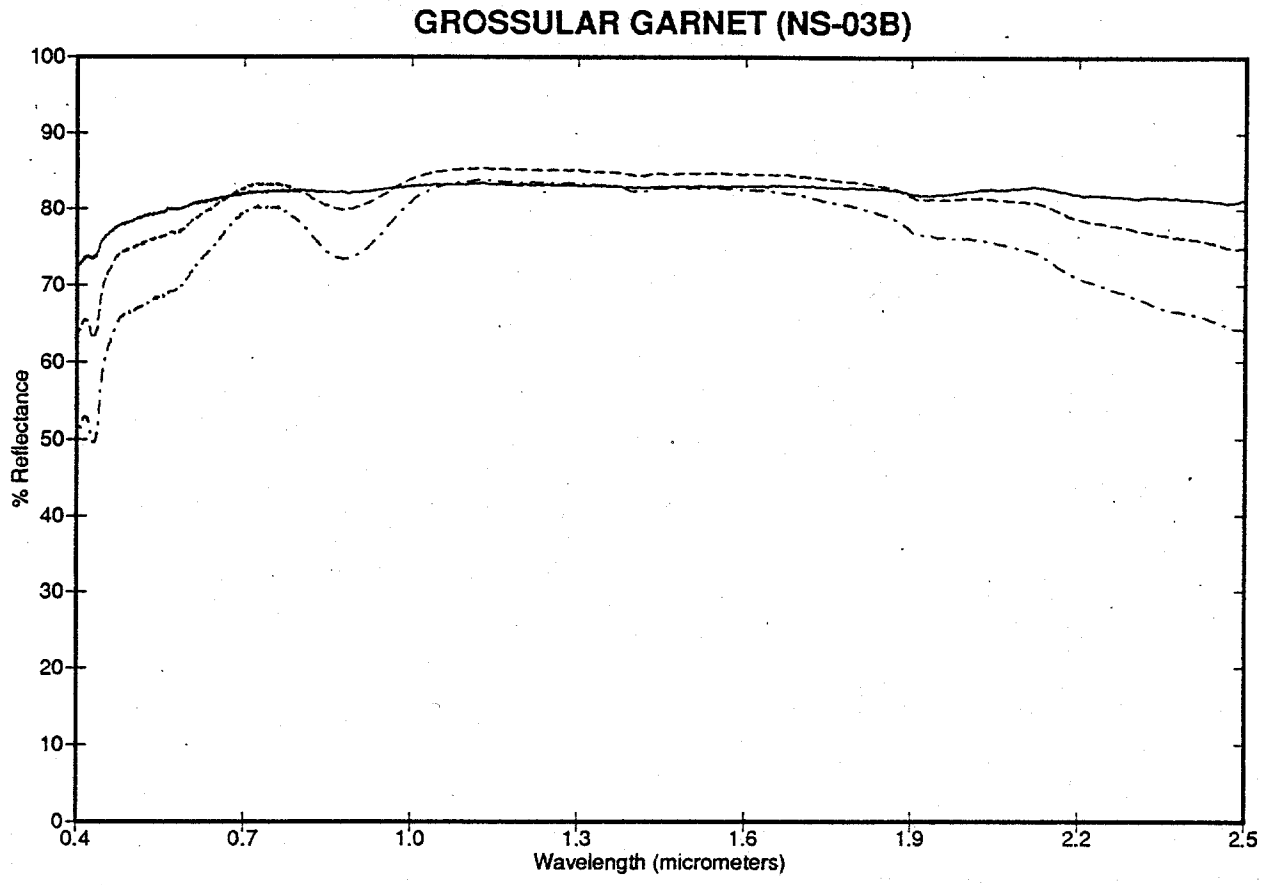


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 14.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9640	0.6954	0.4070	5.5074
2.2160	0.5511	0.1110	0.2691

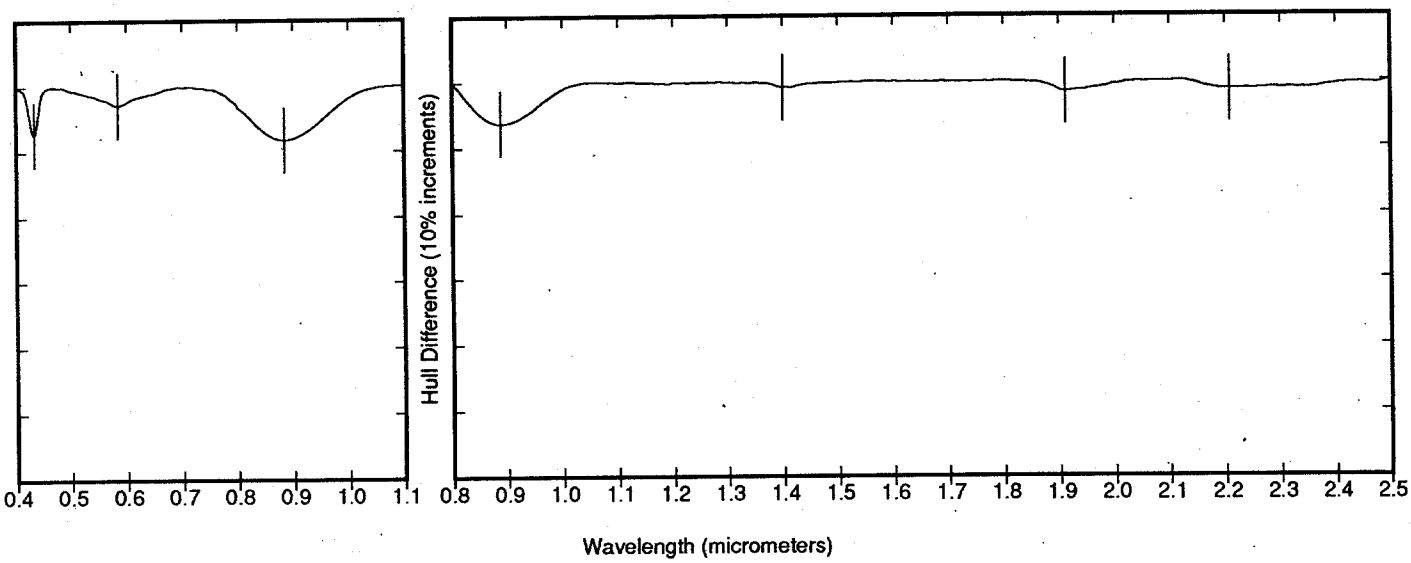
240



DESCRIPTION: GROSSULAR GARNET
SAMPLE_NUM: NS-03B
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: LAKE JACO
SITE: LAKE JACO
COLLECTOR: NEW,DAVID
MINERALOGY: GROSSULAR GARNET(A)
CHEMICAL FORMULA: $(Ca_{2.97}Mn_{0.01}Mg_{0.08})\ (Al_{1.71}Fe^{3+}_{0.21}Ti_{0.02})\ Si_{3.01}O_{12}$*

247

GROSSULAR GARNET (NS-03B)



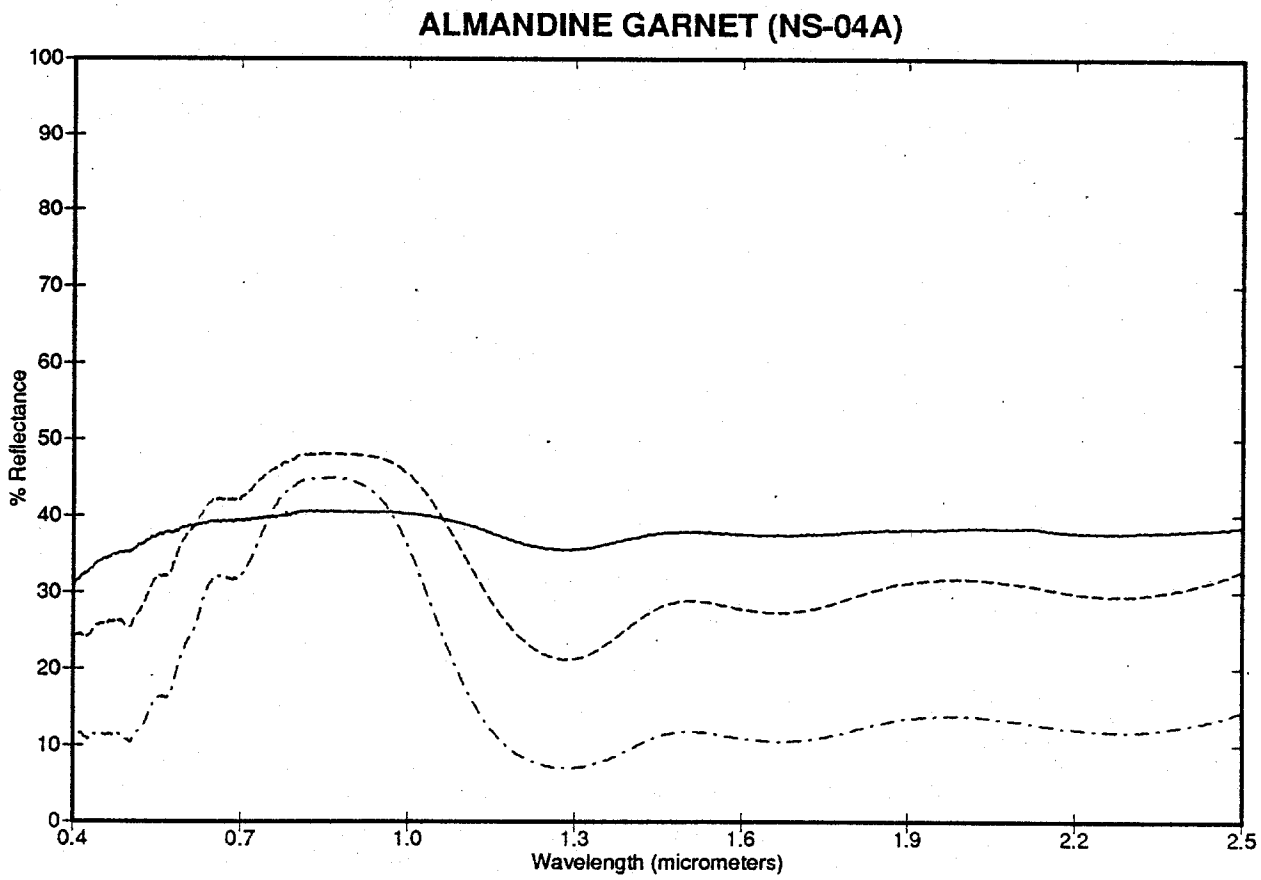
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.8840	8.2368	1.2895	0.8630
0.4330	7.2324	0.1516	1.1890
0.5840	2.8543	0.2760	1.0230

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 14.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.8880	6.2642	0.8122	0.7122
1.9120	1.6056	0.2016	0.7804
2.2080	1.3212	0.3239	0.2898
1.4000	0.8652	0.0653	1.3499

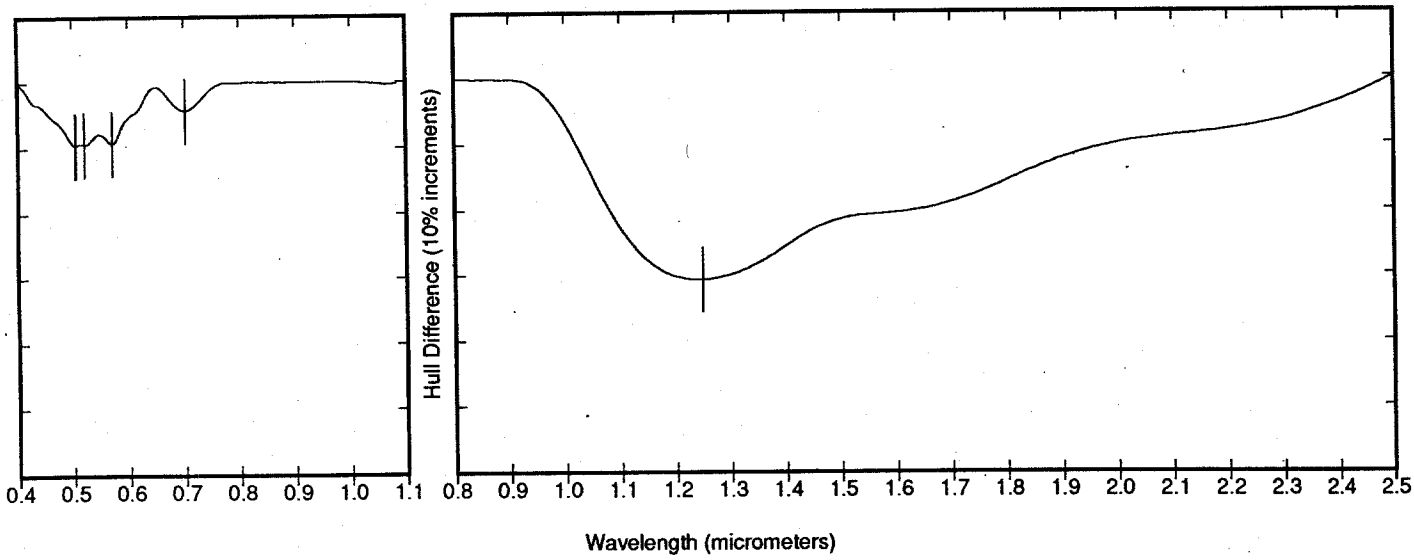
248



DESCRIPTION: ALMANDINE GARNET
SAMPLE_NUM: NS-04A
COUNTRY: USA
POLITICAL_SUBDIVISION: ARIZONA
GEOGRAPHICAL_REGION: GRAHAM COUNTY
SITE: STANLEY BUTTE
COLLECTOR: BURMINCO
MINERALOGY: ALMANDINE GARNET(A)
CHEMICAL FORMULA: $(Fe_{1.41}Mg_{1.25}Mn_{0.03}Ca_{0.32})\ (Al_{2.00})\ (Si_{2.99}Al_{0.01})\ O_{12}$*

249

ALMANDINE GARNET (NS-04A)



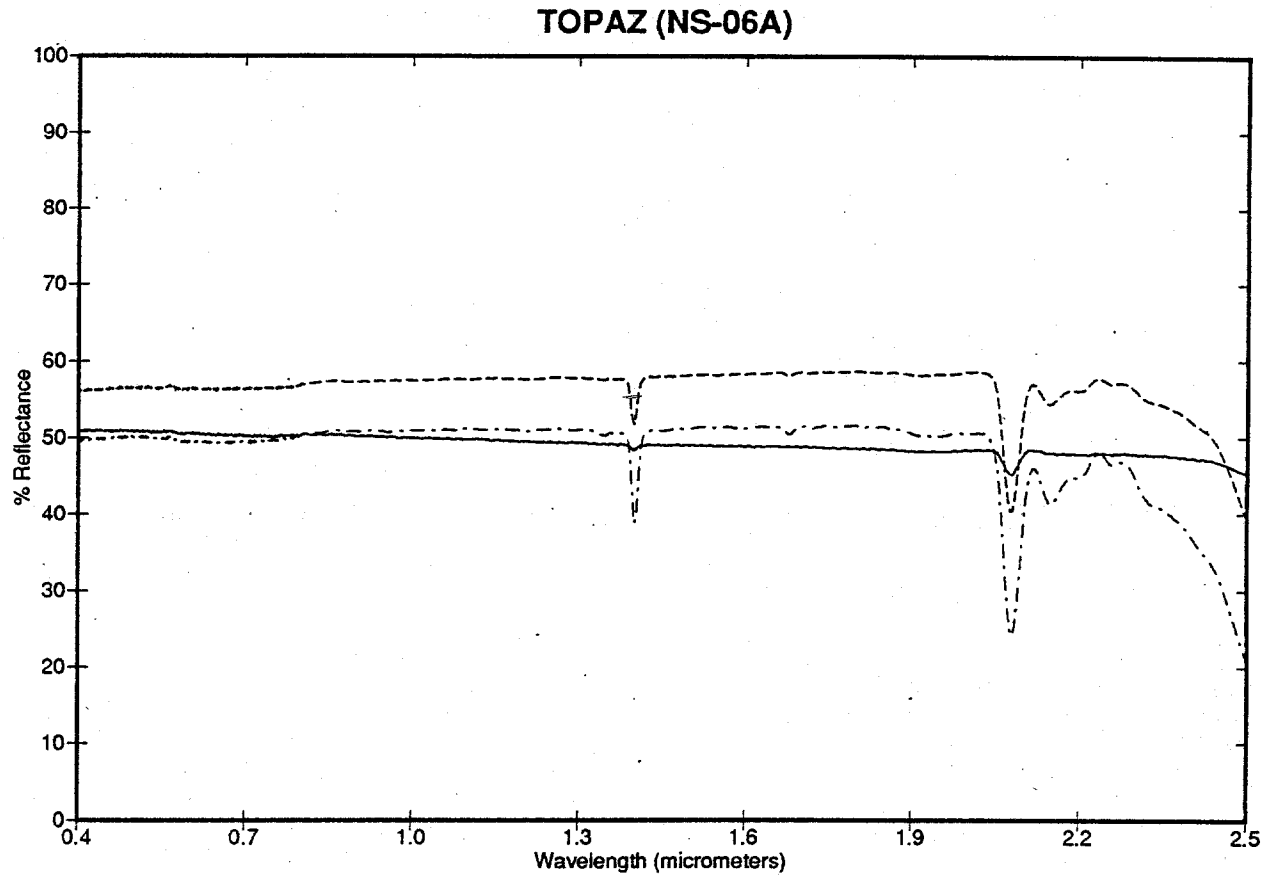
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5050	9.6037	0.5910	4.7159
0.5210	9.3884	0.2799	0.2009
0.5710	9.2796	0.5593	0.5381
0.7030	4.3448	0.2841	0.9631

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.2480	30.6784	24.1801	0.3235

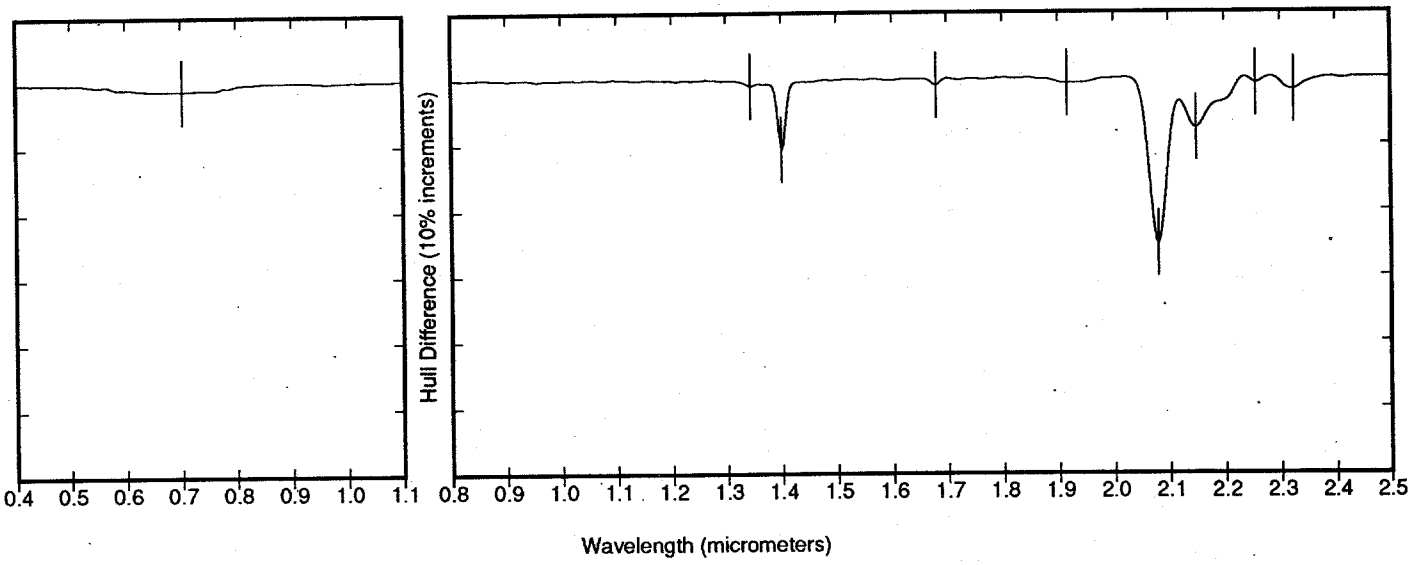
250



DESCRIPTION: TOPAZ
SAMPLE_NUM: NS-06A
COUNTRY: AUSTRALIA
POLITICAL_SUBDIVISION: WESTERN AUSTRALIA
GEOGRAPHICAL_REGION: GROSSMONT
SITE: GROSSMONT
COLLECTOR: WARD'S
MINERALOGY: TOPAZ(A)
CHEMICAL FORMULA: $Al_2SiO_4(F,OH)_2$

251

TOPAZ (NS-06A)



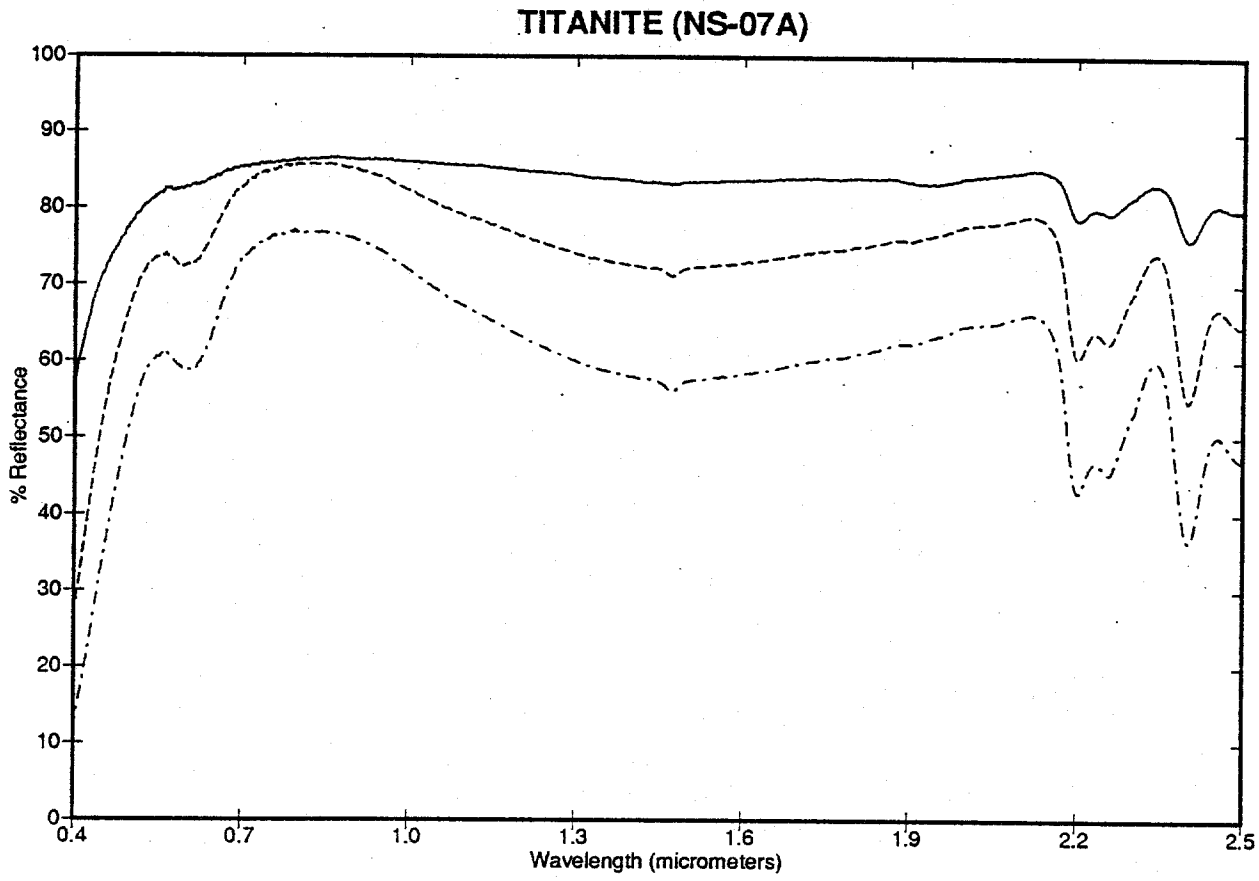
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 23.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7030	1.1710	0.2133	1.6629

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 8.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.0800	25.1275	0.9783	0.9681
1.4000	10.7370	0.2535	0.7421
2.1480	7.6370	0.4897	0.4912
2.3240	1.8718	0.0858	0.9000
1.6800	1.0772	0.0269	1.5891
1.3440	1.0690	0.0456	2.9267
2.2560	0.8730	0.0186	0.7839
1.9160	0.8286	0.0726	0.5677

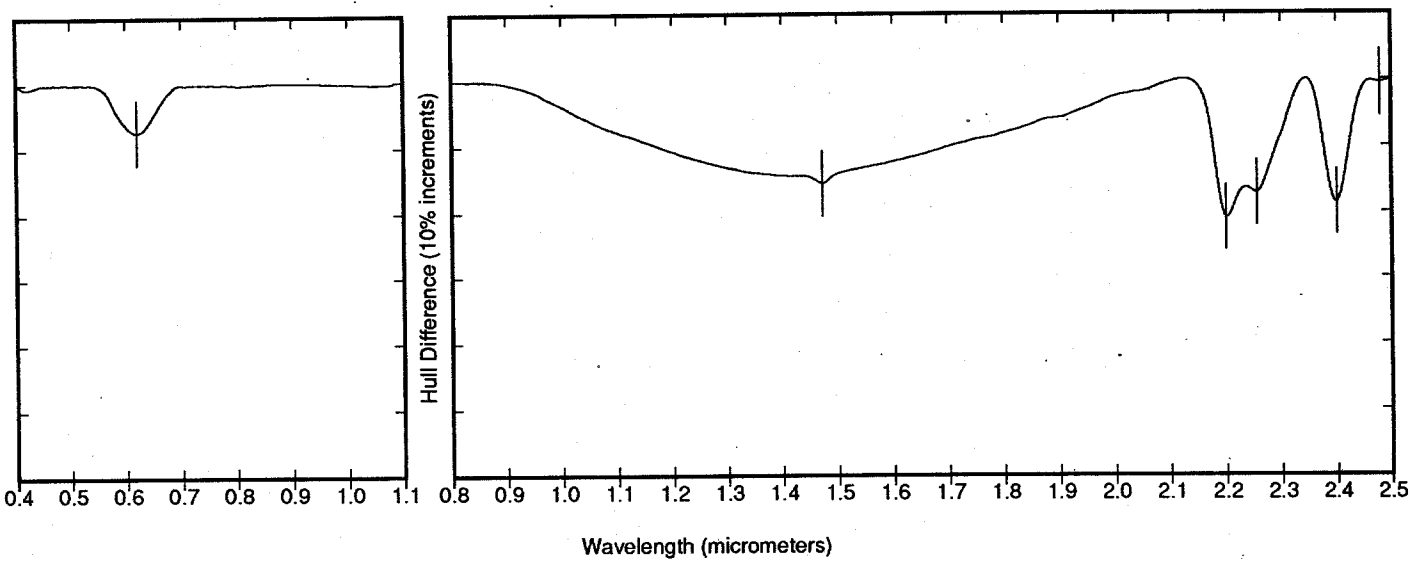
252



DESCRIPTION: TITANITE
SAMPLE_NUM: NS-07A
COUNTRY: BRAZIL
POLITICAL_SUBDIVISION: MINAS GERAIS
GEOGRAPHICAL_REGION: CAPELINHA
SITE: CAPELINHA
COLLECTOR: JPL
MINERALOGY: TITANITE(A),RUTILE(T)
CHEMICAL FORMULA: $Ca_{1.02}$ $(Ti_{0.95}Al_{0.04}Fe_{0.01})$ SiO_5*

253

TITANITE (NS-07A)



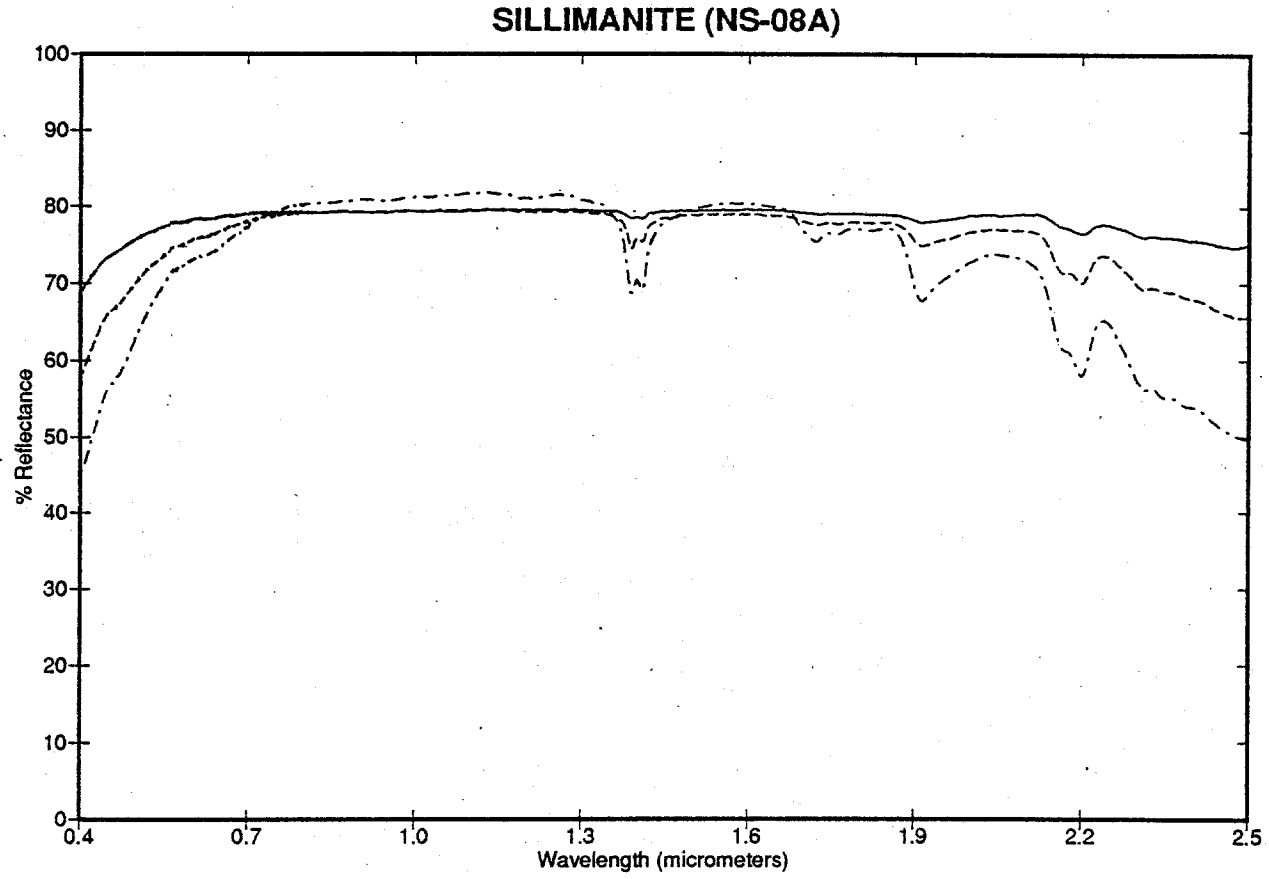
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6200	7.3218	0.5684	1.0191

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.2000	20.9037	1.1584	0.7424
2.4000	18.6048	0.9454	0.9583
2.2560	17.0947	1.0606	0.4606
1.4720	15.5486	10.3366	1.0655
2.4800	0.5443	0.0129	1.1124

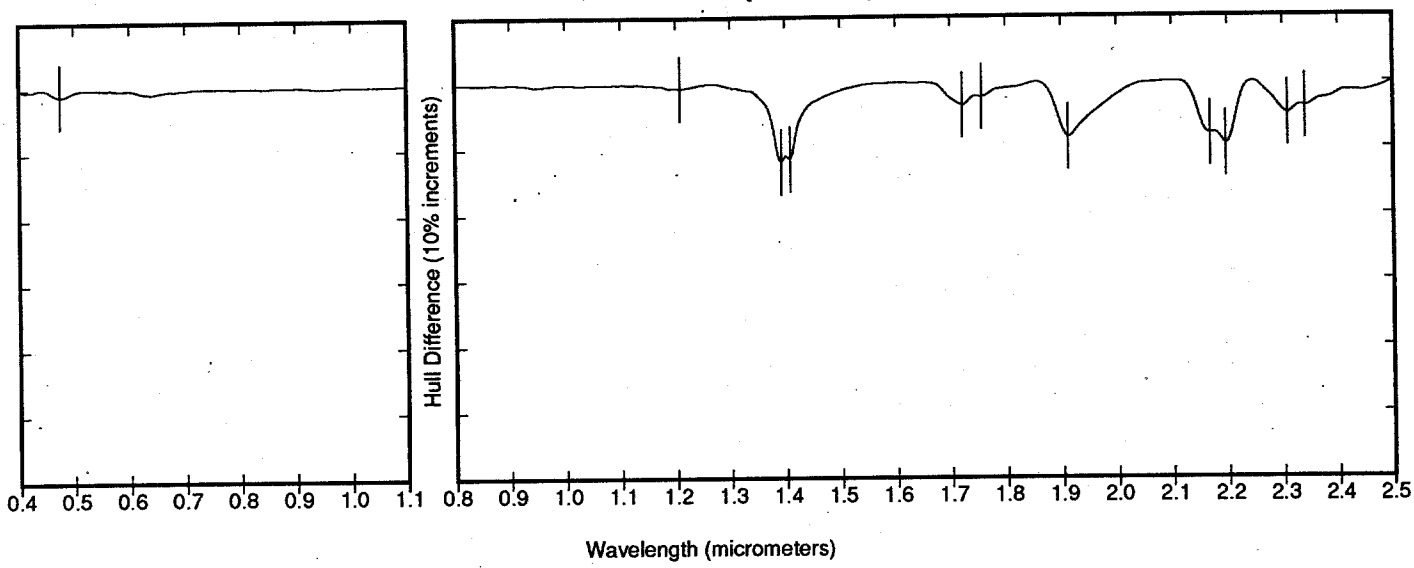
254



DESCRIPTION: SILLIMANITE
SAMPLE_NUM: NS-08A
COUNTRY: AUSTRALIA
POLITICAL_SUBDIVISION: SOUTH AUSTRALIA
GEOGRAPHICAL_REGION: WILLIAMSTOWN
SITE: WILLIAMSTOWN
COLLECTOR: WARD'S
MINERALOGY: SILLIMANITE(A),QUARTZ(M)
CHEMICAL FORMULA: Al_2SiO_5

255

SILLIMANITE (NS-08A)



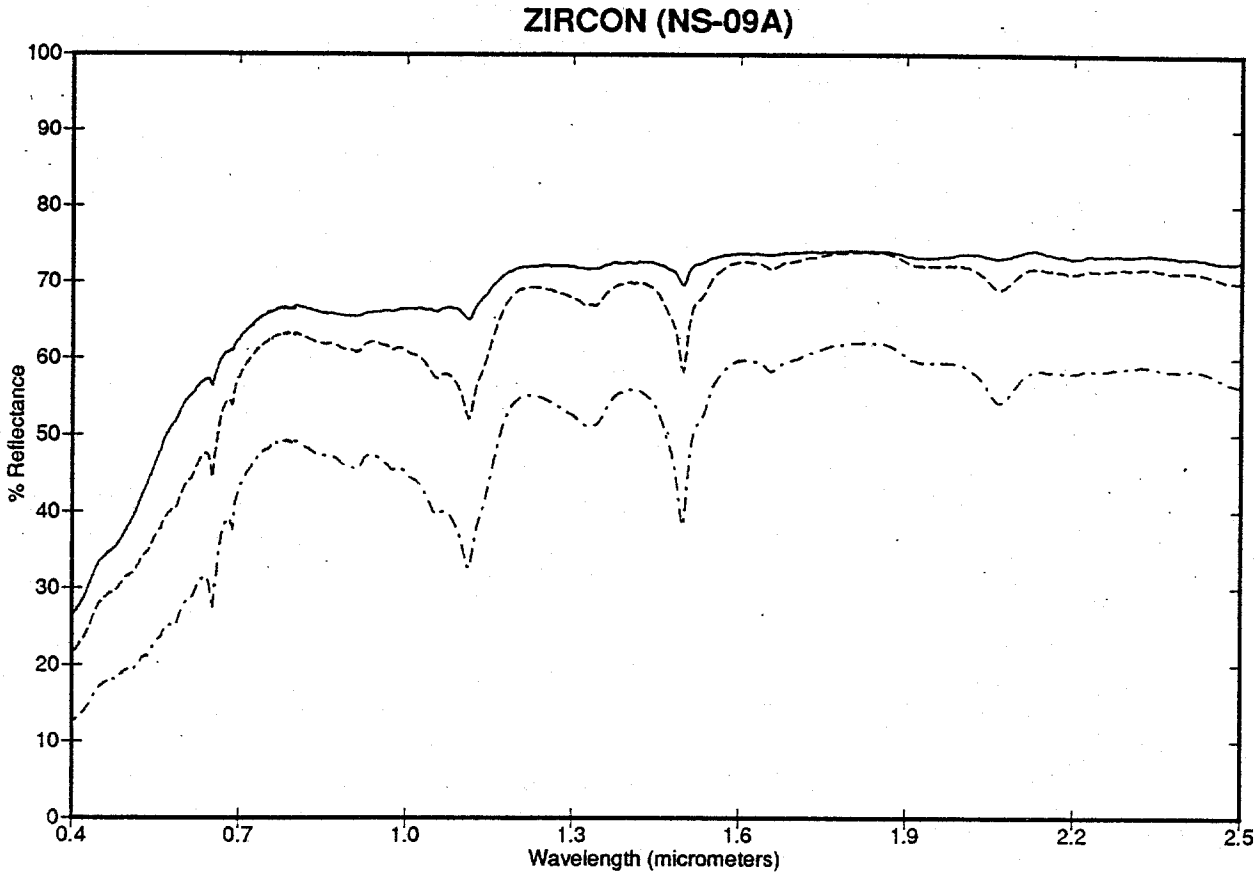
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4750	1.0537	0.0382	0.7056

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3920	11.9973	0.3981	3.3305
1.4080	11.5621	0.4749	0.2353
2.1960	9.4370	0.3690	0.8563
1.9120	8.3767	0.6838	0.3869
2.1680	7.9352	0.2587	3.1094
2.3080	4.8850	0.2610	1.2191
2.3400	3.8217	0.3061	0.0520
1.7200	3.5083	0.1794	1.3337
1.7560	2.2246	0.1096	0.1913
1.2080	0.6574	0.0473	1.8498

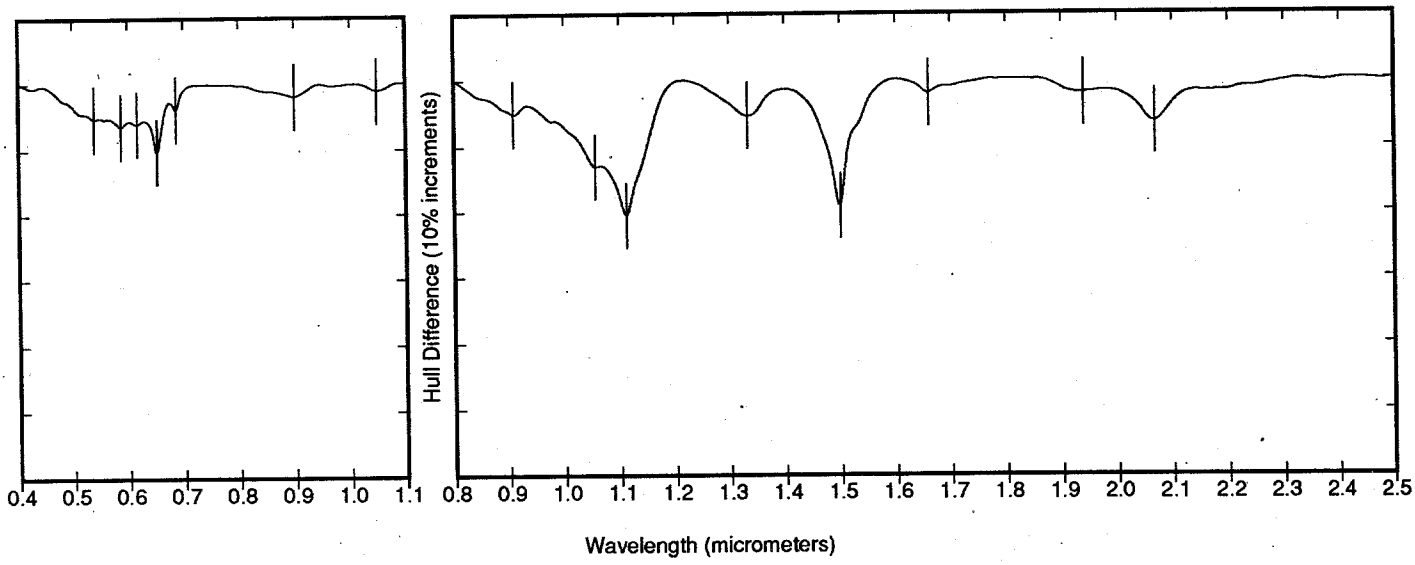
256



DESCRIPTION: ZIRCON
SAMPLE_NUM: NS-09A
COUNTRY: MALAWI
POLITICAL_SUBDIVISION: SOUTHERN MALAWI
GEOGRAPHICAL_REGION: BLANTYRE-LIMBE DISTRICT
SITE: NULL
COLLECTOR: BURMINCO
MINERALOGY: ZIRCON(A)
CHEMICAL FORMULA: $ZrSiO_4$

257

ZIRCON (NS-09A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 25.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6520	10.2252	0.3052	1.2788
0.5870	6.3525	0.3570	2.2258
0.6160	5.9530	0.1206	0.9209
0.5380	5.1884	0.2796	17.0154
0.6860	3.7943	0.0770	0.8015
0.9000	1.9211	0.1671	1.8415
1.0480	1.1144	0.0399	0.7766

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.1120	20.5438	1.5236	0.9766
1.5000	19.1252	1.1612	1.3241
1.0560	13.0905	1.0086	8.6771
2.0680	6.3796	0.8075	0.6741
1.3320	5.3528	0.4818	1.3160
0.9080	5.0862	0.3883	2.6363
1.9400	2.0686	0.1567	1.9008
1.6600	2.0506	0.1360	0.5163

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PHYLLOSILICATES

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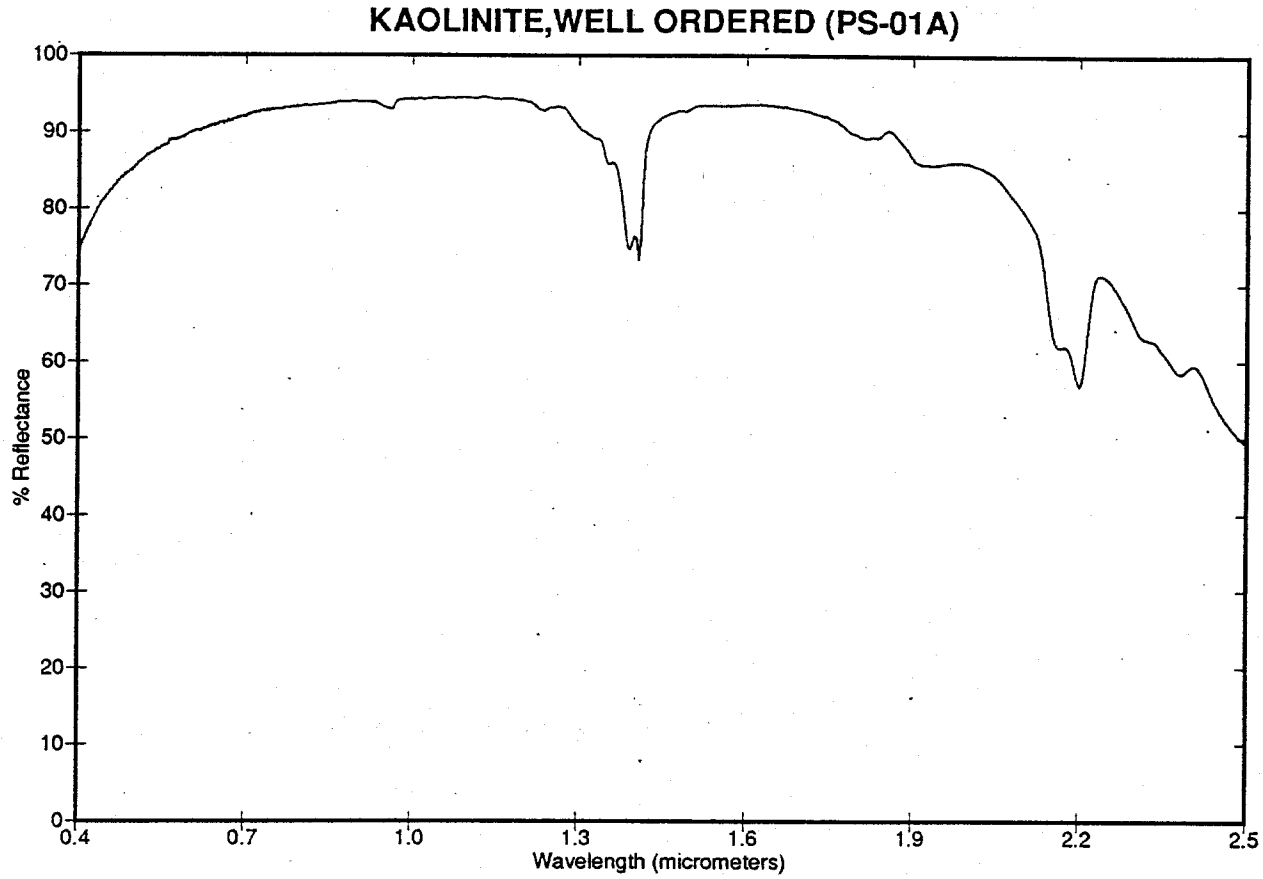
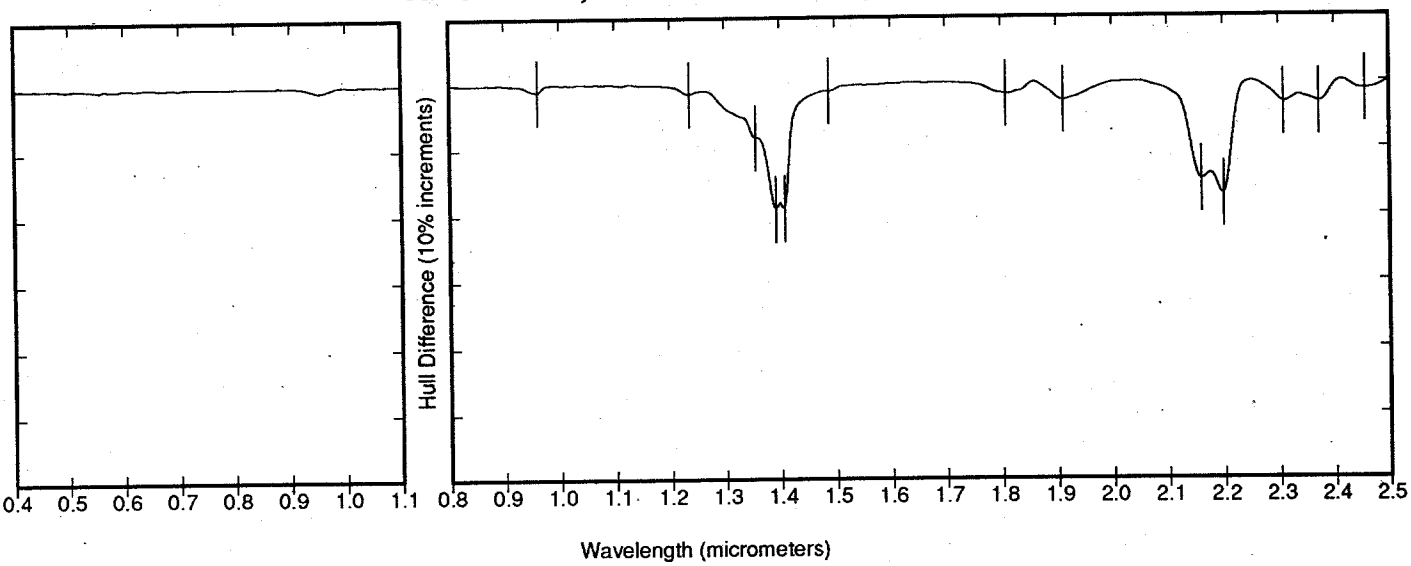


DESCRIPTION: KAOLINITE,WELL ORDERED
SAMPLE_NUM: PS-01A
COUNTRY: USA
POLITICAL_SUBDIVISION: GEORGIA
GEOGRAPHICAL_REGION: WASHINGTON COUNTY
SITE: NULL
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: WELL-ORDERED KAOLINITE(A)
CHEMICAL FORMULA: $Al_2Si_2O_5(OH)_4$

260

KAOLINITE,WELL ORDERED (PS-01A)

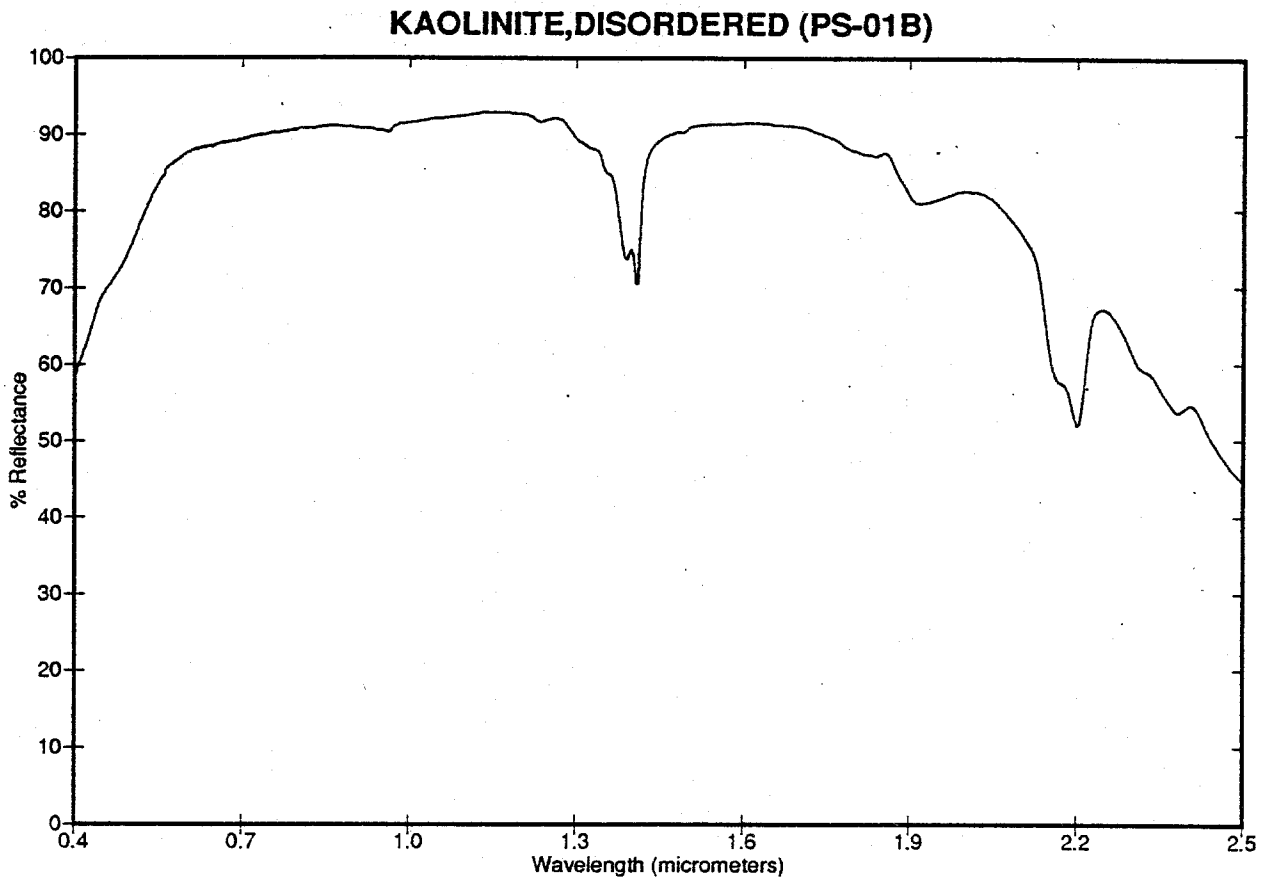


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3920	19.0503	0.5586	2.7624
1.4080	18.9337	0.4743	0.4577
2.2000	17.0183	0.6596	1.2792
2.1600	14.7726	0.6451	1.8024
1.3560	8.2278	0.4142	11.6013
2.3080	3.1968	0.1531	0.9789
2.3720	3.1795	0.1608	1.4833
1.9120	2.7234	0.2036	0.5518
1.8080	1.7290	0.1202	1.0861
1.2360	1.5295	0.0709	1.3651
2.4560	1.3029	0.0683	0.8647
1.4880	1.1937	0.0563	0.0914
0.9600	1.1611	0.0396	2.6036

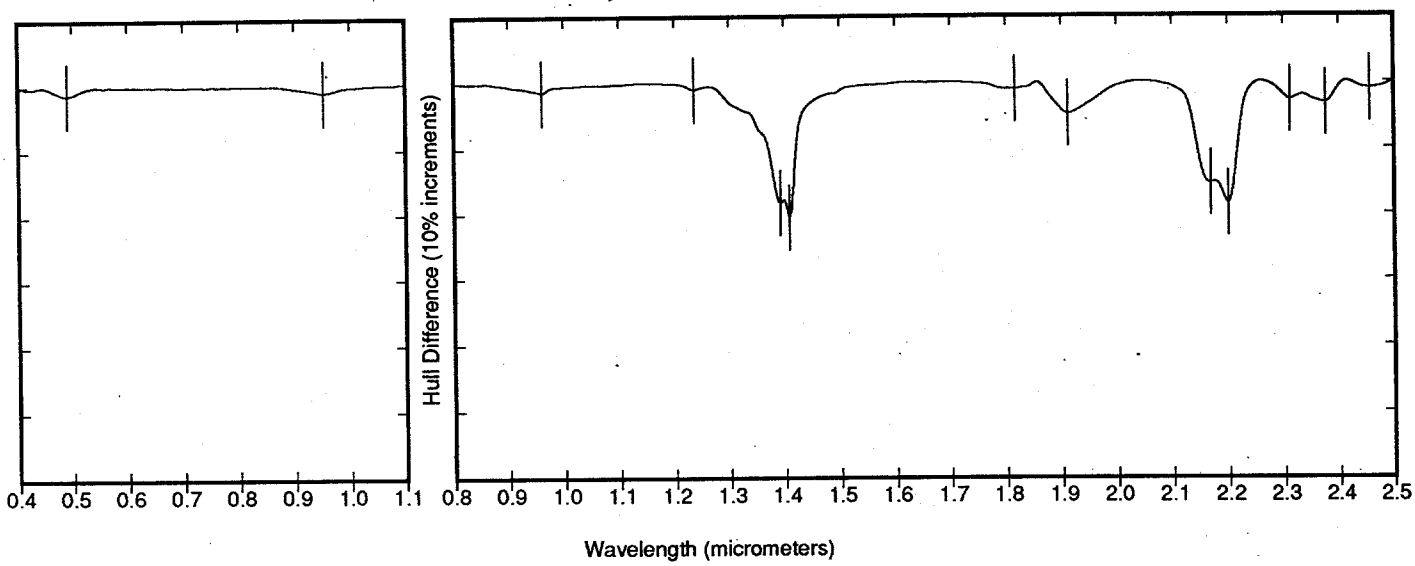
361



DESCRIPTION: KAOLINITE,DISORDERED
SAMPLE_NUM: PS-01B
COUNTRY: USA
POLITICAL_SUBDIVISION: GEORGIA
GEOGRAPHICAL_REGION: WARREN COUNTY
SITE: NULL
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: DISORDERED KAOLINITE(A)
CHEMICAL FORMULA: $Al_2Si_2O_5(OH)_4$

262

KAOLINITE,DISORDERED (PS-01B)



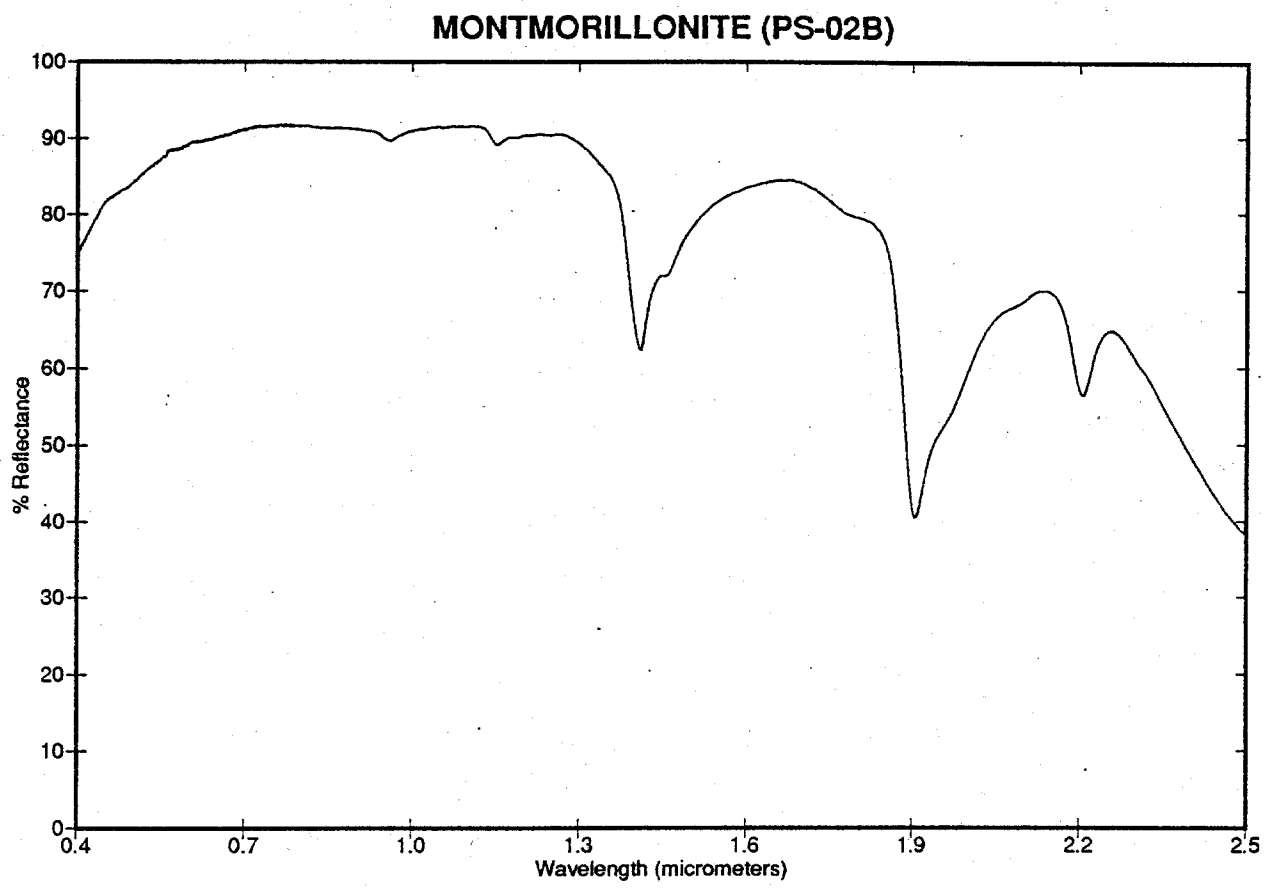
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4900	1.3199	0.0619	1.0257
0.9520	1.1533	0.1069	1.0974

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4080	20.5324	0.6528	0.3060
2.2000	18.4597	0.7575	1.1166
1.3920	18.3063	0.9010	5.2510
2.1680	15.3639	0.6064	3.9564
1.9120	4.7985	0.4039	0.5553
2.3760	3.2666	0.1690	1.9146
2.3120	2.7560	0.1183	1.0597
0.9600	1.4927	0.1187	1.4125
1.8160	1.1083	0.0827	1.7509
2.4560	1.0624	0.0558	0.8737
1.2360	1.0434	0.0412	1.2212

263



DESCRIPTION: MONTMORILLONITE
SAMPLE_NUM: PS-02B
COUNTRY: USA
POLITICAL_SUBDIVISION: TEXAS
GEOGRAPHICAL_REGION: GONZALES COUNTY
SITE: NULL
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: MONTMORILLONITE(A)
CHEMICAL FORMULA: $(Na,Ca)_{0.33}\ (Al,Mg)_2\ Si_4O_{10}(OH)_2 \bullet H_2O$

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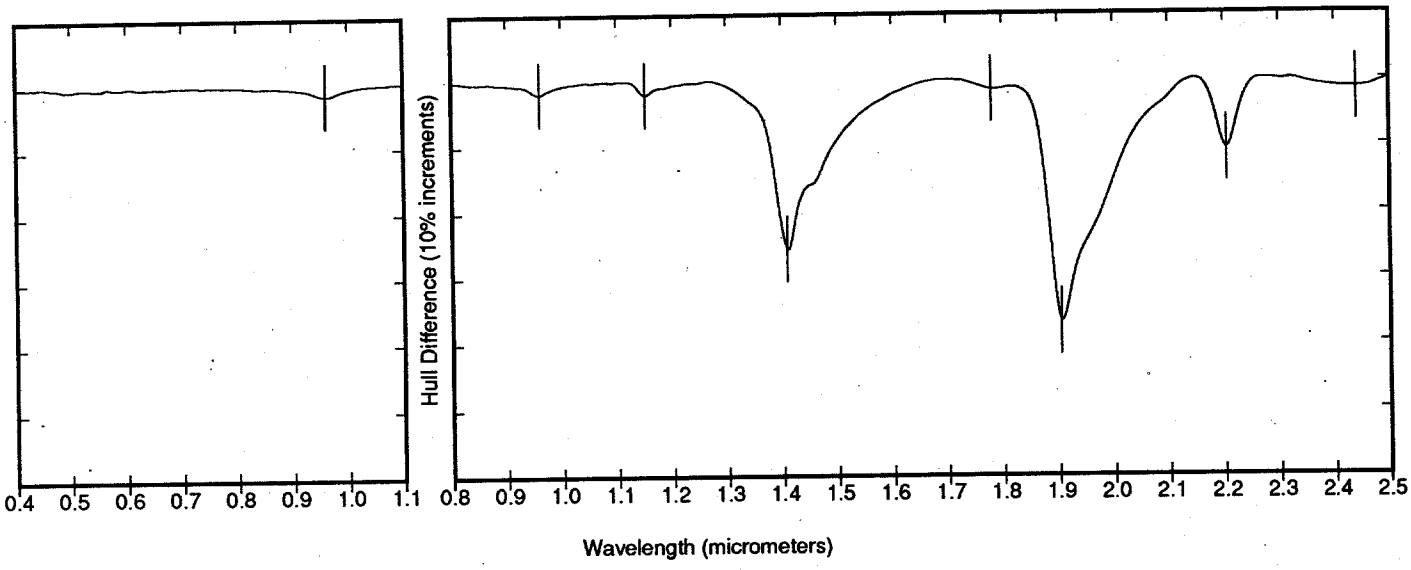
MONTMORILLONITE (PS-02B)



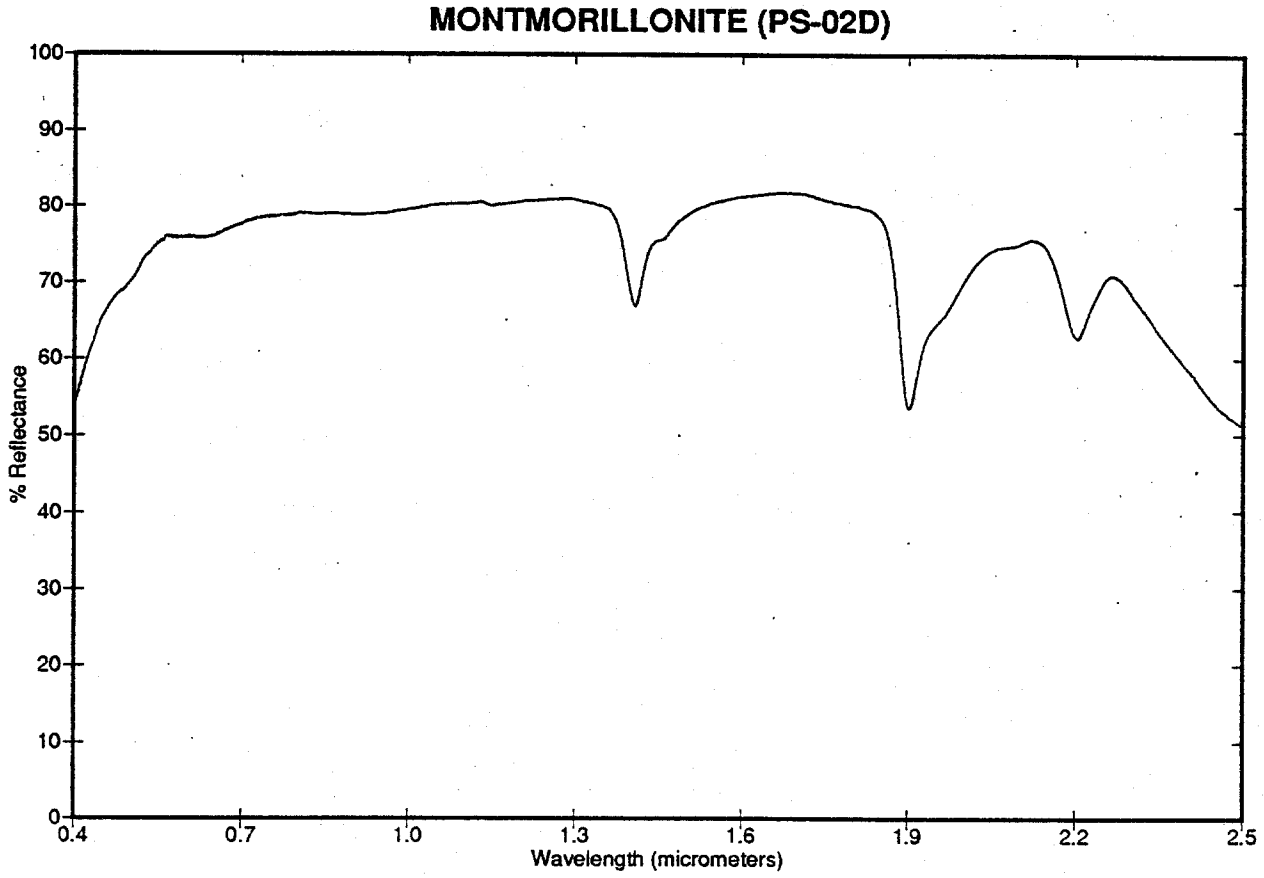
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9600	1.6637	0.1719	1.4640

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9040	36.7339	4.2339	0.3218
1.4080	25.6156	2.9012	0.4048
2.2040	10.6090	0.4722	0.8922
1.1520	2.0667	0.1011	0.4077
0.9600	1.9136	0.1380	1.0155
1.7800	1.4760	0.0849	1.1805
2.4400	1.4333	0.1673	2.0097

265



DESCRIPTION: MONTMORILLONITE
SAMPLE_NUM: PS-02D
COUNTRY: USA
POLITICAL_SUBDIVISION: WYOMING
GEOGRAPHICAL_REGION: CROOK COUNTY
SITE: NULL
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: MONTMORILLONITE(A),QUARTZ(M)
CHEMICAL FORMULA: $(Na,Ca)_{0.33}\ (Al,Mg)_2\ Si_4O_{10}(OH)_2 \bullet H_2O$

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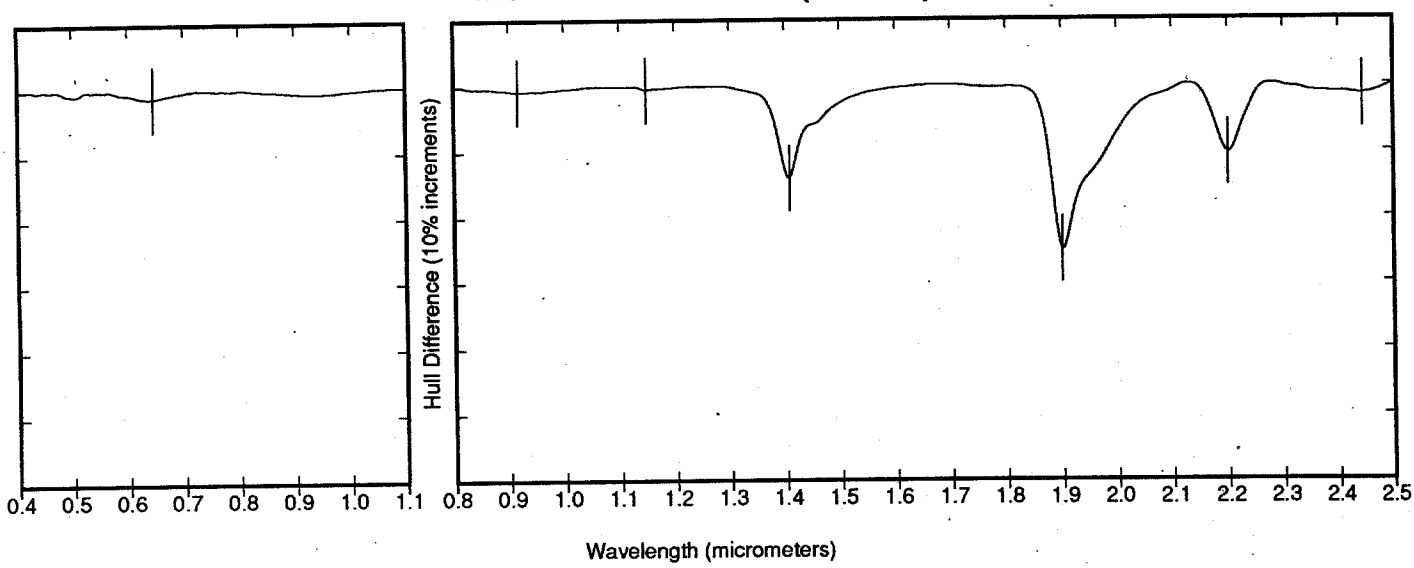
MONTMORILLONITE (PS-02D)



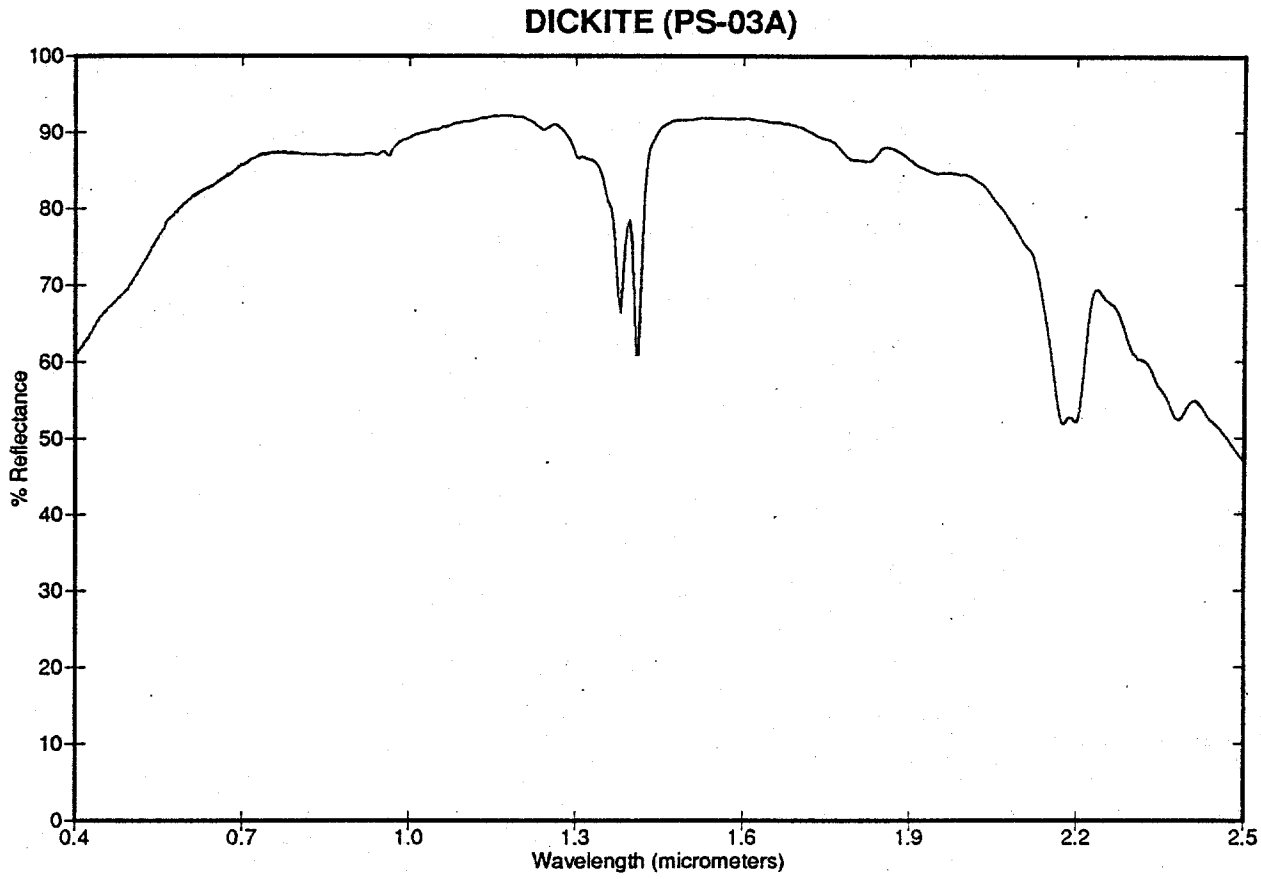
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 15.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6460	1.2456	0.1085	1.3309

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9000	25.0142	2.4049	0.3467
1.4080	14.0233	1.1405	0.5969
2.2000	10.3283	0.6003	0.8828
2.4440	1.5450	0.2084	2.8889
0.9160	0.8045	0.1269	0.6307
1.1480	0.5583	0.0099	1.3116

267



DESCRIPTION: DICKITE
SAMPLE_NUM: PS-03A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: SAN JUANITO
SITE: SAN JUANITO
COLLECTOR: WARD'S
MINERALOGY: DICKITE(A)
CHEMICAL FORMULA: $Al_2Si_2O_5(OH)_4$

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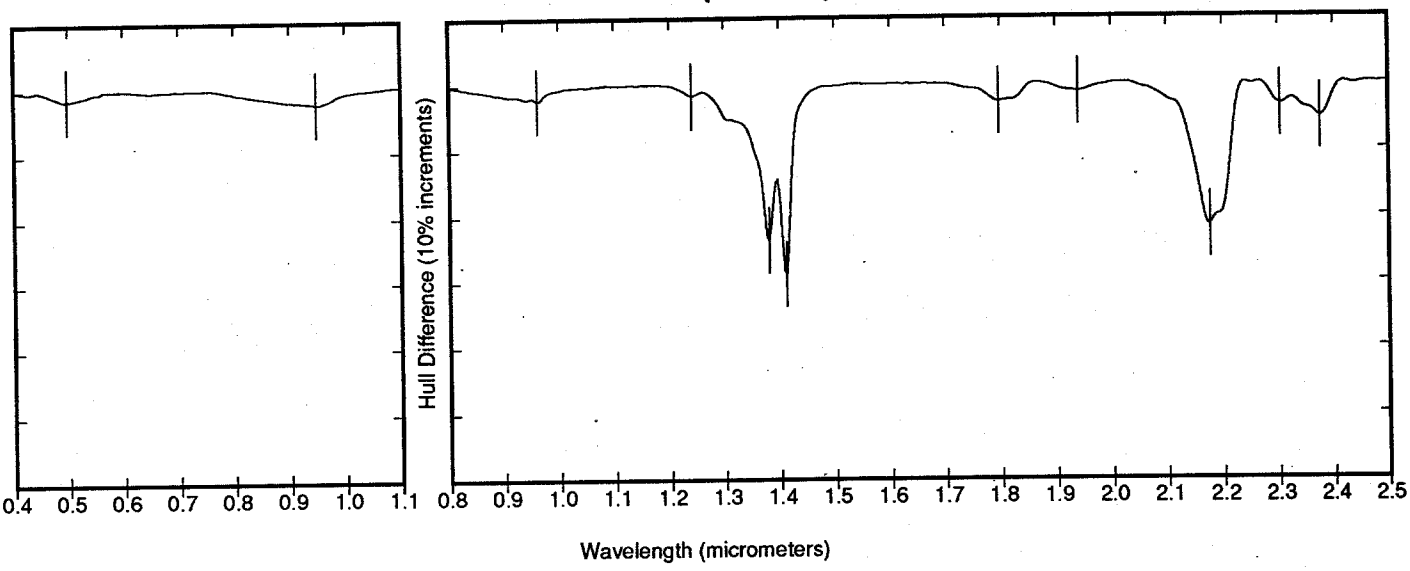
DICKITE (PS-03A)



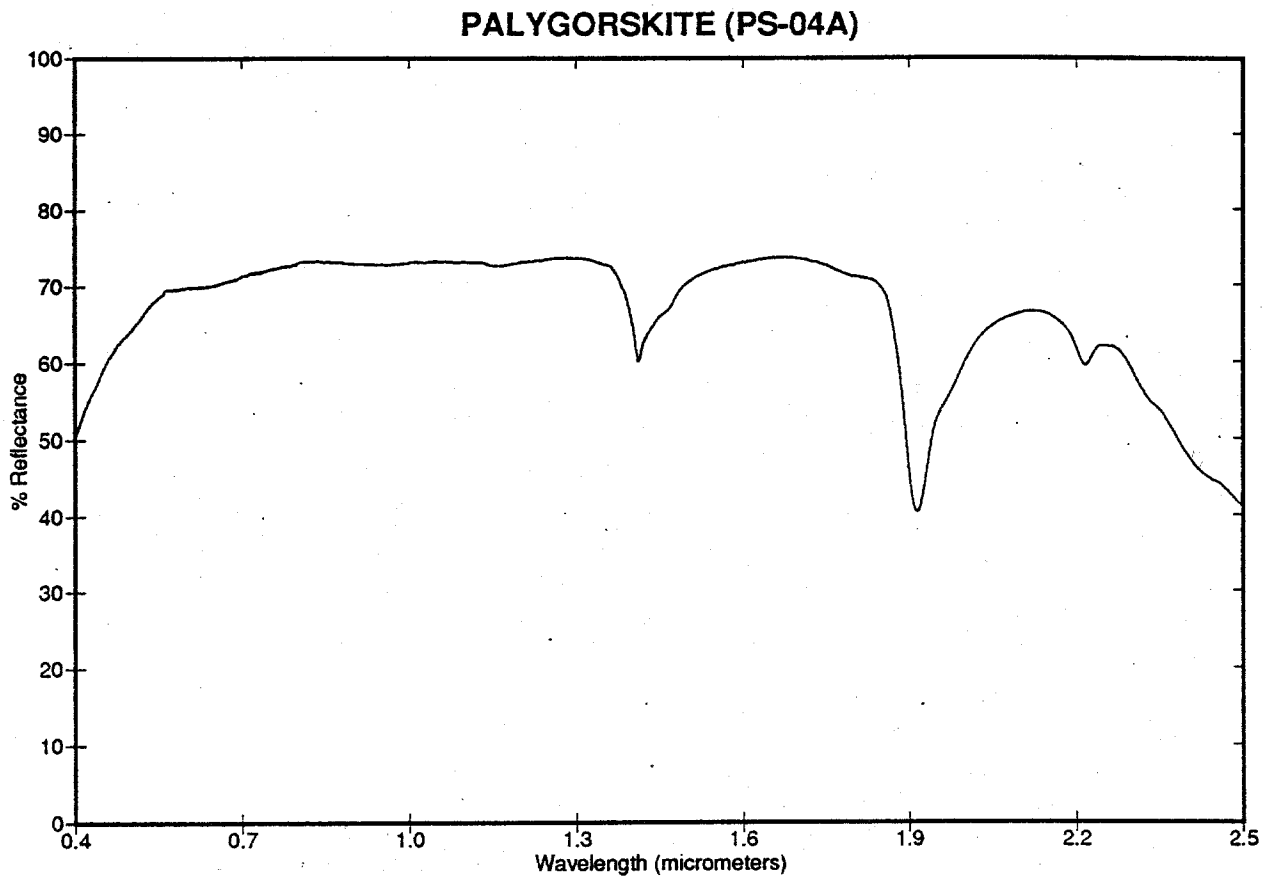
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9480	2.4135	0.3797	2.1484
0.4970	1.4711	0.0982	0.7665

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 27.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4120	28.7537	0.7651	0.8918
1.3800	23.6413	1.1547	2.9484
2.1760	21.4802	1.6142	1.0305
2.3760	5.2734	0.3167	1.9589
2.3040	3.3451	0.1125	1.2763
1.7960	2.7494	0.2176	0.8384
0.9600	2.3895	0.2931	2.1608
1.2400	1.7358	0.0578	1.3564
1.9400	1.2719	0.0889	1.2456

369



DESCRIPTION: PALYGORSKITE
SAMPLE_NUM: PS-04A
COUNTRY: USA
POLITICAL_SUBDIVISION: FLORIDA
GEOGRAPHICAL_REGION: GADSDEN COUNTY
SITE: NULL
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: PALYGORSKITE(A),QUARTZ(T)
CHEMICAL FORMULA: $(Mg,Al)_2Si_4O_{10}(OH) \bullet 4H_2O$

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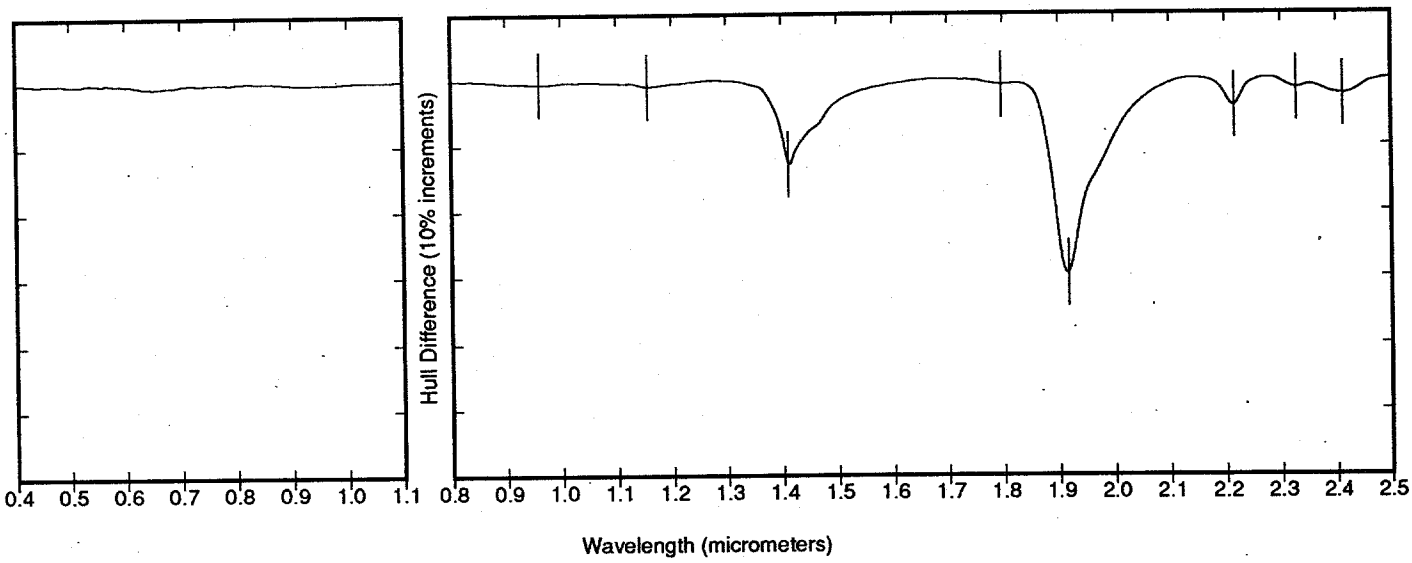
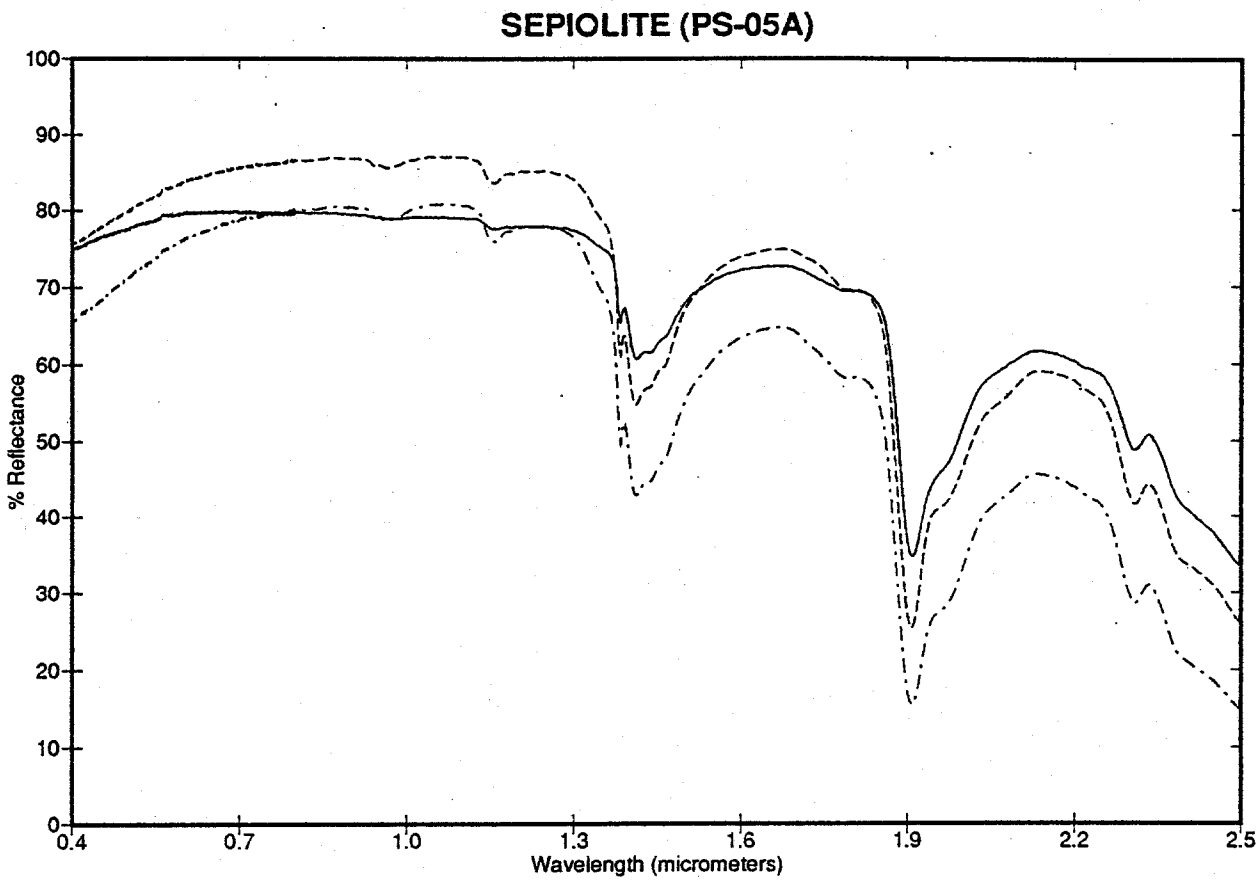
PALYGORSKITE (PS-04A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9160	29.4959	2.7809	0.5213
1.4120	12.8200	1.1695	0.3576
2.2160	4.1462	0.1671	1.2841
2.4120	2.3950	0.1976	1.1855
2.3280	1.5238	0.0645	1.0646
1.1560	0.9458	0.0782	0.4105
1.7960	0.8573	0.0468	1.5013
0.9600	0.6143	0.0688	1.9286



DESCRIPTION: SEPIOLITE
SAMPLE_NUM: PS-05A
COUNTRY: USA
POLITICAL_SUBDIVISION: NEVADA
GEOGRAPHICAL_REGION: TWO CROWS
SITE: TWO CROWS
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: SEPIOLITE(A)
CHEMICAL FORMULA: $Mg_4Si_6O_{15}(OH)_2 \bullet 6H_2O$

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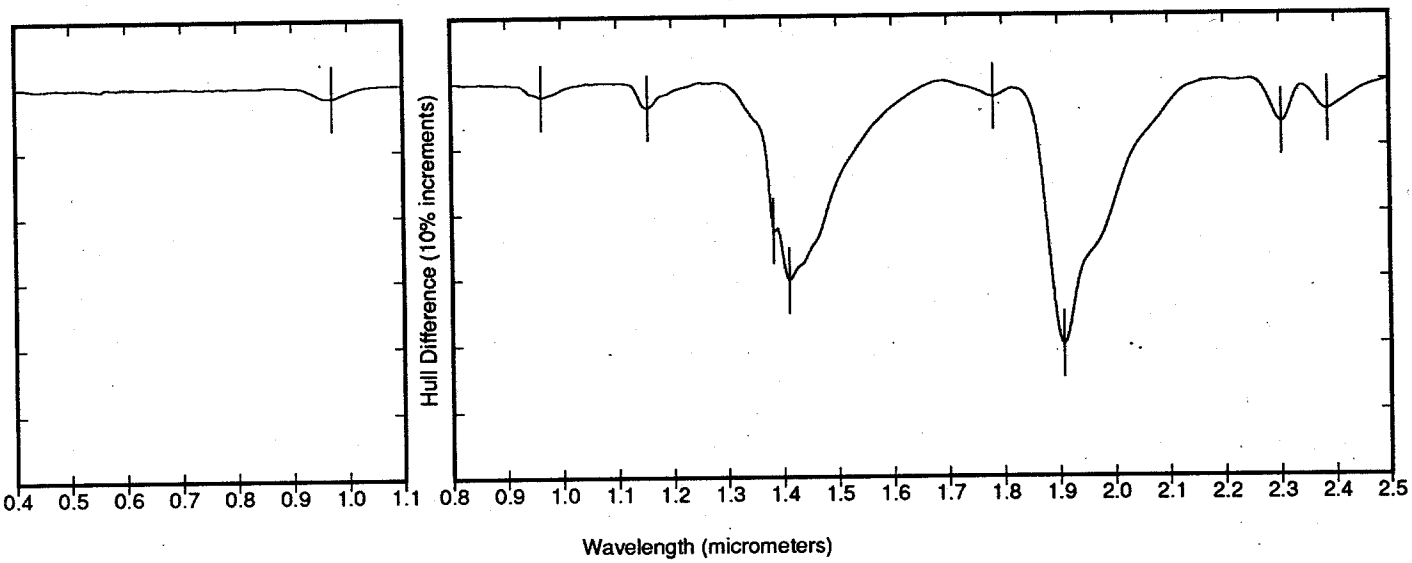
SEPIOLITE (PS-05A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9720	1.8507	0.1524	1.4748

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9080	40.0805	5.0037	0.3648
1.4120	30.2812	3.6721	0.1715
1.3840	22:6742	0.6999	2.8779
2.3040	6.5322	0.2881	1.1453
2.3880	4.6422	0.3630	0.6136
1.1560	3.7891	0.2088	0.5194
1.7840	2.4176	0.1635	1.7382
0.9640	2.1371	0.1341	0.7366

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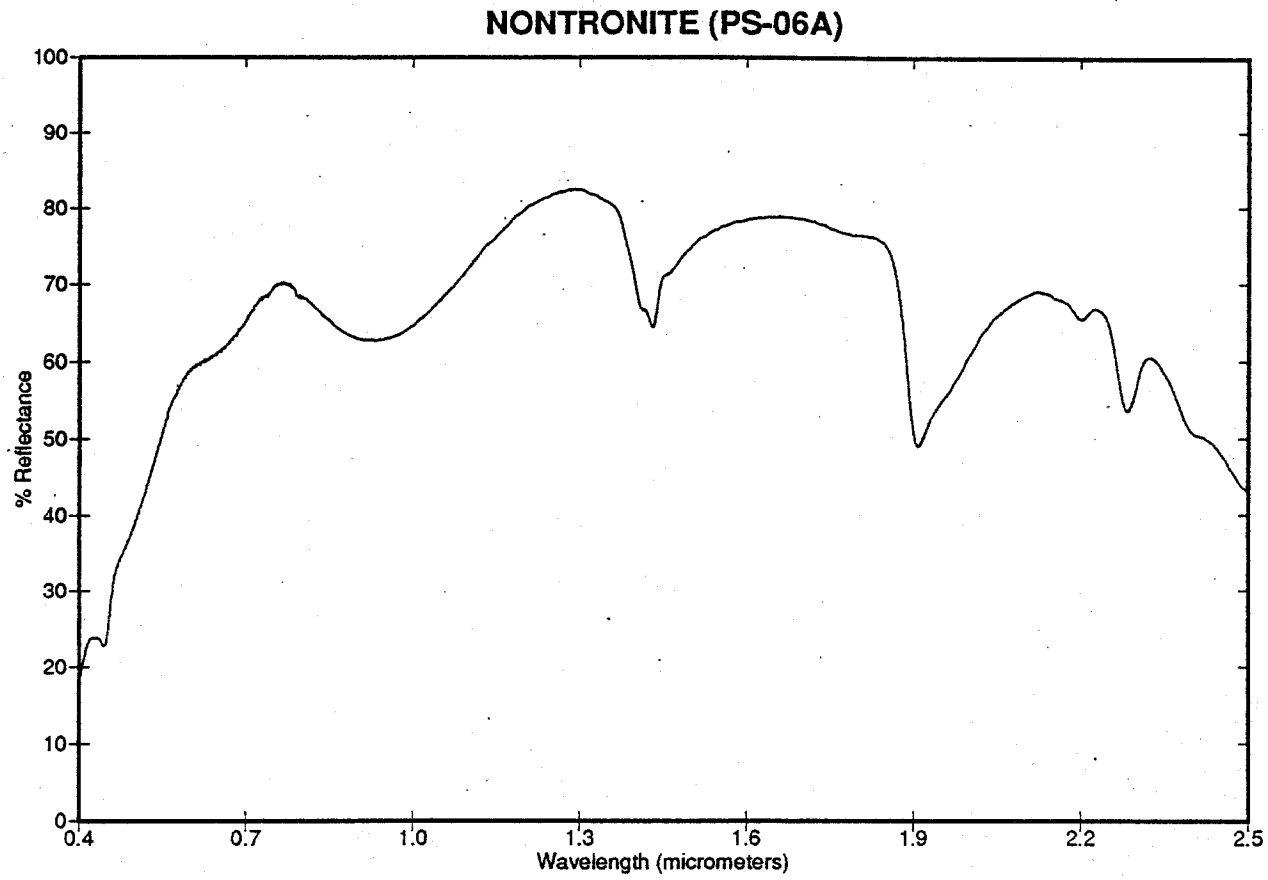

DESCRIPTION: NONTRONITE
SAMPLE_NUM: PS-06A
COUNTRY: USA
POLITICAL_SUBDIVISION: PENNSYLVANIA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: NONTRONITE(A)
CHEMICAL FORMULA: $Na_{0.33}Fe_2^{3+}(Si,Al)_4O_{10}(OH)_2 \bullet H_2O$

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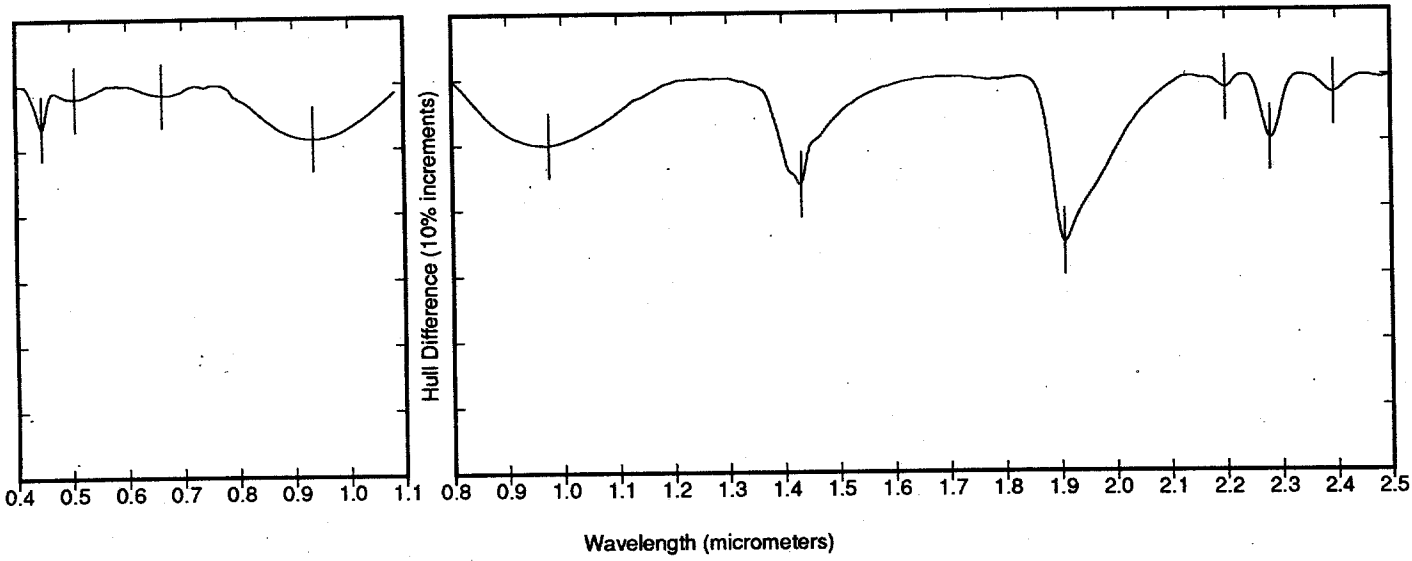
NONTRONITE (PS-06A)



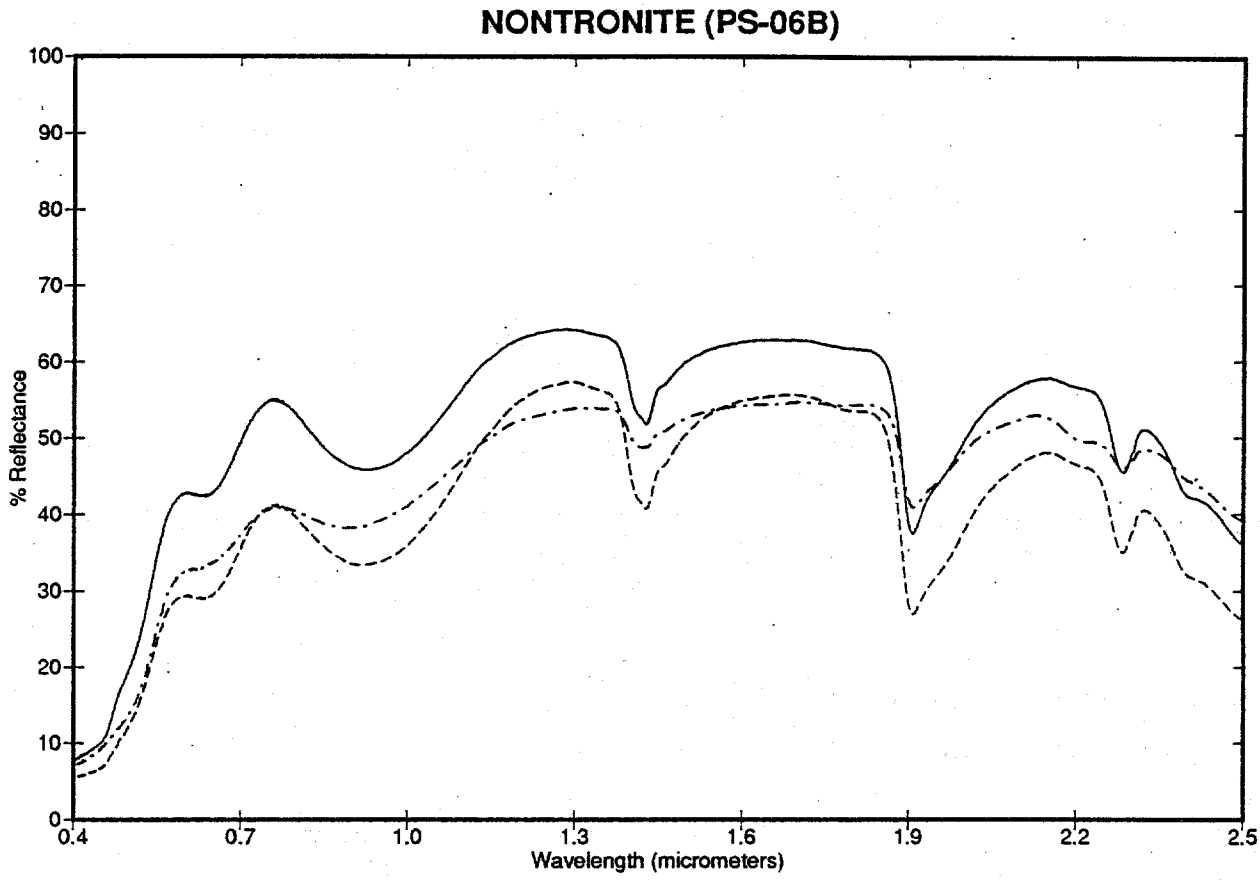
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 15.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9360	8.4625	1.7374	1.0001
0.4470	6.4932	0.1656	1.1851
0.5080	2.0010	0.1309	0.9268
0.6640	1.5816	0.1168	0.9362

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9080	25.1460	2.9134	0.2876
1.4320	16.3849	1.7004	0.7586
0.9760	10.0924	2.4403	0.9327
2.2800	9.6496	0.3892	0.7814
2.3960	2.7160	0.1306	1.0478
2.2000	1.9197	0.0707	1.7386

275



DESCRIPTION: NONTRONITE
SAMPLE_NUM: PS-06B
COUNTRY: GERMANY
POLITICAL_SUBDIVISION: WESTPHALIA
GEOGRAPHICAL_REGION: HOHEN HAGEN
SITE: HOHEN HAGEN
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: NONTRONITE(A),QUARTZ(M)
CHEMICAL FORMULA: $Na_{0.33}Fe_2^{3+}(Si,Al)_4O_{10}(OH)_2 \bullet H_2O$

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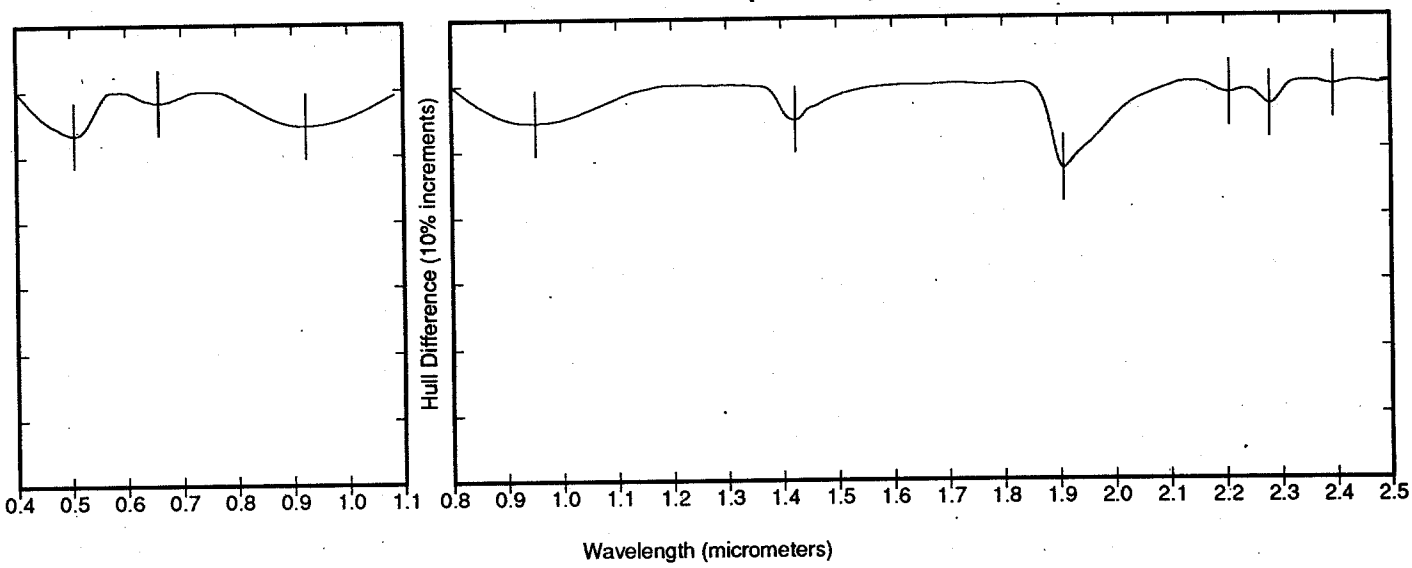
NONTRONITE (PS-06B)



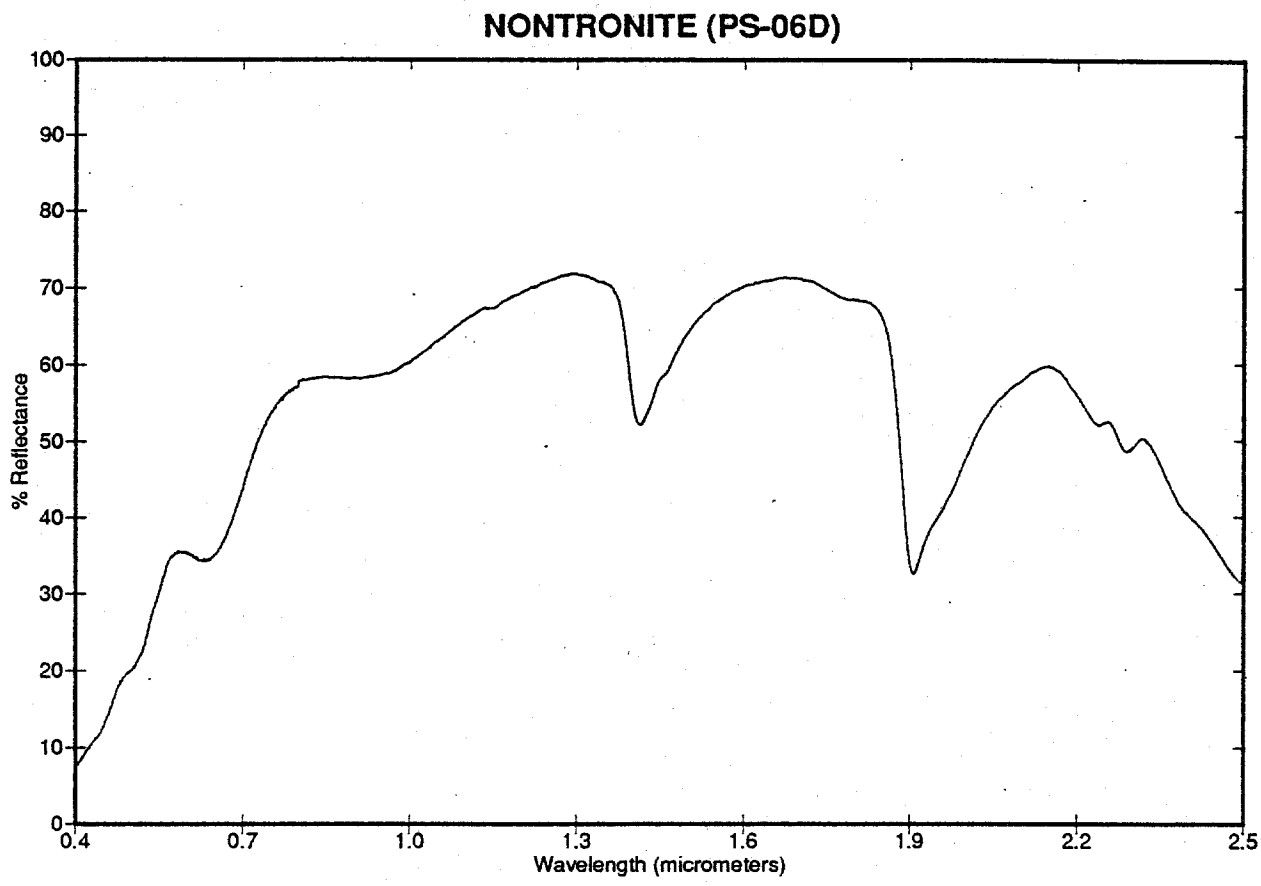
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 11.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5060	6.6150	0.6682	1.7828
0.9240	5.4336	1.1089	0.8646
0.6590	1.7613	0.1316	0.9385

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9080	12.9593	1.4369	0.2891
0.9520	5.6466	1.2763	0.8152
1.4240	5.3532	0.5234	0.5157
2.2800	3.5069	0.1732	1.0525
2.2080	1.7322	0.1008	1.1481
2.3960	0.5797	0.0205	1.1219

277



DESCRIPTION: NONTRONITE
SAMPLE_NUM: PS-06D
COUNTRY: USA
POLITICAL_SUBDIVISION: WASHINGTON
GEOGRAPHICAL_REGION: GRANT COUNTY
SITE: NULL
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: NONTRONITE(A),QUARTZ(M)
CHEMICAL FORMULA: $Na_{0.33}Fe_2^{3+}(Si,Al)_4O_{10}(OH)_2 \bullet H_2O$

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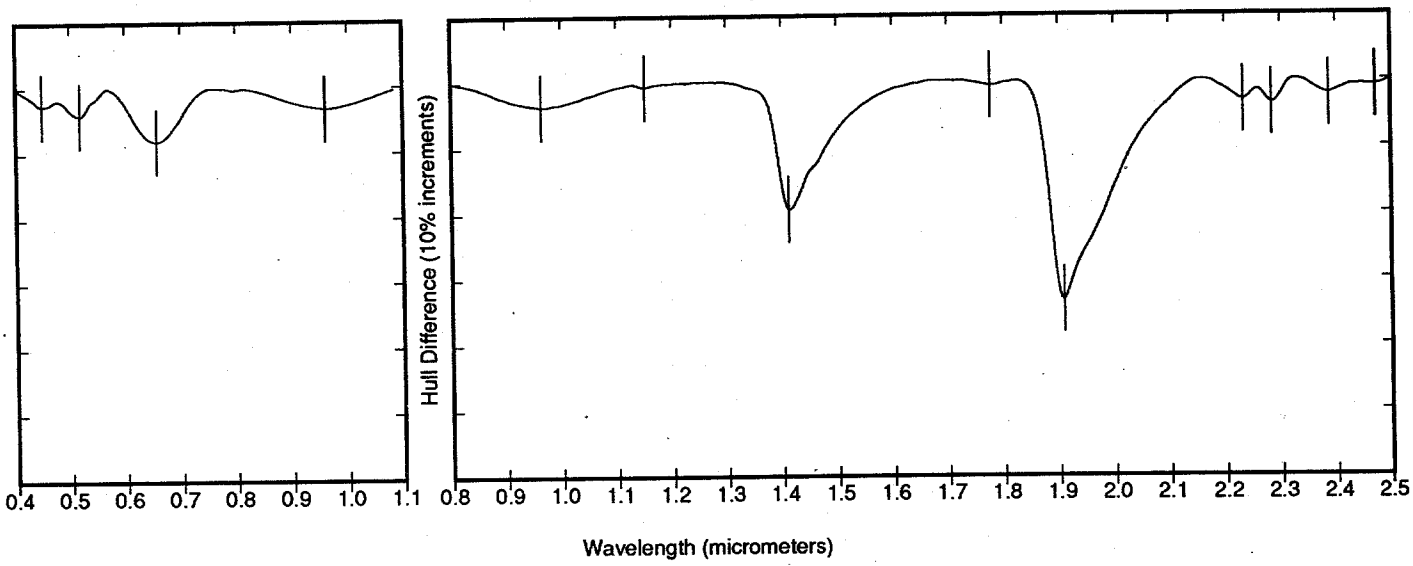
NONTRONITE (PS-06D)



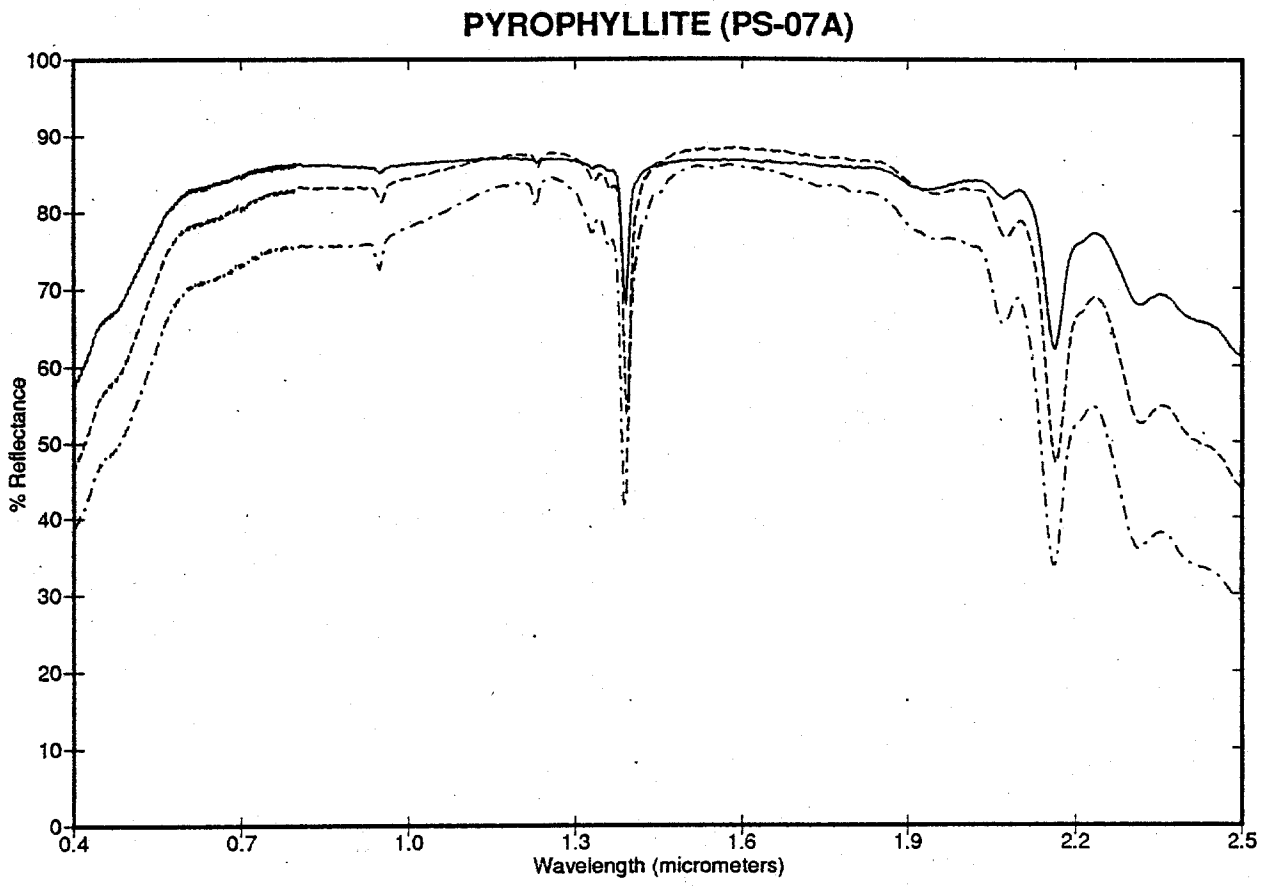
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6560	8.1234	0.7587	0.9631
0.5170	4.1422	0.2239	1.2186
0.9600	3.1807	0.5198	1.0358
0.4480	2.7053	0.1325	0.9395

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9080	33.1954	4.1250	0.3018
1.4120	19.4012	2.1070	0.3288
0.9640	3.7375	0.6665	0.9103
2.2840	3.5342	0.1320	0.8669
2.2320	3.0281	0.1579	1.4641
2.3880	2.1233	0.1388	0.8141
2.4720	0.9000	0.0366	1.3271
1.1520	0.7600	0.0337	0.5947
1.7760	0.6840	0.0374	0.9192

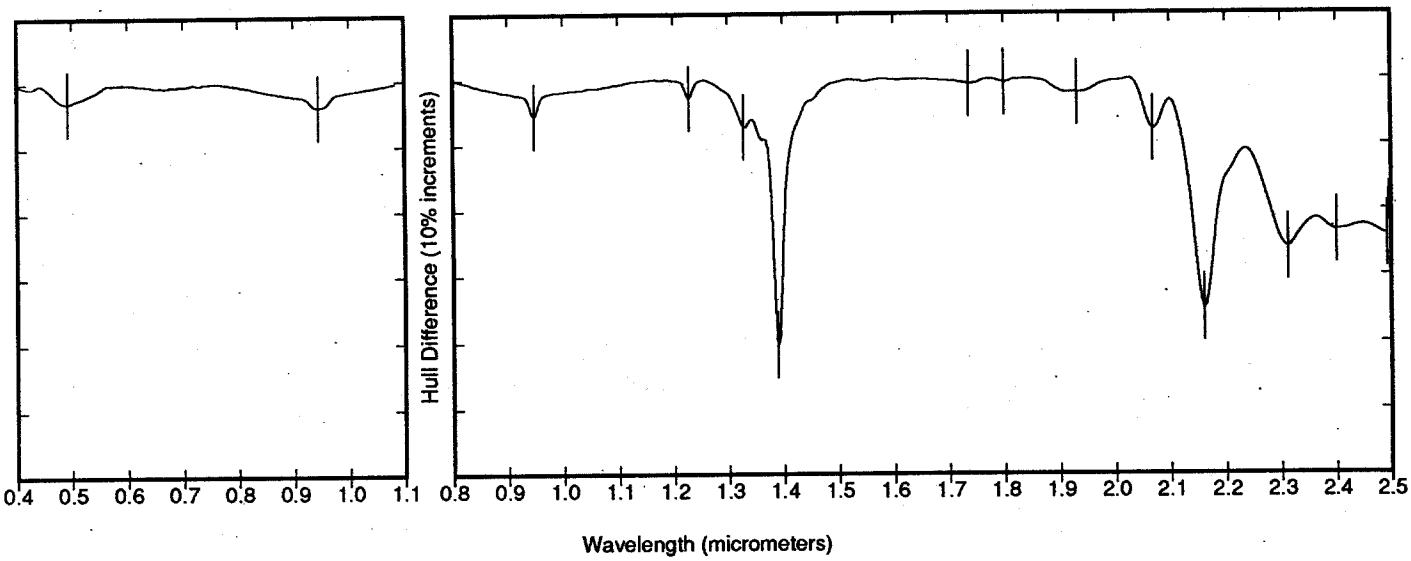
279



DESCRIPTION: PYROPHYLLITE
SAMPLE_NUM: PS-07A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: PYROPHYLLITE(A),KAOLINITE(M)
CHEMICAL FORMULA: $Al_2Si_4O_{10}(OH)_2$

280

PYROPHYLLITE (PS-07A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9440	3.7667	0.4756	1.2287
0.4930	2.9452	0.2052	0.7042

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 18.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3880	40.2789	1.5454	0.7136
2.1600	34.8134	2.4255	0.6816
2.3120	25.7376	2.5943	1.1427
2.4920	23.8282	1.2753	15.0652
2.4000	23.2398	1.7256	0.8784
2.0680	7.6817	0.3191	0.7843
1.3280	7.3190	0.2544	2.0731
0.9480	5.5266	0.5298	0.8555
1.2280	2.8680	0.0530	0.9823
1.9320	2.1770	0.1968	1.1420
1.7360	0.7756	0.0537	1.9322
1.8000	0.5478	0.0138	0.9141

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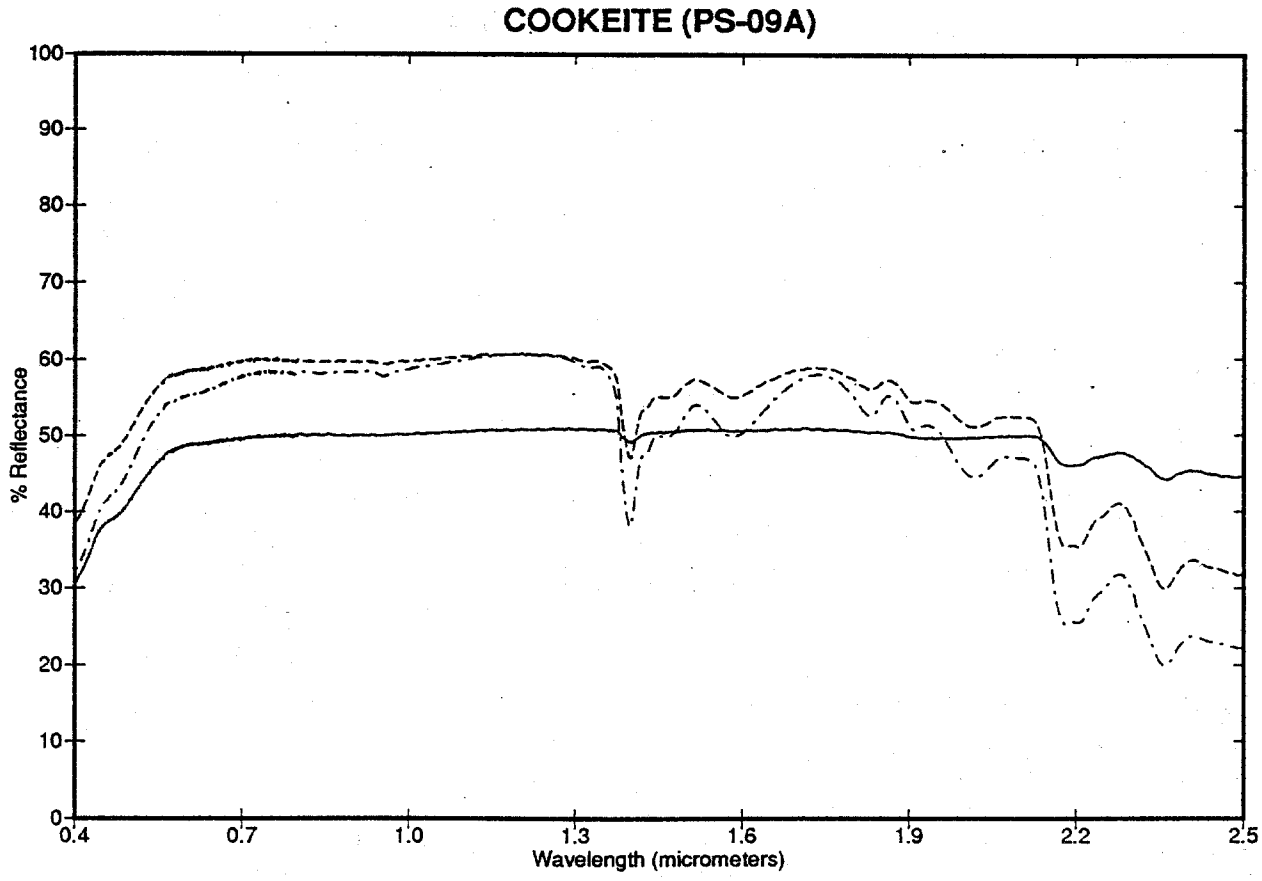
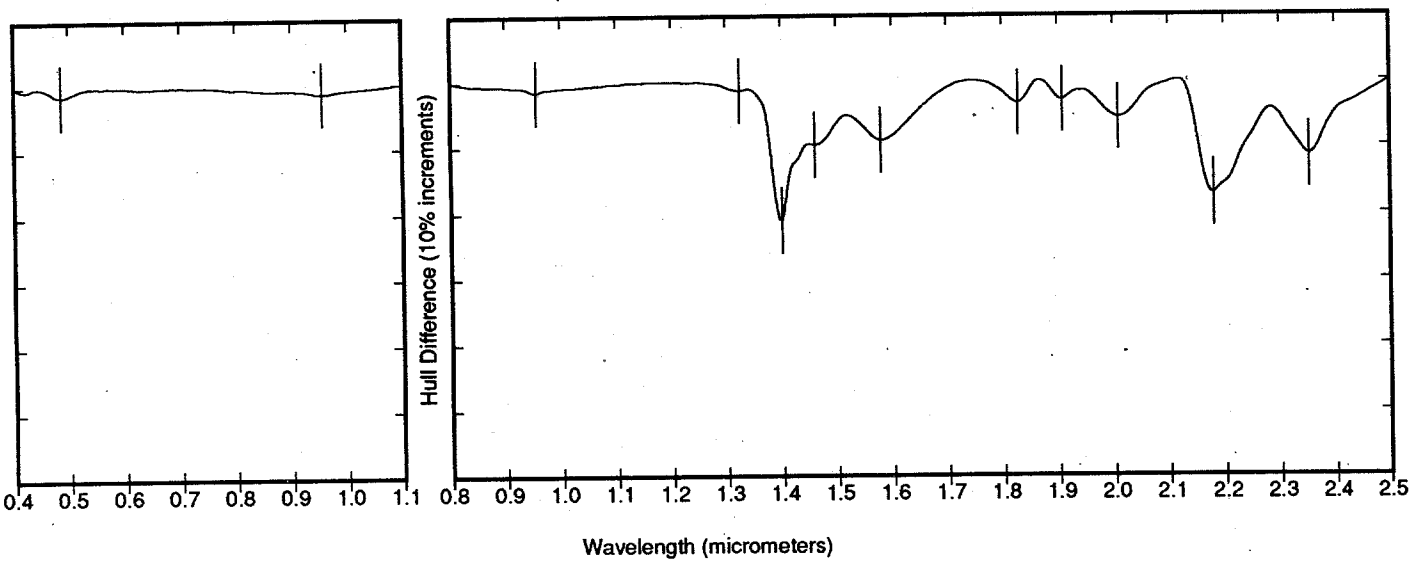


DESCRIPTION: COOKEITE
SAMPLE_NUM: PS-09A
COUNTRY: USA
POLITICAL_SUBDIVISION: ARKANSAS
GEOGRAPHICAL_REGION: PULASKI COUNTY
SITE: NULL
COLLECTOR: JPL
MINERALOGY: COOKEITE(A),QUARTZ(M),FELDSPAR(M)
CHEMICAL FORMULA: $LiAl_4(Si_3Al)O_{10}(OH)_8$

282

COOKEITE (PS-09A)



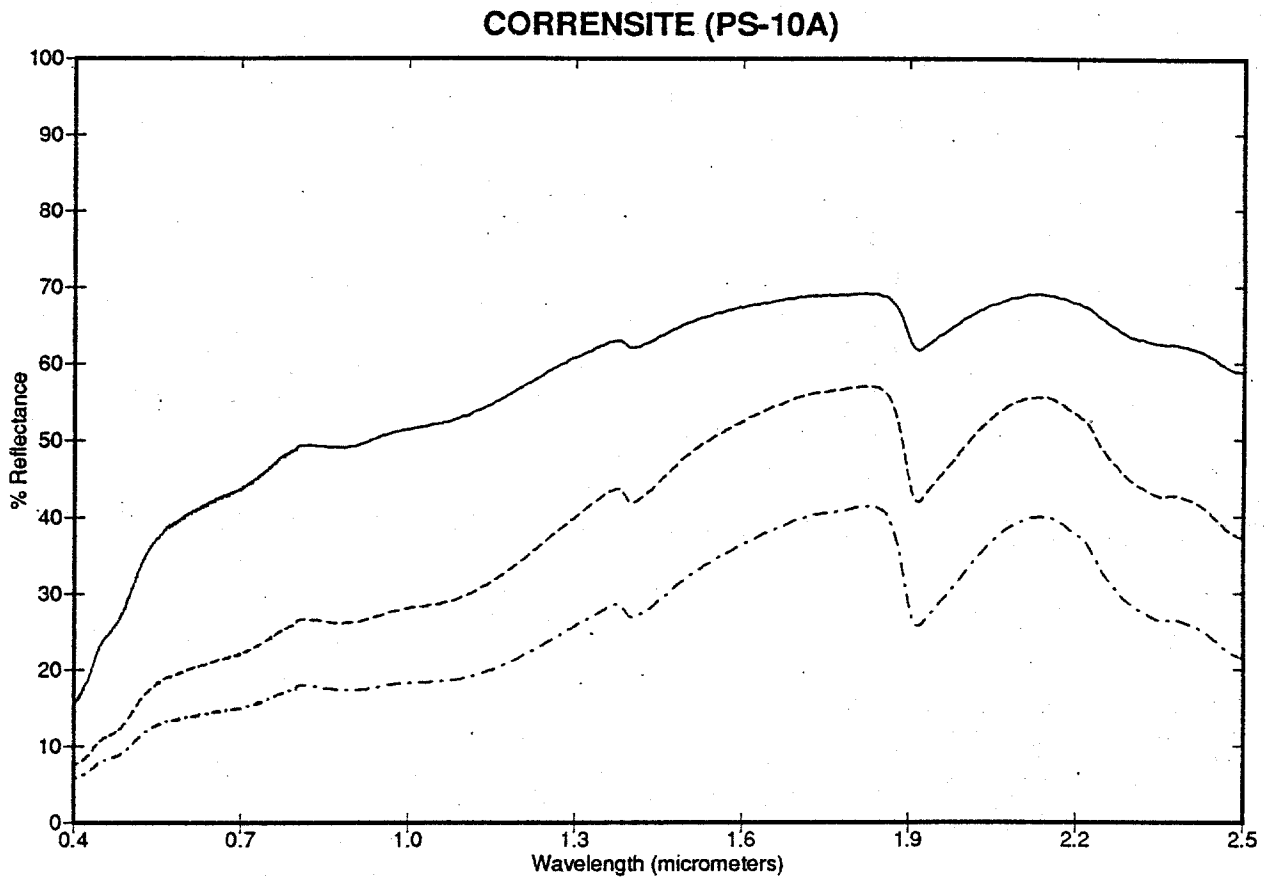
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4860	1.3771	0.0633	0.7977
0.9560	1.2709	0.1974	1.4509

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 8.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4000	21.0745	1.1669	0.7127
2.1800	17.1354	1.6457	0.4472
2.3520	11.4358	1.1922	0.8032
1.4600	9.7152	0.5321	0.1703
1.5800	9.0766	1.0737	0.6671
2.0080	5.6429	0.4950	0.9484
1.8280	3.4101	0.1701	1.6130
1.9080	2.9658	0.1199	0.9458
0.9560	1.5501	0.2160	0.8459
1.3240	1.3681	0.0644	2.2690

283



DESCRIPTION: CORRENSITE
SAMPLE_NUM: PS-10A
COUNTRY: USA
POLITICAL_SUBDIVISION: WASHINGTON
GEOGRAPHICAL_REGION: PACKWOOD
SITE: PACKWOOD
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: QUARTZ(A),FELDSPAR(A),CORRENSITE(M)
CHEMICAL FORMULA: $(Mg,Fe)_9\ (Si,Al)_8\ O_{20}(OH)_{10} \bullet \chi H_2O$

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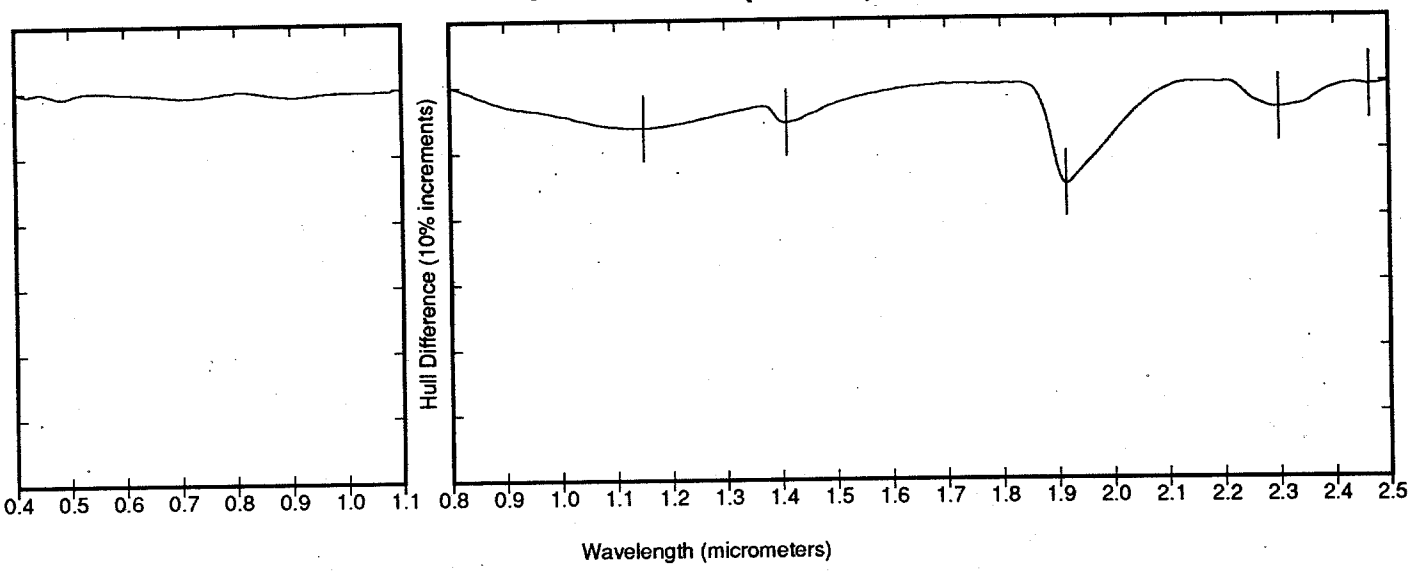
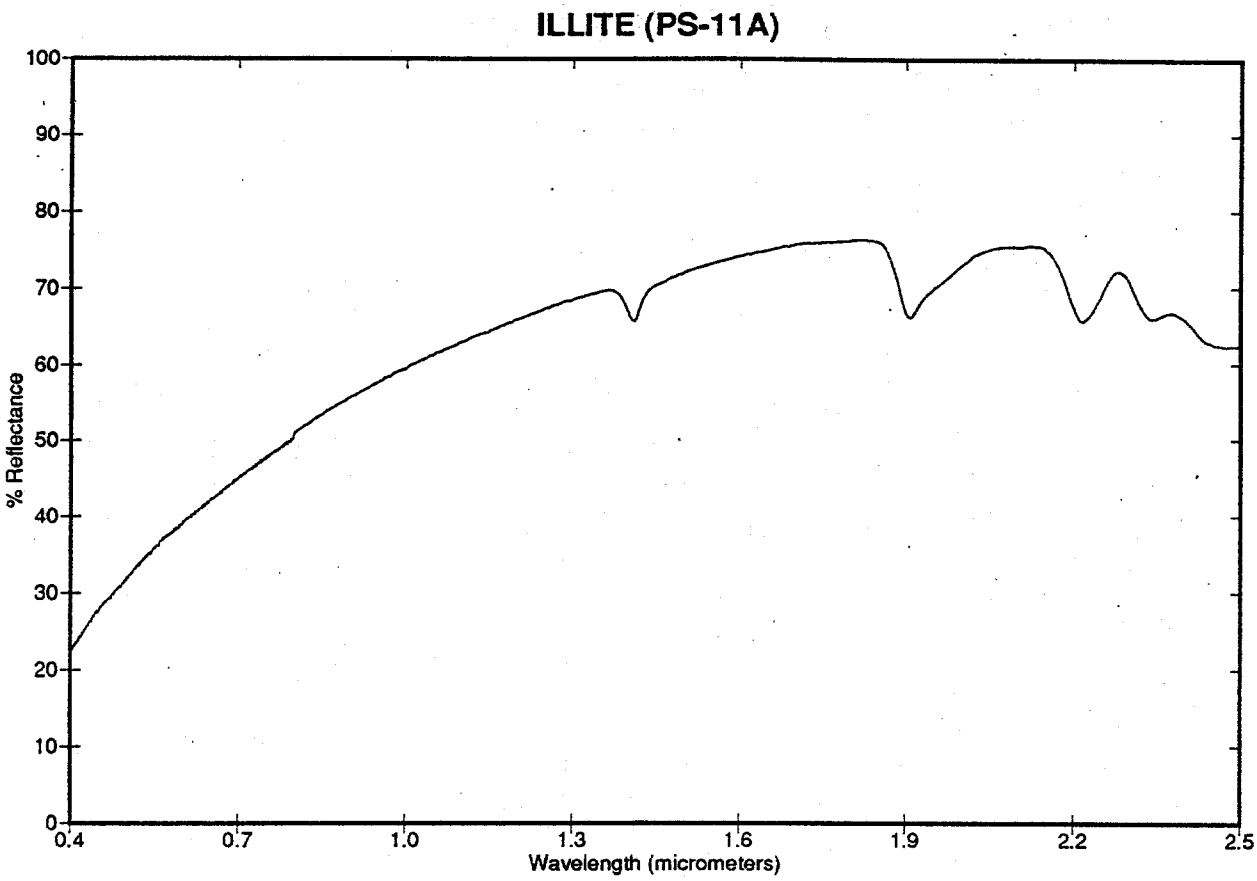
CORRENSITE (PS-10A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 8.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9160	15.2170	1.8494	0.3299
1.1520	6.3588	2.4528	1.2904
1.4120	5.6347	0.7799	0.3067
2.3000	3.8951	0.5112	0.7207
2.4640	0.5561	0.0248	0.7743



DESCRIPTION: ILLITE
SAMPLE_NUM: PS-11A
COUNTRY: USA
POLITICAL_SUBDIVISION: WISCONSIN
GEOGRAPHICAL_REGION: MARBLEHEAD
SITE: MARBLEHEAD
COLLECTOR: JPL
MINERALOGY: ILLITE(A)
CHEMICAL FORMULA: $(K,H_3O)\ (Al,Mg,Fe)_2\ (Si,Al)_4O_{10}\ ((OH)_2,H_2O)$

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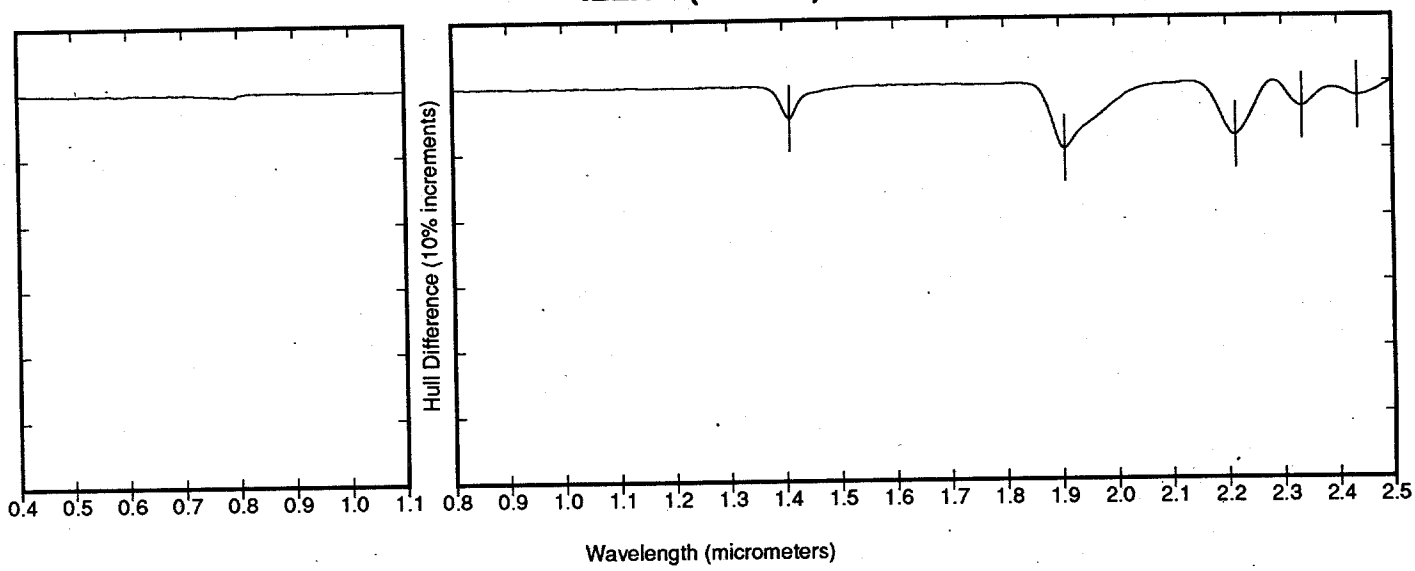
ILLITE (PS-11A)

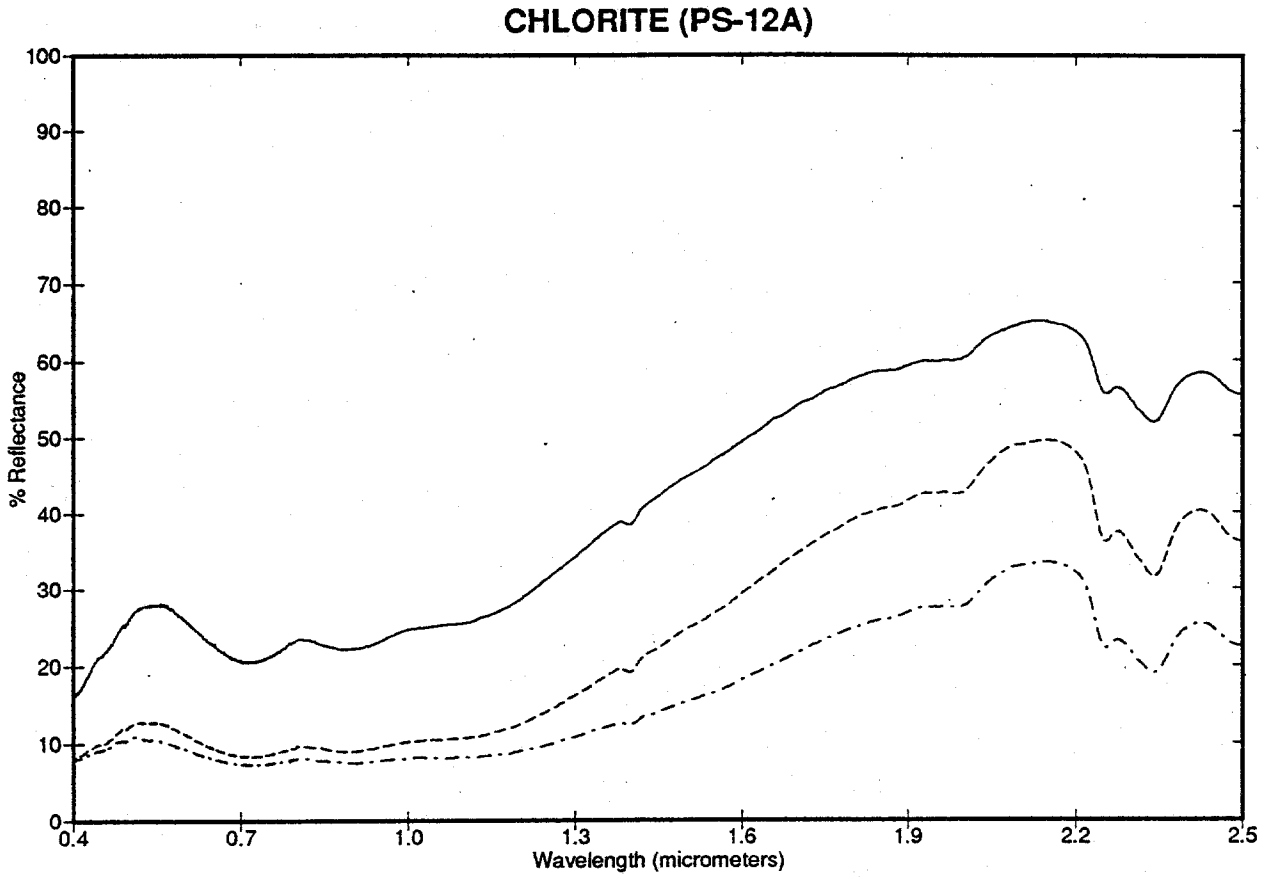


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9080	9.8745	0.9206	0.3944
2.2160	8.0295	0.5182	0.9993
1.4120	4.9072	0.2444	0.6934
2.3360	3.7610	0.2220	0.7661
2.4360	2.2587	0.1525	0.7689

287



DESCRIPTION: CHLORITE
SAMPLE_NUM: PS-12A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: EL DORADO COUNTY
SITE: FLAGSTAFF HILL
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: CHLORITE(A)
CHEMICAL FORMULA: $(Mg_{2.77}Fe_{1.92}Mn_{0.01}Cr_{0.01}Al_{1.28})\ (Si_{2.73}Al_{1.27})\ O_{10}(OH)_8$*

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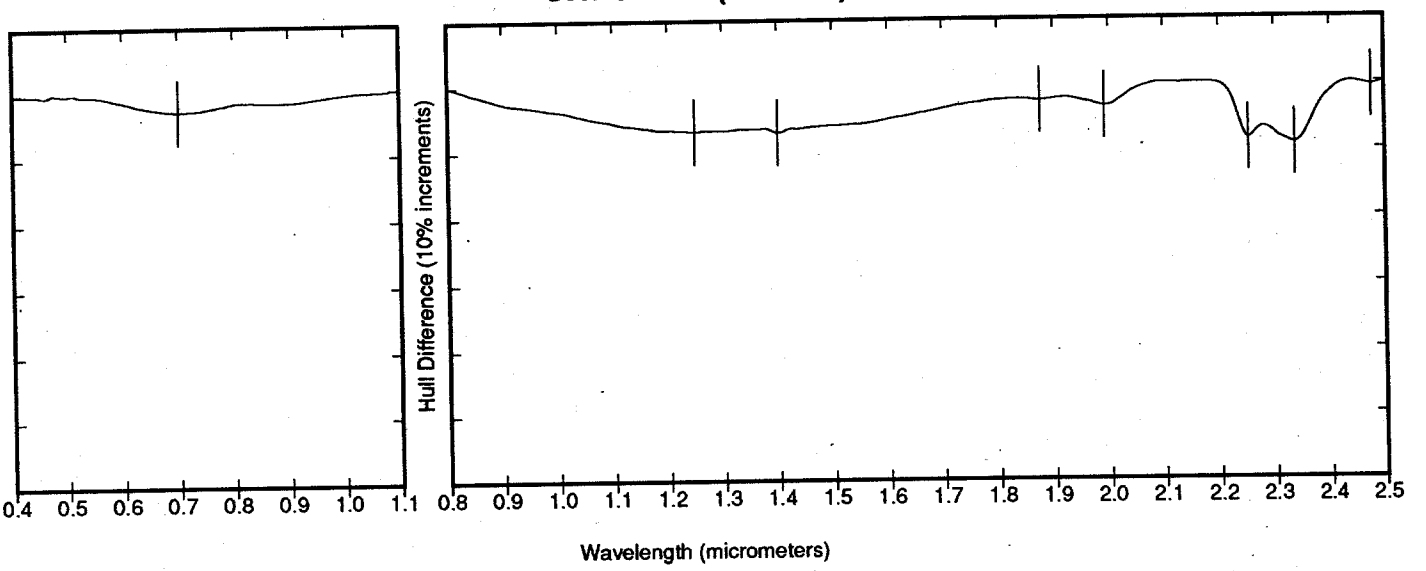
CHLORITE (PS-12A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 14.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7000	2.7736	0.8046	0.5056

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3360	9.1531	0.8281	1.1947
2.2520	8.4104	0.4088	0.9316
1.4000	7.1293	2.6426	0.2536
1.2480	6.8985	2.3540	3.7956
1.9920	3.4424	0.3742	1.4654
1.8760	2.5384	0.1270	0.6441
2.4760	0.5616	0.0179	1.2384

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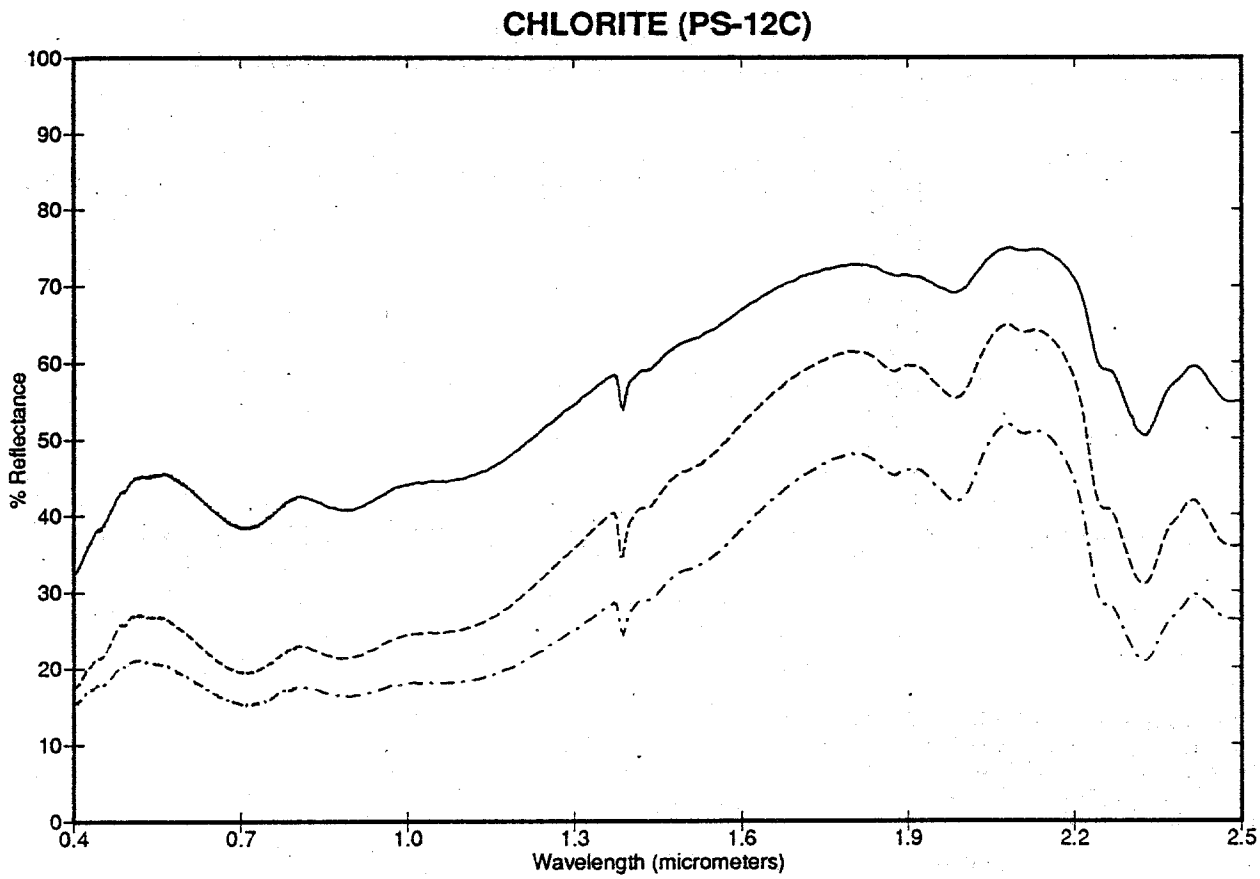
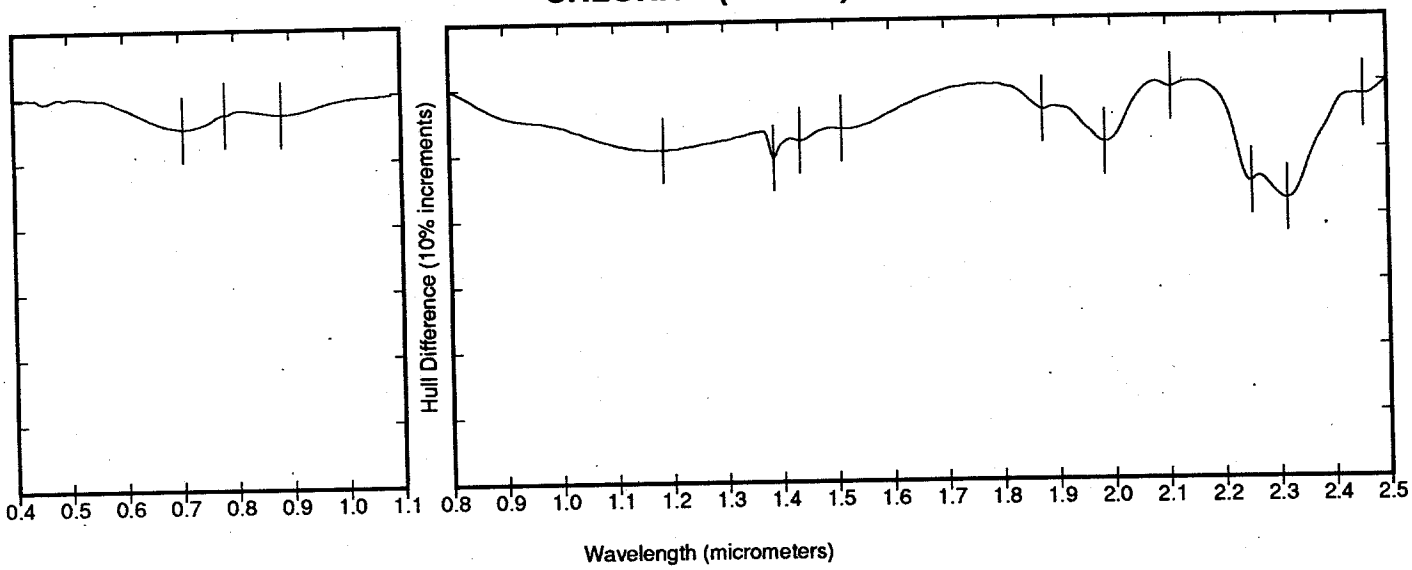


DESCRIPTION: CHLORITE
SAMPLE_NUM: PS-12C
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: CHLORITE(A)
CHEMICAL FORMULA: $(Mg_{4.31}Fe_{0.51}Mn_{0.01}Cr_{0.02}Al_{1.09})\ (Si_{3.01}Al_{0.99})\ O_{10}(OH)_8$ *

290

CHLORITE (PS-12C)



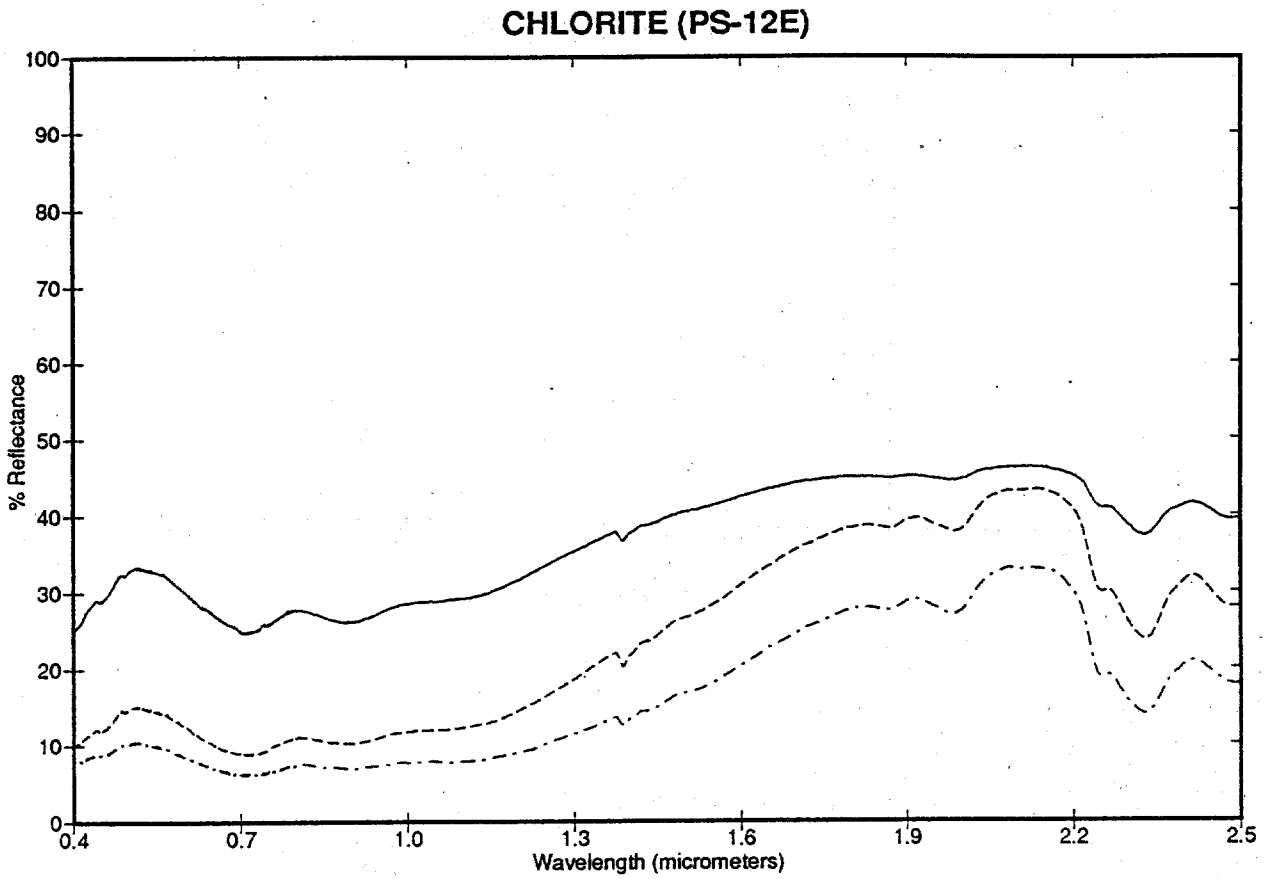
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 15.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7060	4.9080	0.7322	1.4006
0.8840	2.9194	0.4841	0.7964
0.7820	2.8205	0.0500	0.1261

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY.
2.3160	17.8113	1.9491	0.7581
2.2520	15.1428	0.7111	3.0069
1.3880	10.7747	0.4486	0.5866
1.1880	9.4012	3.7178	1.5177
1.9880	8.9321	0.9173	1.3813
1.4360	8.1649	0.5794	0.2841
1.5120	6.4499	0.8250	0.1028
1.8760	3.9553	0.2060	1.7529
2.4560	2.1770	0.0855	0.4265
2.1080	0.7917	0.0223	1.1289

291



DESCRIPTION: CHLORITE
SAMPLE_NUM: PS-12E
COUNTRY: USA
POLITICAL_SUBDIVISION: VERMONT
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: CHLORITE(A)
CHEMICAL FORMULA: $(Mg_{4.15}Fe_{0.67}Mn_{0.01}Ti_{0.01}Al_{1.15})\ (Si_{2.86}Al_{1.14})\ O_{10}(OH)_8$*

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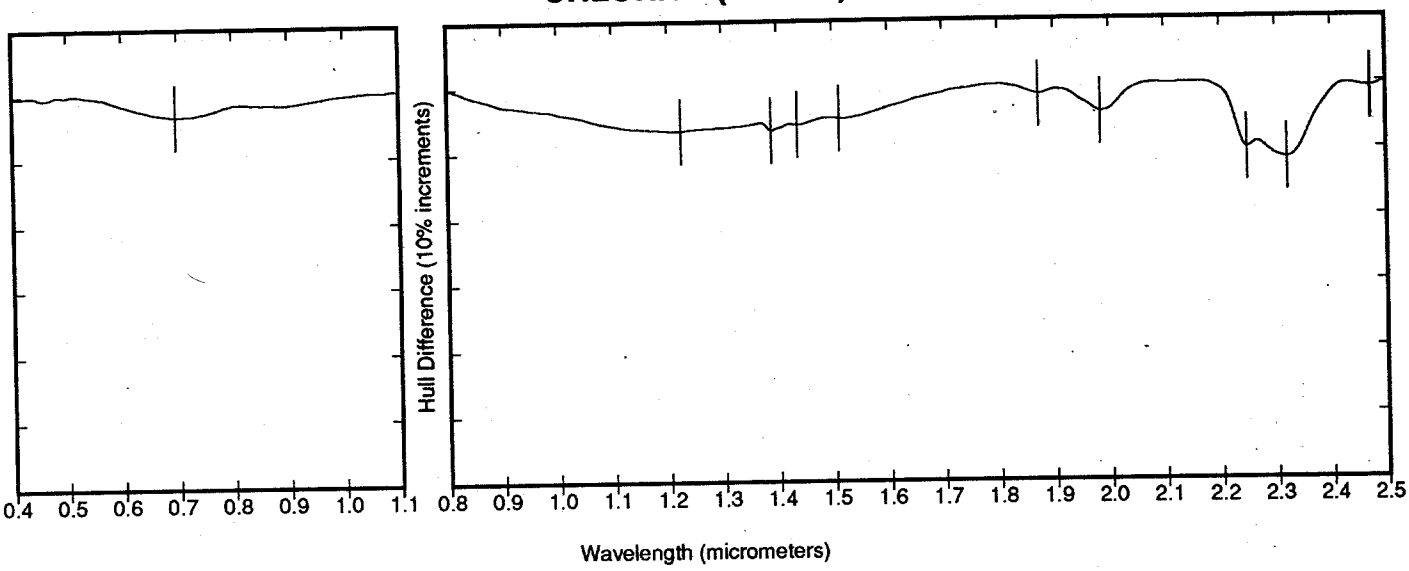
CHLORITE (PS-12E)



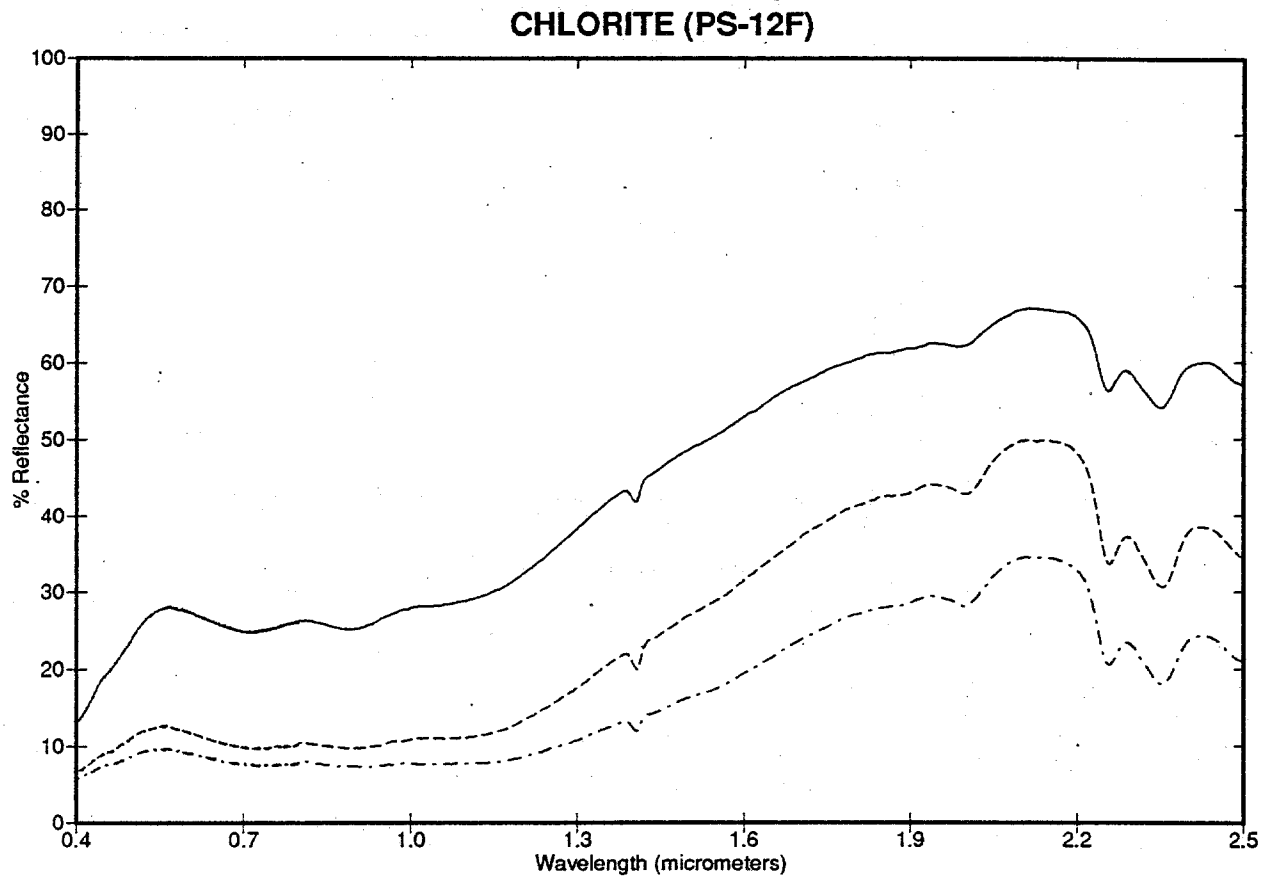
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6970	3.3897	0.9105	0.5198

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3200	11.5171	1.1392	0.9294
2.2480	9.9733	0.4516	1.3704
1.2240	6.7454	2.6736	1.9180
1.3880	6.7453	0.3218	0.4363
1.4360	5.8682	0.4070	0.2069
1.5120	4.9594	0.7122	0.0901
1.9840	4.2660	0.3616	1.0618
1.8720	1.5413	0.0881	1.2134
2.4720	0.8533	0.0406	1.8285

293



DESCRIPTION: CHLORITE
SAMPLE_NUM: PS-12F
COUNTRY: USA
POLITICAL_SUBDIVISION: NEW MEXICO
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: CHLORITE(A)
CHEMICAL FORMULA: $(Mg_{1.11}Fe_{3.22}Mn_{0.08}Ti_{0.01}Al_{1.49})\ (Si_{2.68}Al_{1.32})\ O_{10}(OH)_8$ *

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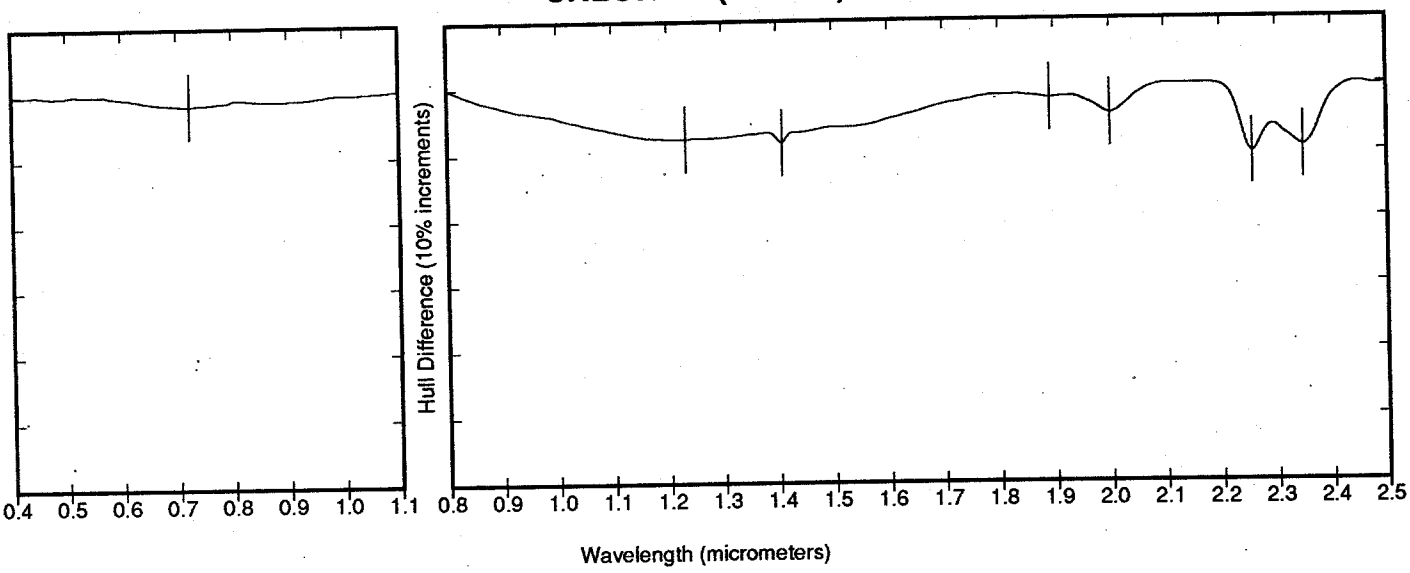
CHLORITE (PS-12F)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 24.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7230	1.6321	0.4772	0.5446

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.2560	10.2671	0.5759	0.8061
2.3480	9.3486	0.7627	1.1675
1.4080	8.3554	2.0179	0.1318
1.2320	7.7033	3.0974	1.9228
2.0000	4.3070	0.4114	1.2939
1.8920	1.9412	0.1775	3.7318

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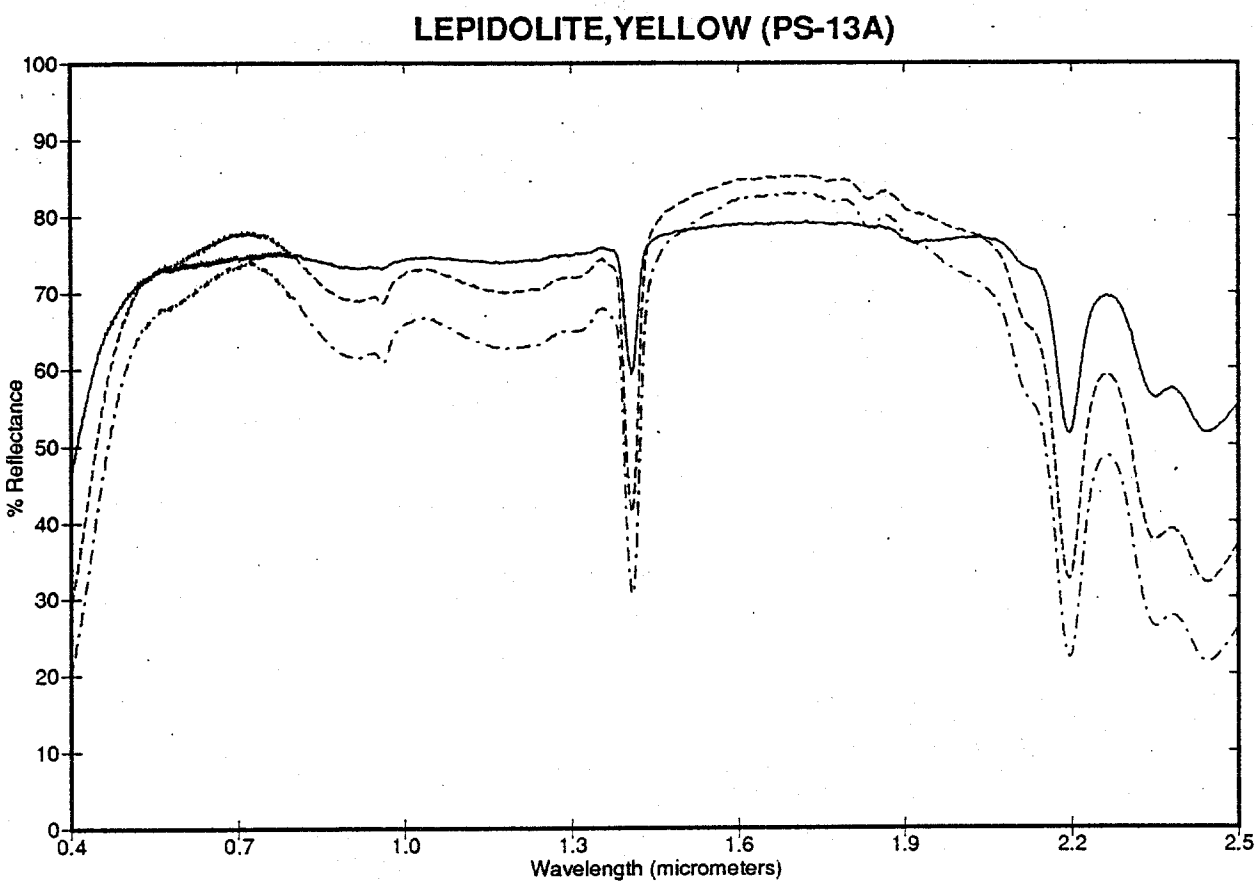

DESCRIPTION: LEPIDOLITE,YELLOW
SAMPLE_NUM: PS-13A
COUNTRY: USA
POLITICAL_SUBDIVISION: SOUTH DAKOTA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: LEPIDOLITE(A),FELDSPAR(M)
CHEMICAL FORMULA: $K(Li,Al)_3\ (Si,Al)_4O_{10}\ (F,OH)_2$

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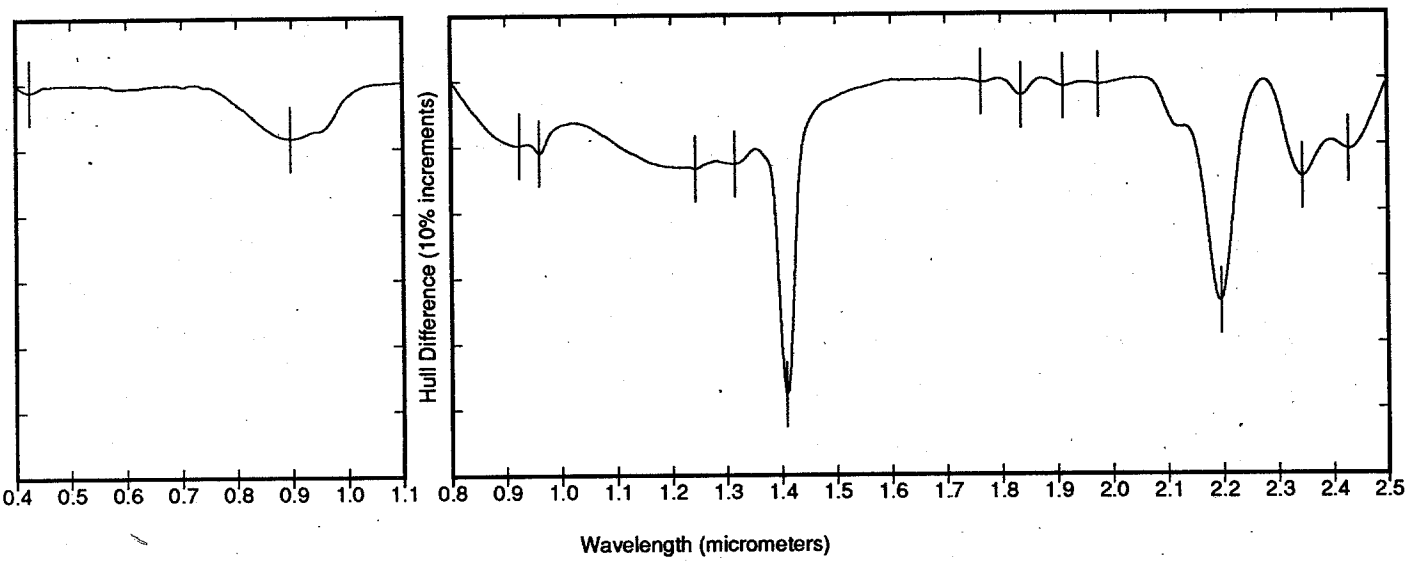
LEPIDOLITE,YELLOW (PS-13A)

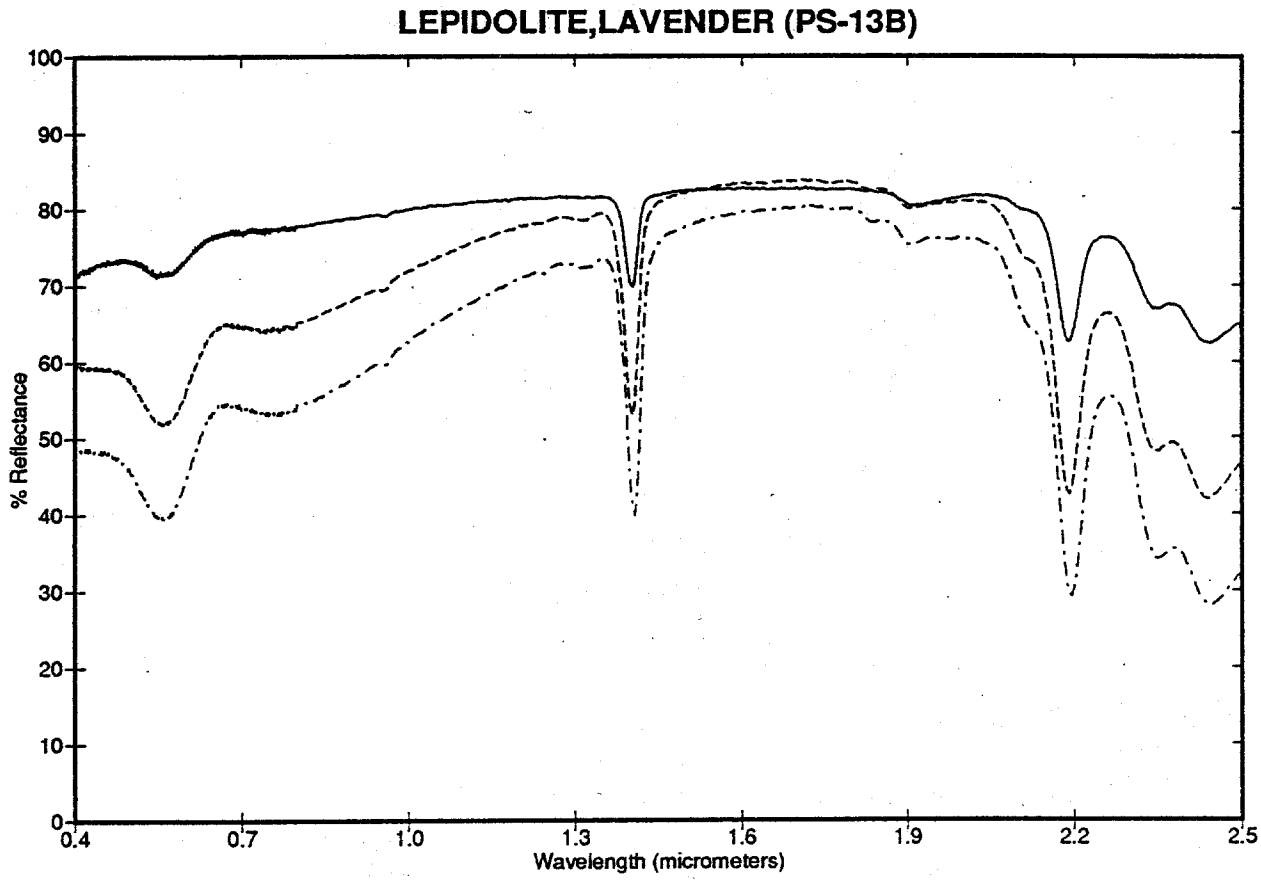


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 23.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.8960	8.3444	1.3925	0.9680
0.4250	1.0642	0.0338	0.8694

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4080	47.7897	2.4771	0.8670
2.1960	33.7716	2.4779	1.4922
2.3440	14.9426	1.1744	0.7625
1.2440	13.4524	2.9137	4.6992
1.3160	12.7384	0.8268	0.9485
0.9600	11.0062	0.6900	0.5393
2.4280	10.8627	0.7702	0.5937
0.9240	9.8732	0.8886	6.5875
1.8360	2.5027	0.0872	1.0389
1.9120	1.1694	0.0545	0.5599
1.9760	0.9754	0.0401	0.5838
1.7640	0.5351	0.0226	1.5006



DESCRIPTION: LEPIDOLITE,LAVENDER
SAMPLE_NUM: PS-13B
COUNTRY: SOUTH AFRICA
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: LEPIDOLITE(A),FELDSPAR(M)
CHEMICAL FORMULA: $K(Li,Al)_3\ (Si,Al)_4O_{10}\ (F,OH)_2$

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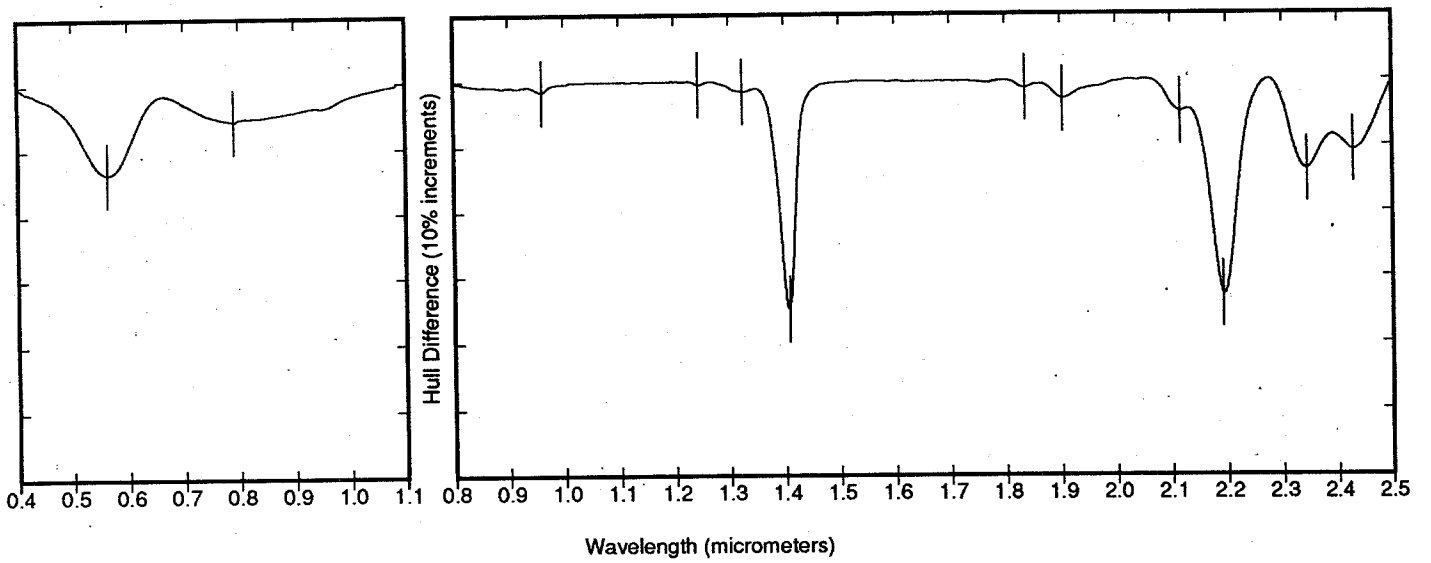
LEPIDOLITE,LAVENDER (PS-13B)



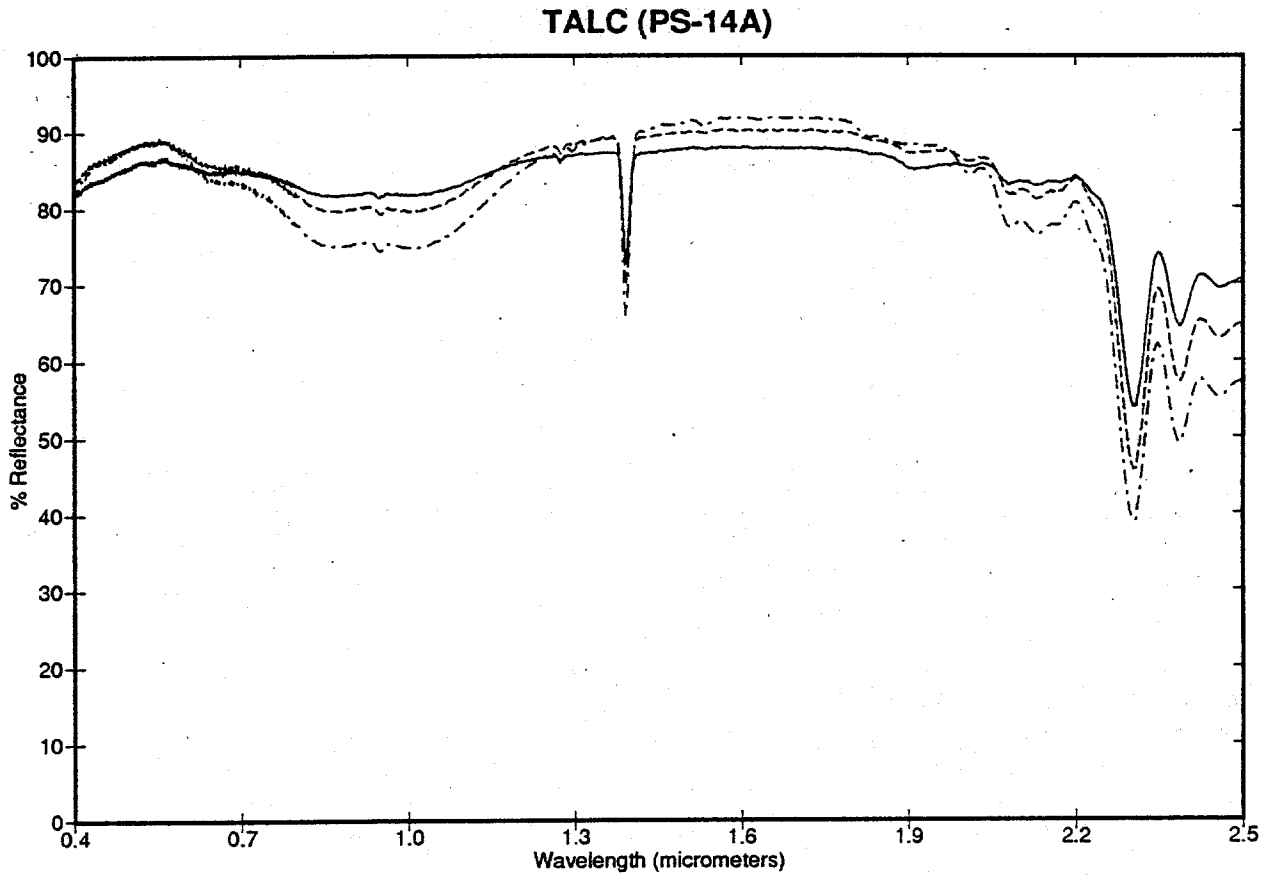
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 32.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5620	13.2947	1.5688	1.1840
0.7900	5.3195	1.3151	0.5021

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 19.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4080	34.8113	1.3648	1.3254
2.1920	32.7033	1.9654	0.9503
2.3440	13.6992	0.9739	0.8655
2.4280	10.8383	0.8153	0.7352
2.1160	4.8767	0.1837	2.2409
1.9040	2.8877	0.2145	0.5381
1.3240	1.6665	0.0741	2.0008
0.9600	1.6503	0.1893	2.0585
1.8360	1.1805	0.0389	1.4951
1.2440	0.6000	0.0115	0.6470

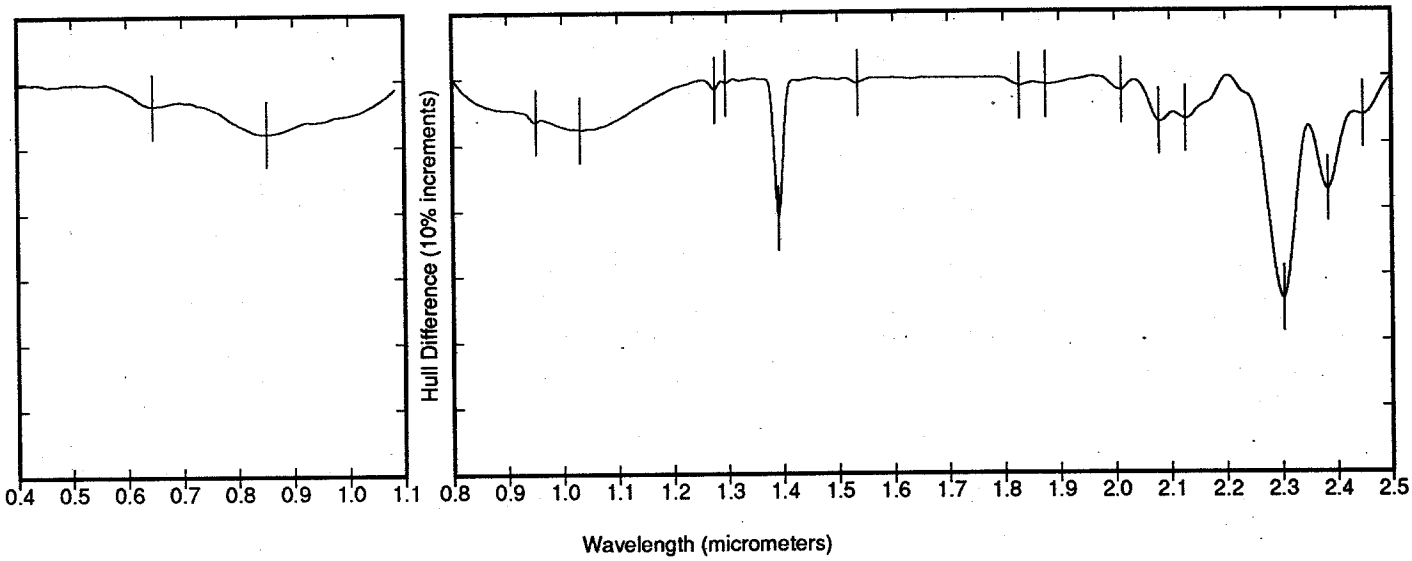
299



DESCRIPTION: TALC
SAMPLE_NUM: PS-14A
COUNTRY: USA
POLITICAL_SUBDIVISION: GEORGIA
GEOGRAPHICAL_REGION: CHEROKEE COUNTY
SITE: HOLLY SPRINGS
COLLECTOR: BURMINCO
MINERALOGY: TALC(A)
CHEMICAL FORMULA: $Mg_3Si_4O_{10}(OH)_2$

300

TALC (PS-14A)



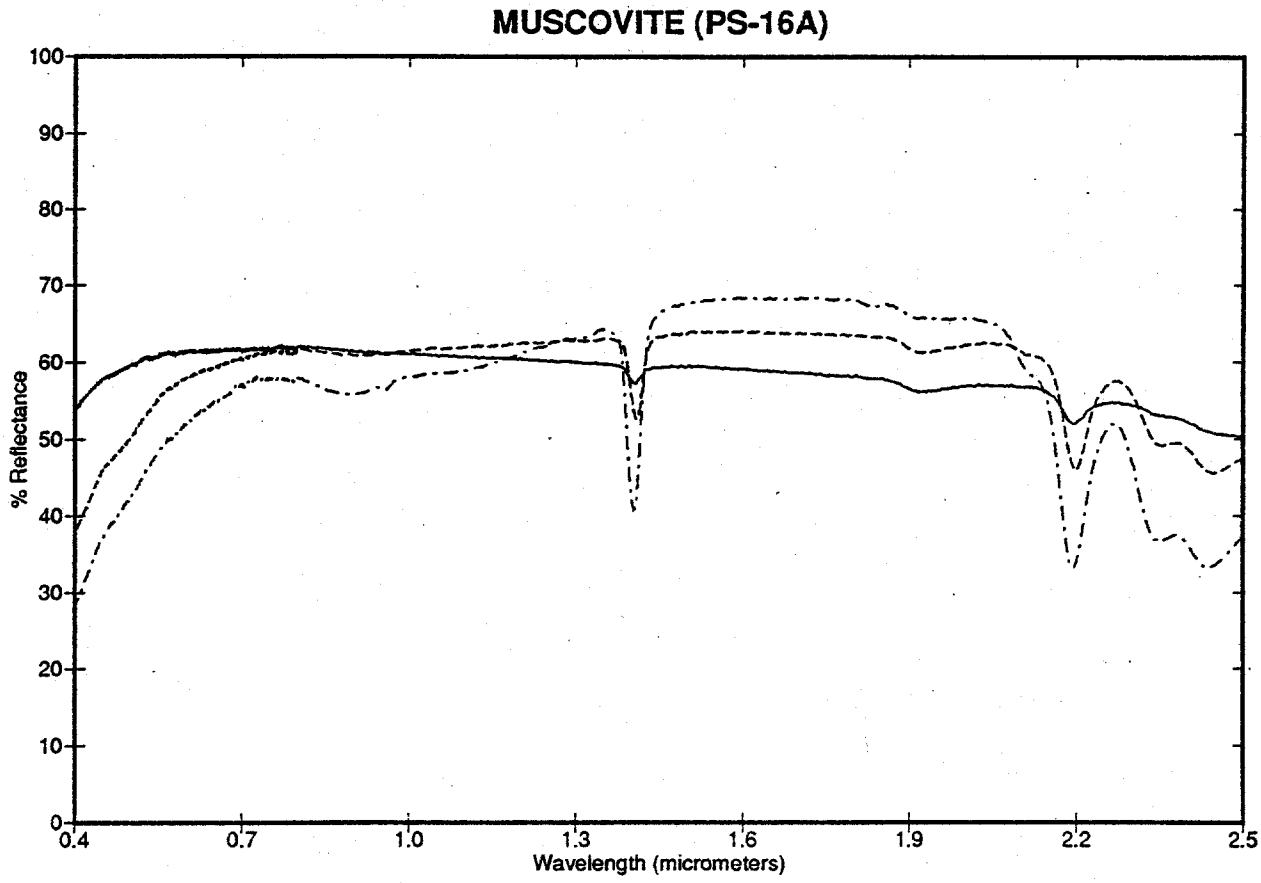
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 43.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.8520	7.7132	2.0445	0.6757
0.6470	3.4520	0.2667	1.2034

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 16.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3040	33.6828	2.0756	1.3469
1.3920	21.1813	0.4012	0.8037
2.3840	17.0646	0.9658	0.8390
1.0320	7.6700	1.4002	0.5577
2.0800	6.8396	0.3195	0.8573
0.9520	6.4630	0.6430	11.8651
2.1280	6.4519	0.3935	0.4393
2.4480	5.8627	0.2375	0.4120
2.0120	2.0880	0.0754	1.4584
1.2760	1.7204	0.0305	1.3763
1.8280	1.3422	0.0554	0.8086
1.8760	1.1628	0.0736	0.3980
1.5360	0.8198	0.0452	0.3464
1.2960	0.7063	0.0108	0.6939

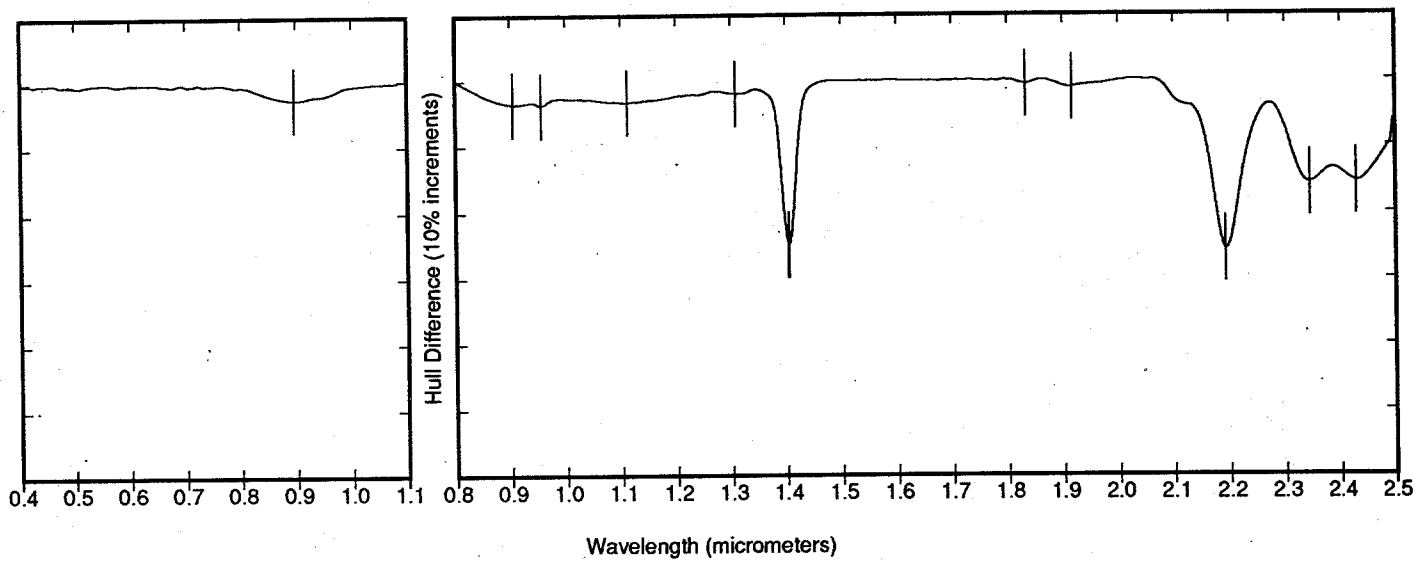
301



DESCRIPTION: MUSCOVITE
SAMPLE_NUM: PS-16A
COUNTRY: USA
POLITICAL_SUBDIVISION: CONNECTICUT
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: MUSCOVITE(A),FELDSPAR(M)
CHEMICAL FORMULA: $K\ Al_2(Si_3Al)\ O_{10}\ (OH,F)_2$

302

MUSCOVITE (PS-16A)

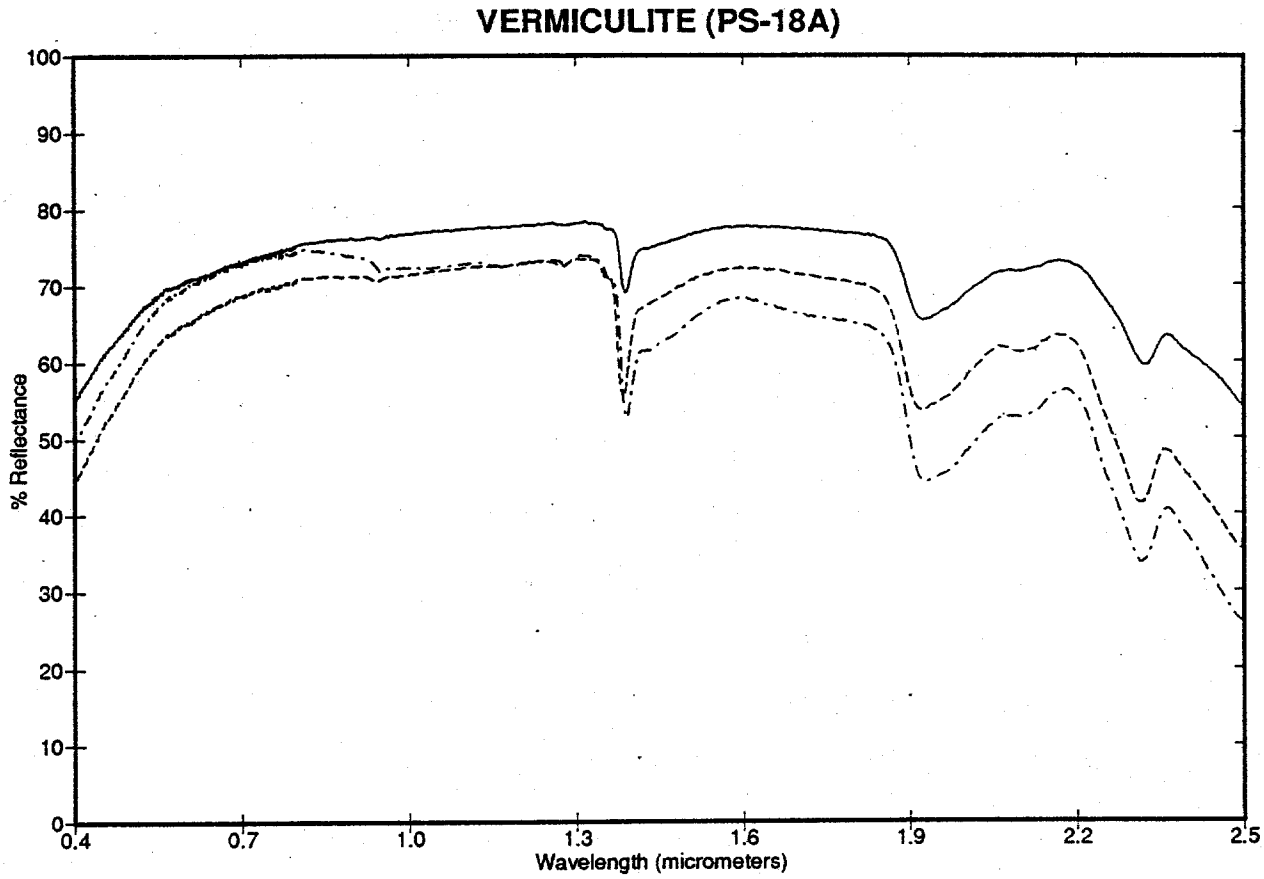


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.8960	2.5510	0.3662	0.7784

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 14.0000

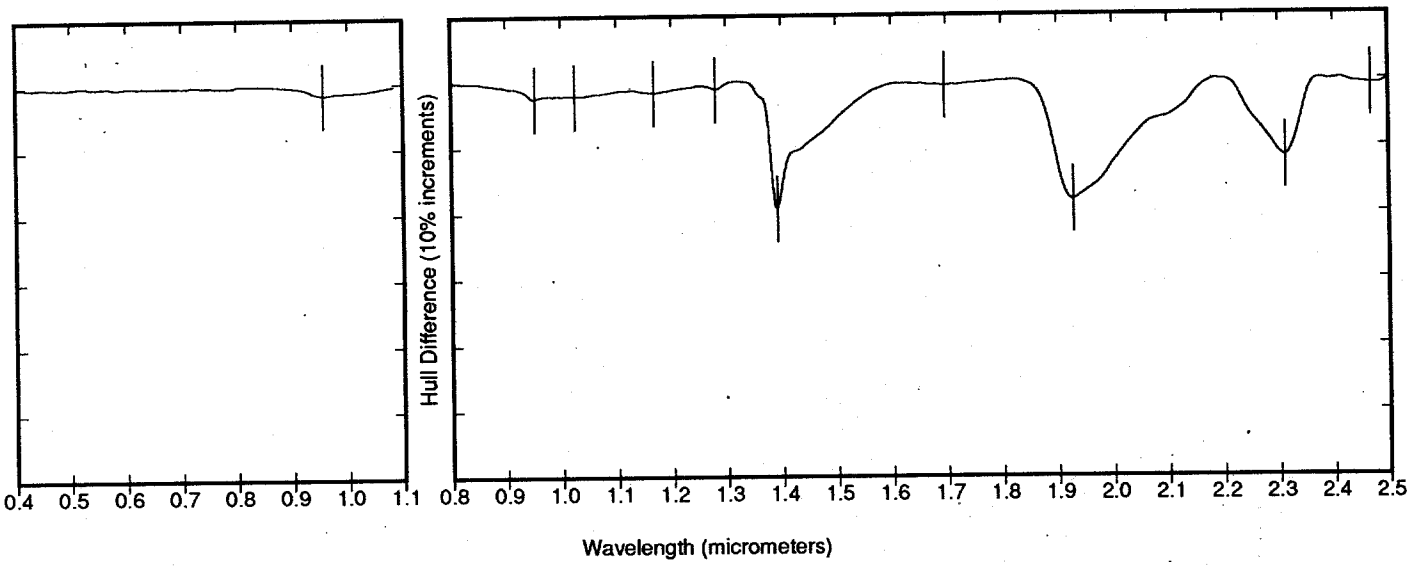
WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.1920	25.5774	1.9787	0.9332
1.4040	24.8525	0.8963	0.9552
2.3440	15.7068	1.3228	1.0702
2.4280	15.4924	1.4498	0.6651
0.9560	3.7660	0.4051	0.2059
0.9040	3.5848	0.3284	1.9405
1.1120	3.3095	0.5319	0.3196
1.3080	2.0111	0.1301	1.0133
1.9160	1.1969	0.0977	0.5617
1.8320	0.6519	0.0216	1.0473



DESCRIPTION: VERMICULITE
SAMPLE_NUM: PS-18A
COUNTRY: USA
POLITICAL_SUBDIVISION: TEXAS
GEOGRAPHICAL_REGION: LLANO COUNTY
SITE: LLANO
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: MAGNESITE(A),VERMICULITE(M)
CHEMICAL FORMULA: $(Mg,Fe^{2+},Al)_3\ (Al,Si)_4O_{10}(OH)_2 \bullet 4H_2O$

304

VERMICULITE (PS-18A)



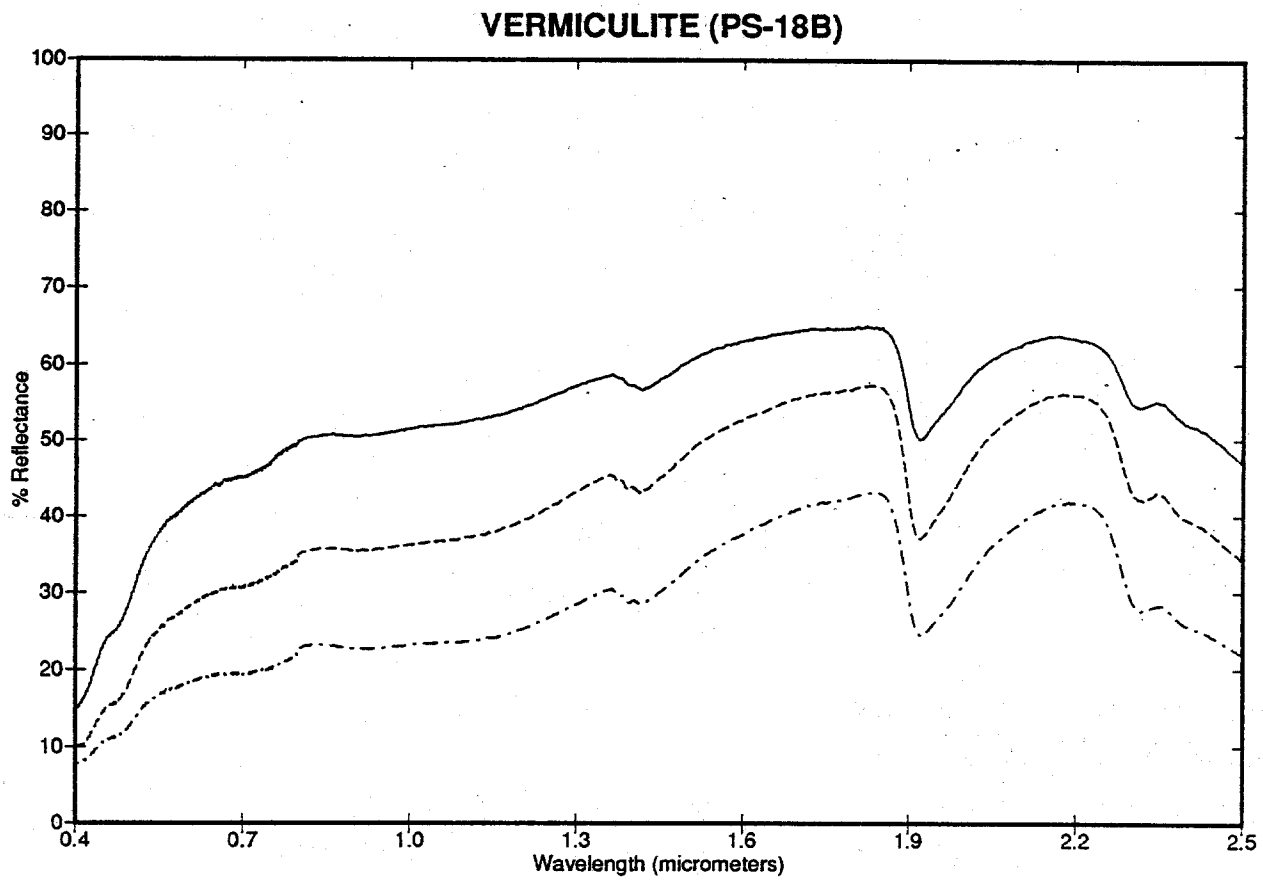
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9560	1.5618	0.1923	0.4554

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3920	19.3432	1.6690	0.2387
1.9280	18.0962	2.8844	0.3244
2.3120	11.5852	0.9748	1.9955
0.9520	2.5694	0.2603	0.7395
1.0240	2.2099	0.1943	0.0469
1.1680	1.7143	0.1629	0.5125
1.2800	1.2437	0.0340	0.8770
2.4680	0.8223	0.0501	1.5697
1.6960	0.8191	0.0966	1.1115

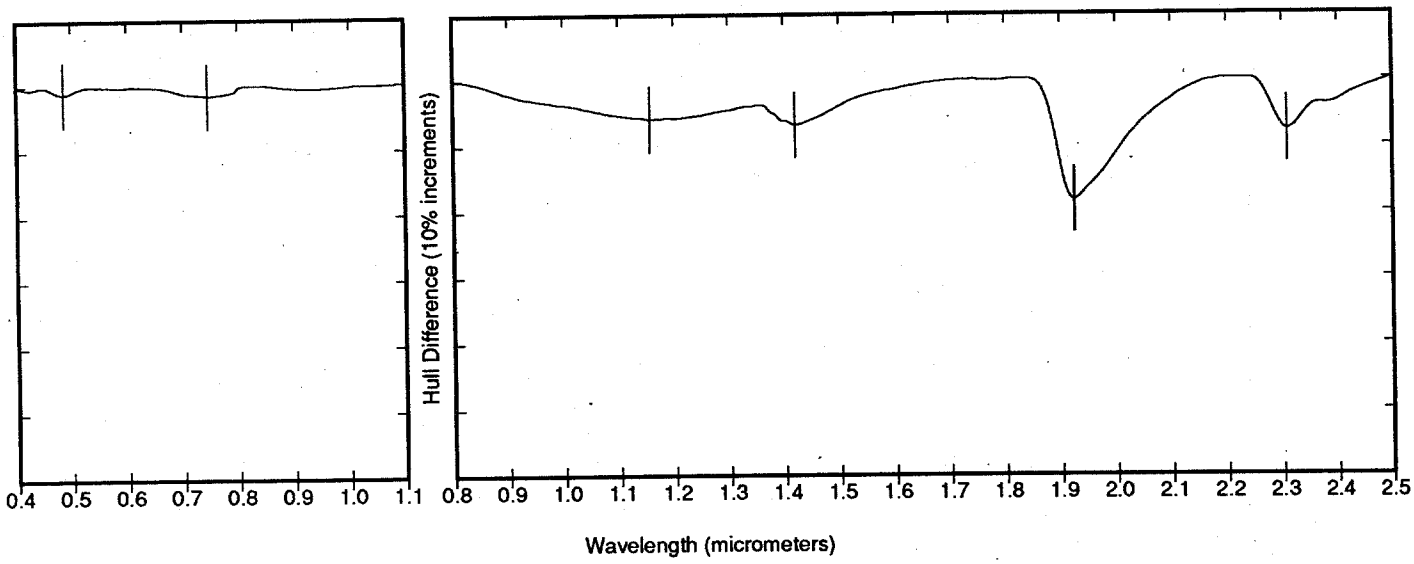
305



DESCRIPTION: VERMICULITE
SAMPLE_NUM: PS-18B
COUNTRY: USA
POLITICAL_SUBDIVISION: MONTANA
GEOGRAPHICAL_REGION: LINCOLN COUNTY
SITE: LIBBY
COLLECTOR: WARD'S
MINERALOGY: VERMICULITE(A),SMECTITE(A),POSSIBLE KAOLINITE(T)
CHEMICAL FORMULA: $(Mg,Fe^{2+},Al)_3\ (Al,Si)_4O_{10}(OH)_2 \bullet 4H_2O$

306

VERMICULITE (PS-18B)



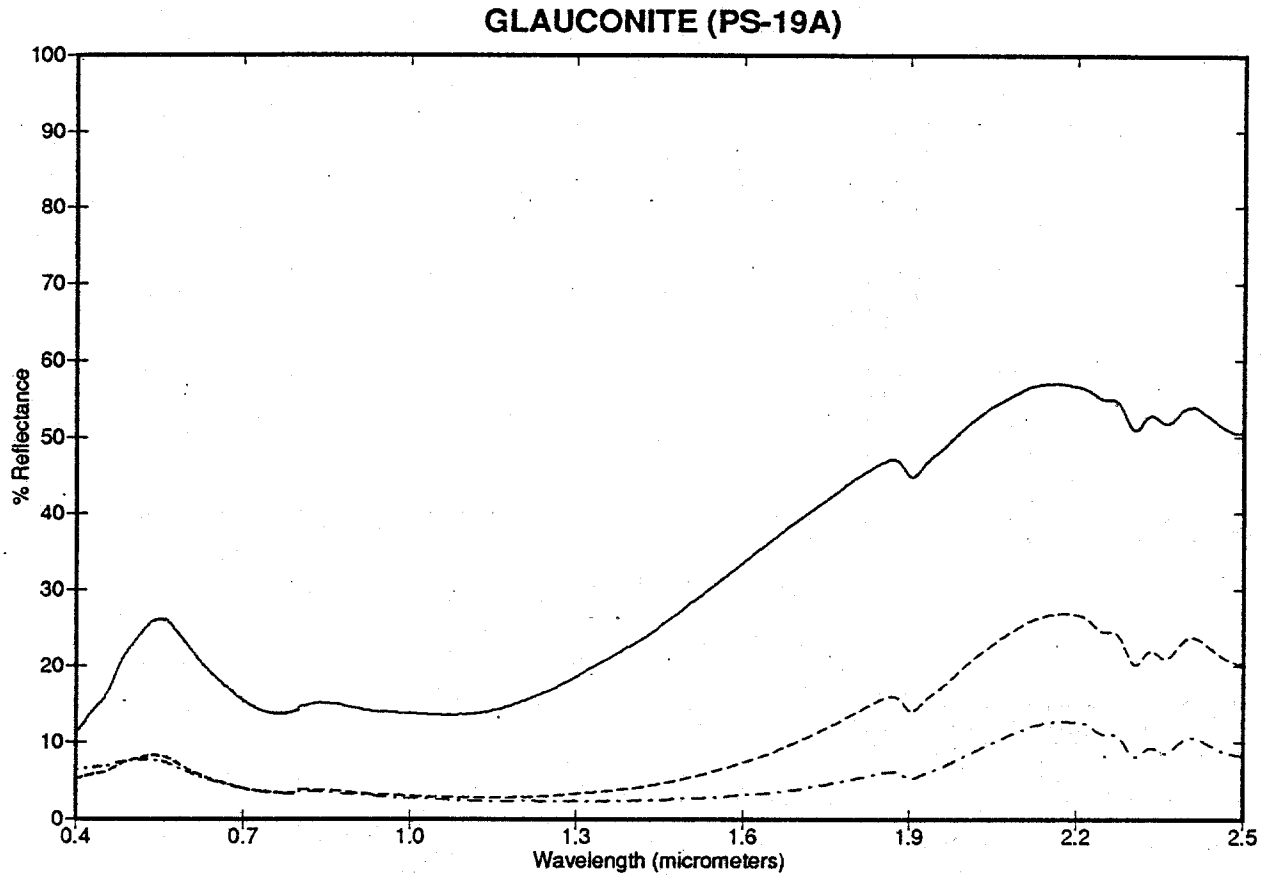
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 24.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7450	1.5905	0.1724	1.4154
0.4860	1.1968	0.0533	0.9635

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9240	18.3216	2.5451	0.3293
2.3080	7.6925	0.8513	0.3703
1.4200	6.8615	1.1500	0.4666
1.1560	5.9285	2.1691	1.1638

307



DESCRIPTION: GLAUCONITE
SAMPLE_NUM: PS-19A
COUNTRY: USA
POLITICAL_SUBDIVISION: NEW JERSEY
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: GLAUCONITE(A)
CHEMICAL FORMULA: $(K,Na)\ (Fe^{3+},Al,Mg)_2\ (Si,Al)_4O_{10}(OH)_2$

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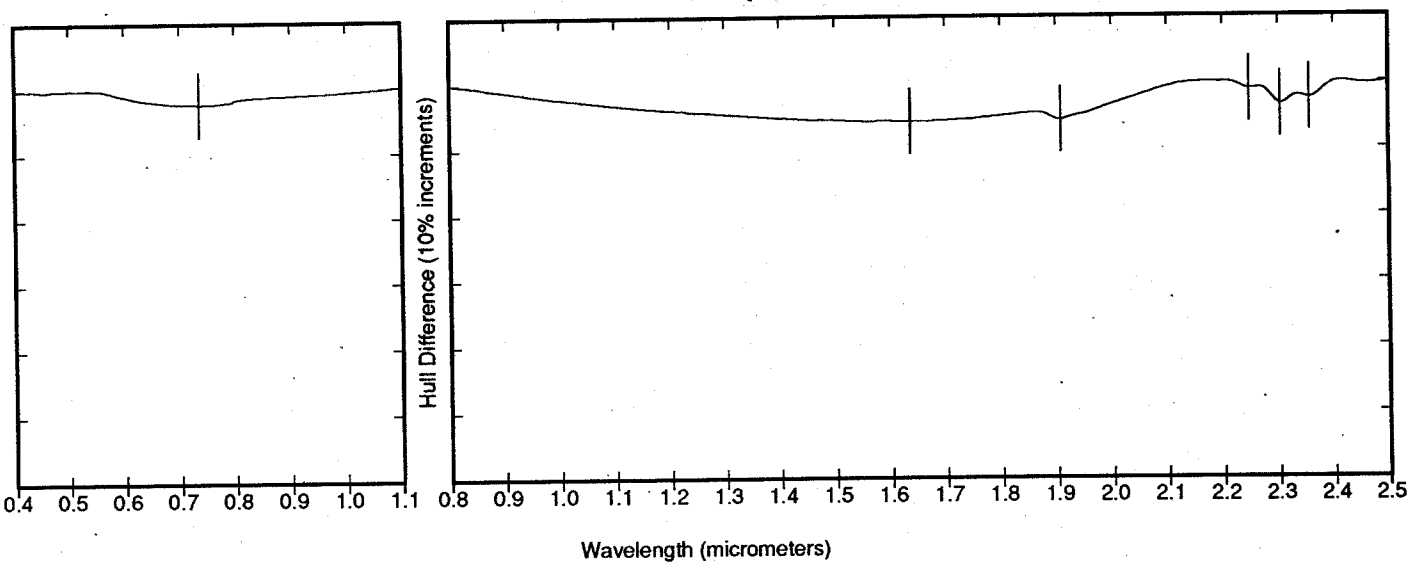
GLAUCONITE (PS-19A)



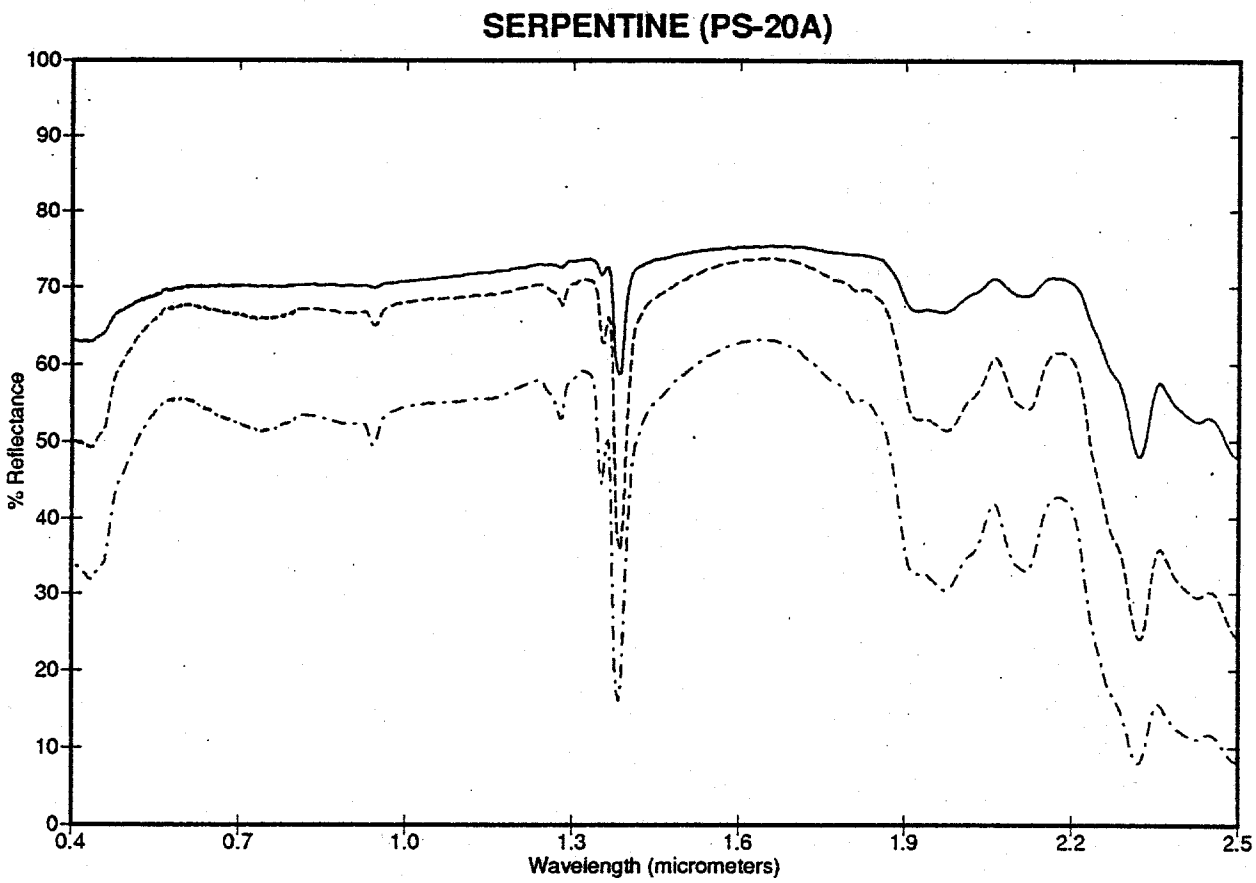
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 11.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7350	2.2659	0.6440	0.7297

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.6360	5.8741	4.3768	2.4855
1.9080	5.6667	0.8299	0.2895
2.3040	3.4055	0.1717	0.9525
2.3560	2.4614	0.1085	0.7166
2.2480	1.1127	0.0346	1.6523

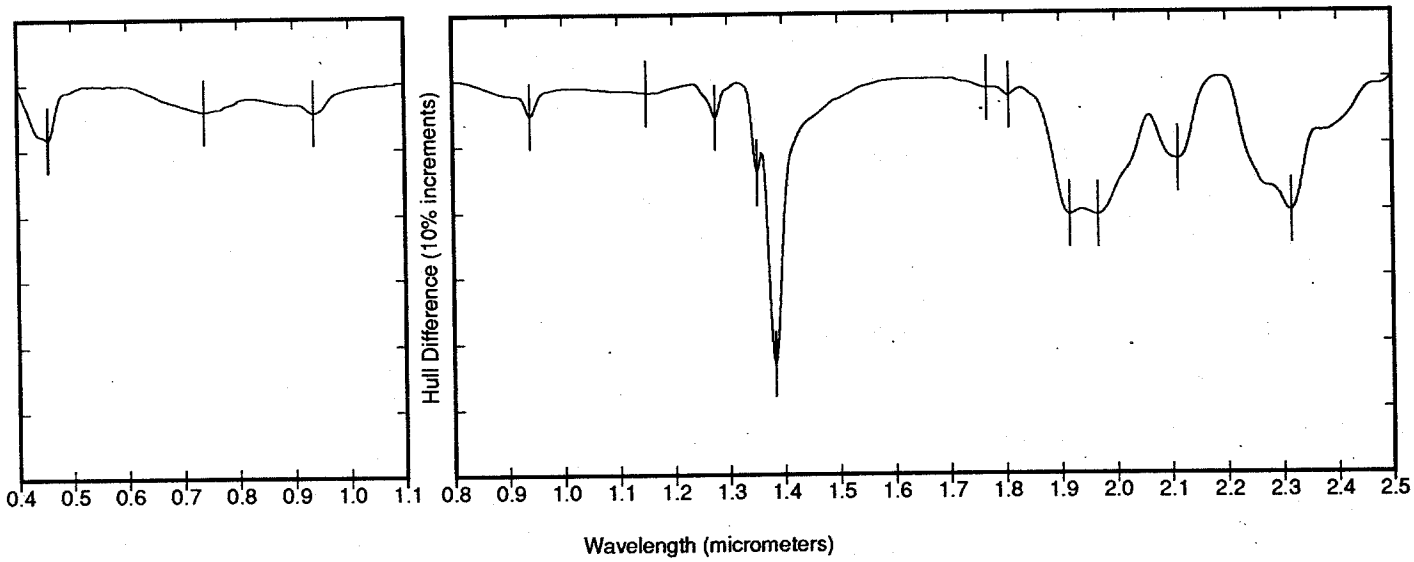
309



DESCRIPTION: SERPENTINE
SAMPLE_NUM: PS-20A
COUNTRY: USA
POLITICAL_SUBDIVISION: NEW YORK
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: SERPENTINE(A),TALC(T)
CHEMICAL FORMULA: $(Mg,Fe^{2+},Ni)\ Si_2O_5(OH)_4$

310

SERPENTINE (PS-20A)



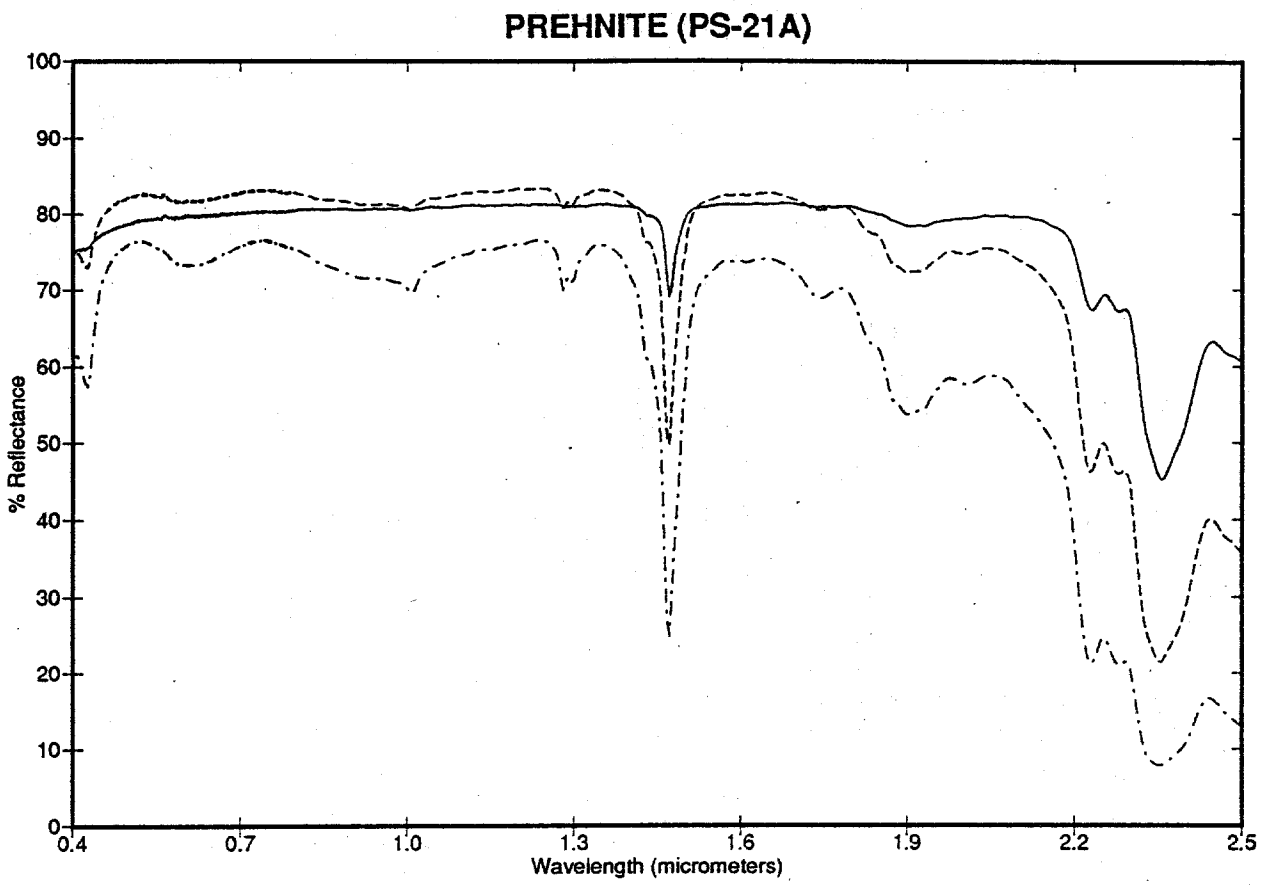
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4560	8.1107	0.4376	1.9329
0.9360	4.3772	0.5316	1.8267
0.7390	4.1037	0.5575	1.2440

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3840	43.1310	2.0319	0.4642
1.9680	20.7187	1.9668	0.4931
1.9160	20.5963	1.1783	1.8967
2.3160	20.1886	2.7338	1.1949
1.3520	14.1181	0.2524	1.4529
2.1120	12.3577	0.8918	1.3351
1.2760	5.7021	0.1883	1.1833
0.9400	5.3285	0.4048	1.1225
1.8080	2.6187	0.1018	1.4545
1.1520	1.9417	0.2852	1.5496
1.7680	1.5246	0.0606	4.0812

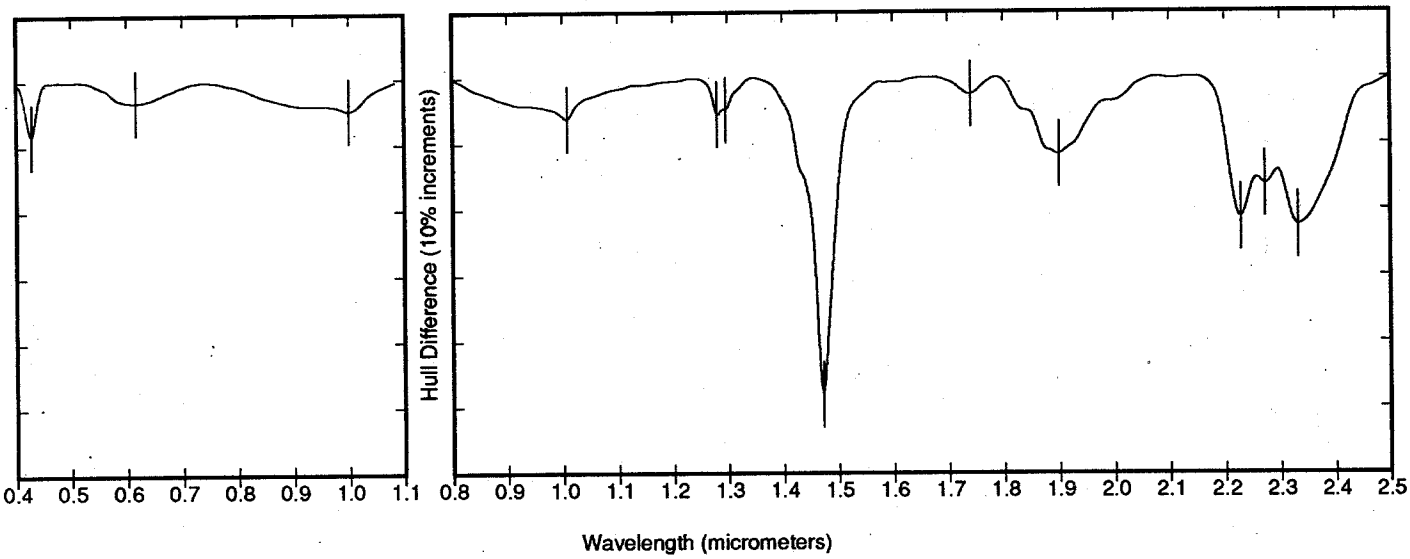
311



DESCRIPTION: PREHNITE
SAMPLE_NUM: PS-21A
COUNTRY: USA
POLITICAL_SUBDIVISION: VIRGINIA
GEOGRAPHICAL_REGION: CENTERVILLE
SITE: CENTERVILLE
COLLECTOR: BURMINCO
MINERALOGY: PREHNITE(A)
CHEMICAL FORMULA: $Ca_2Al_2Si_3O_{10}(OH)_2$

312

PREHNITE (PS-21A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

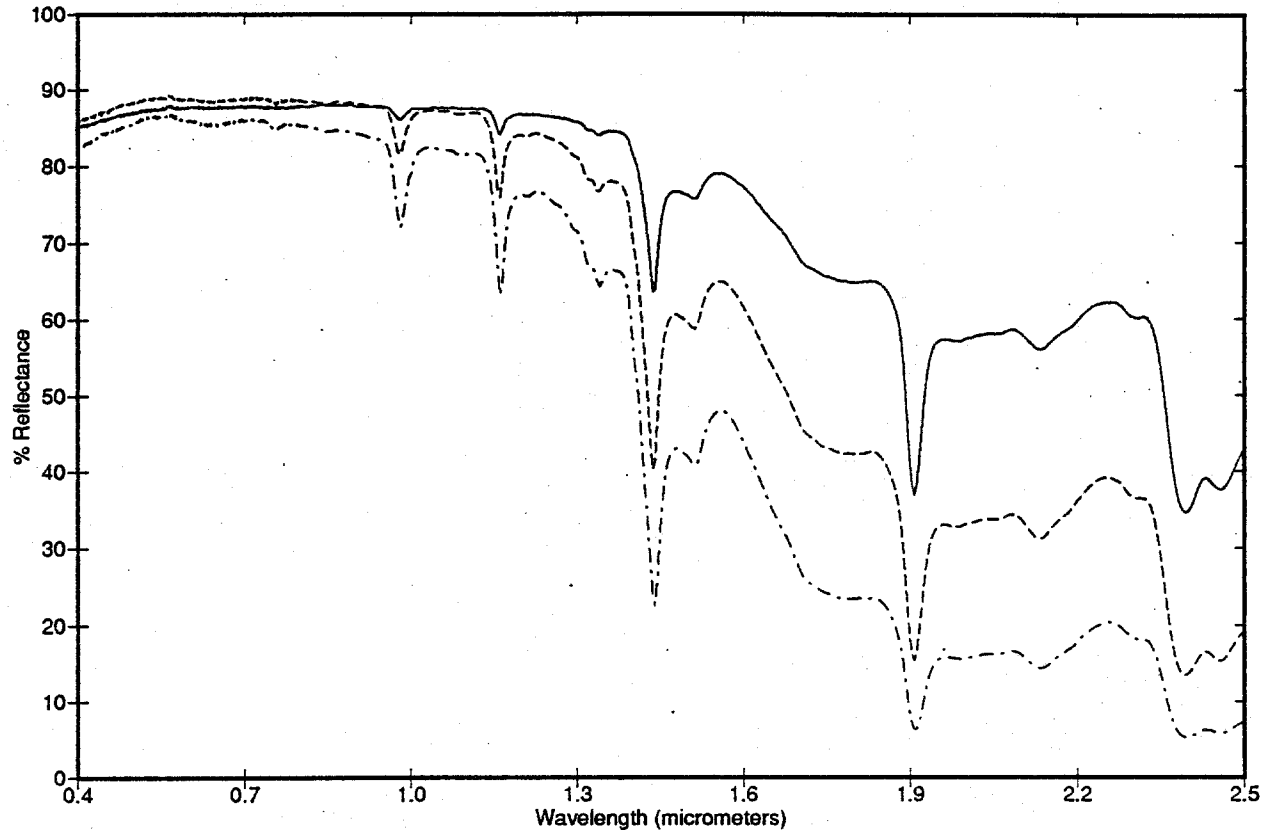
WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4280	8.2927	0.1963	1.1486
1.0000	4.7742	0.8942	3.5028
0.6160	3.2681	0.3767	0.8427

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 11.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4720	48.0170	2.6611	1.0534
2.3320	22.4531	2.3246	0.4079
2.2280	21.2726	1.1507	1.0087
2.2720	16.2721	0.5586	0.5187
1.9000	11.7086	1.5107	0.8023
1.0080	6.2177	1.0949	1.7890
1.2800	5.5735	0.1224	0.9496
1.2960	4.8644	0.1082	0.2173
1.7400	2.5660	0.1285	1.2800

313

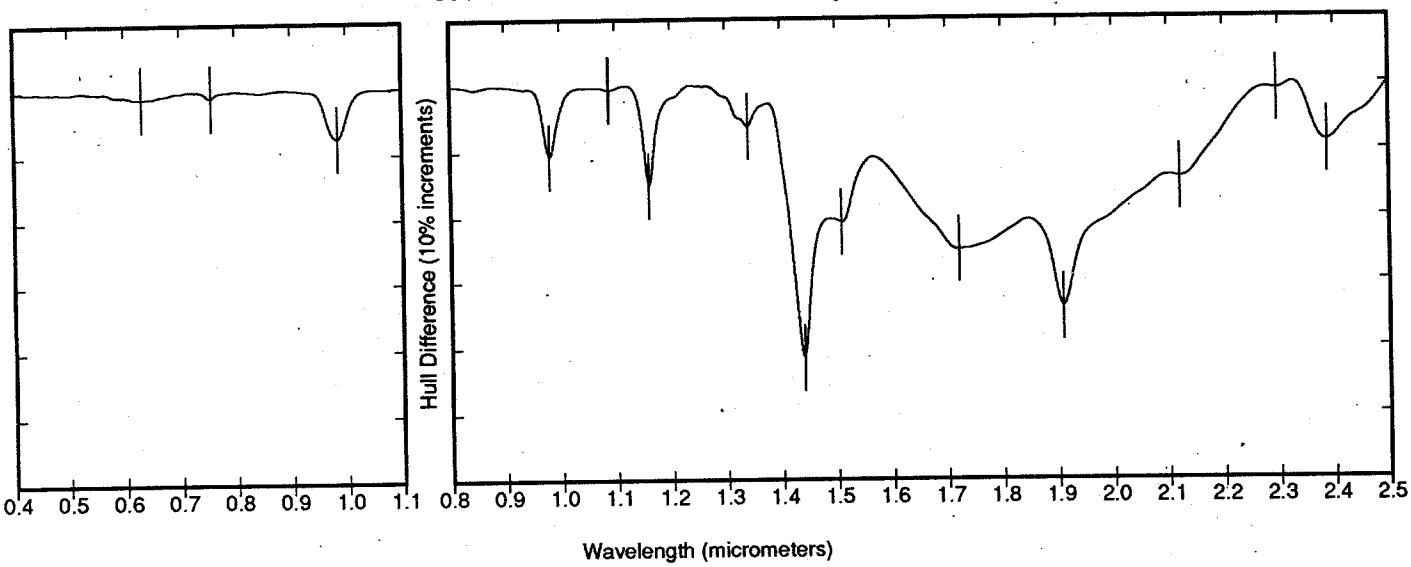
HYDROXYAPOPHYLLITE (PS-22A)



DESCRIPTION: HYDROXYAPOPHYLLITE
SAMPLE_NUM: PS-22A
COUNTRY: INDIA
POLITICAL_SUBDIVISION: MAHARASHTRA
GEOGRAPHICAL_REGION: POONA
SITE: POONA
COLLECTOR: BURMINCO
MINERALOGY: HYDROXYAPOPHYLLITE(A)
CHEMICAL FORMULA: $K\ Ca_4Si_8O_{20}(OH,F) \bullet 8H_2O$

314

HYDROXYAPOPHYLLITE (PS-22A)



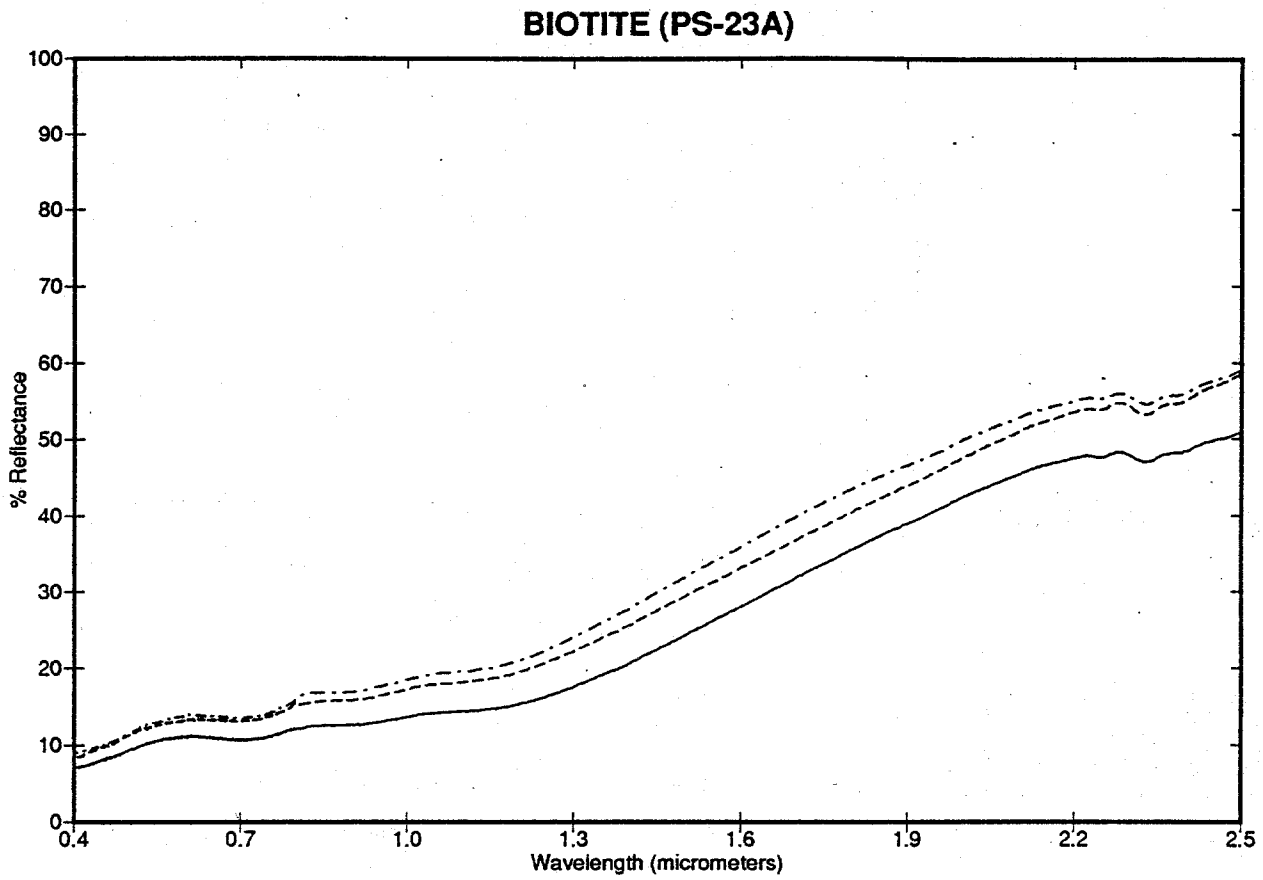
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 23.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9840	7.4821	0.3343	1.1537
0.6320	1.1682	0.1065	1.0758
0.7560	1.0875	0.0444	0.4759

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4400	41.5626	2.4538	0.9393
1.9080	33.9047	5.4904	0.4094
1.7200	25.1195	5.6465	0.9472
1.5080	20.8768	1.3131	0.4557
1.1600	15.1517	0.4589	0.6226
2.1200	14.1974	1.4120	0.2492
0.9800	10.6875	0.3408	0.7286
2.3880	8.7928	0.8195	0.5336
1.3400	6.2739	0.3479	1.4024
2.2960	1.0272	0.0365	1.0571
1.0880	0.6200	0.0178	0.9210

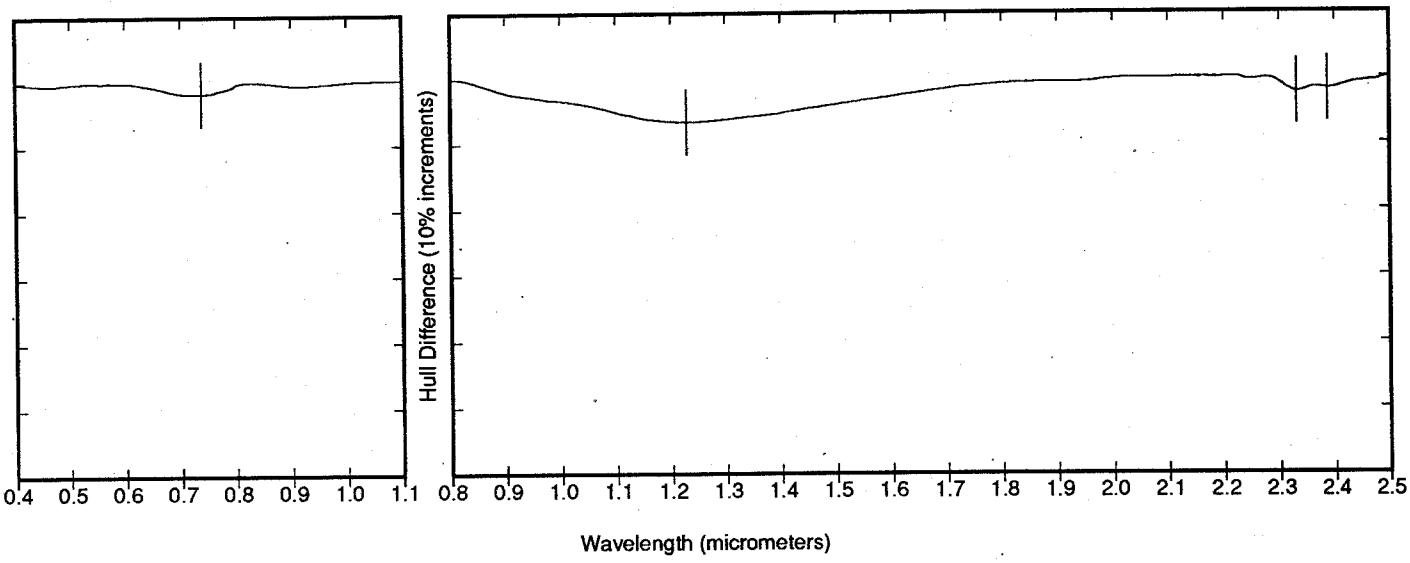
315



DESCRIPTION: BIOTITE
SAMPLE_NUM: PS-23A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: BIOTITE(A)
CHEMICAL FORMULA: $K(Mg,Fe^{2+})_3\ (Al,Fe^{3+})\ Si_3O_{10}(OH,F)_2$

316

BIOTITE (PS-23A)



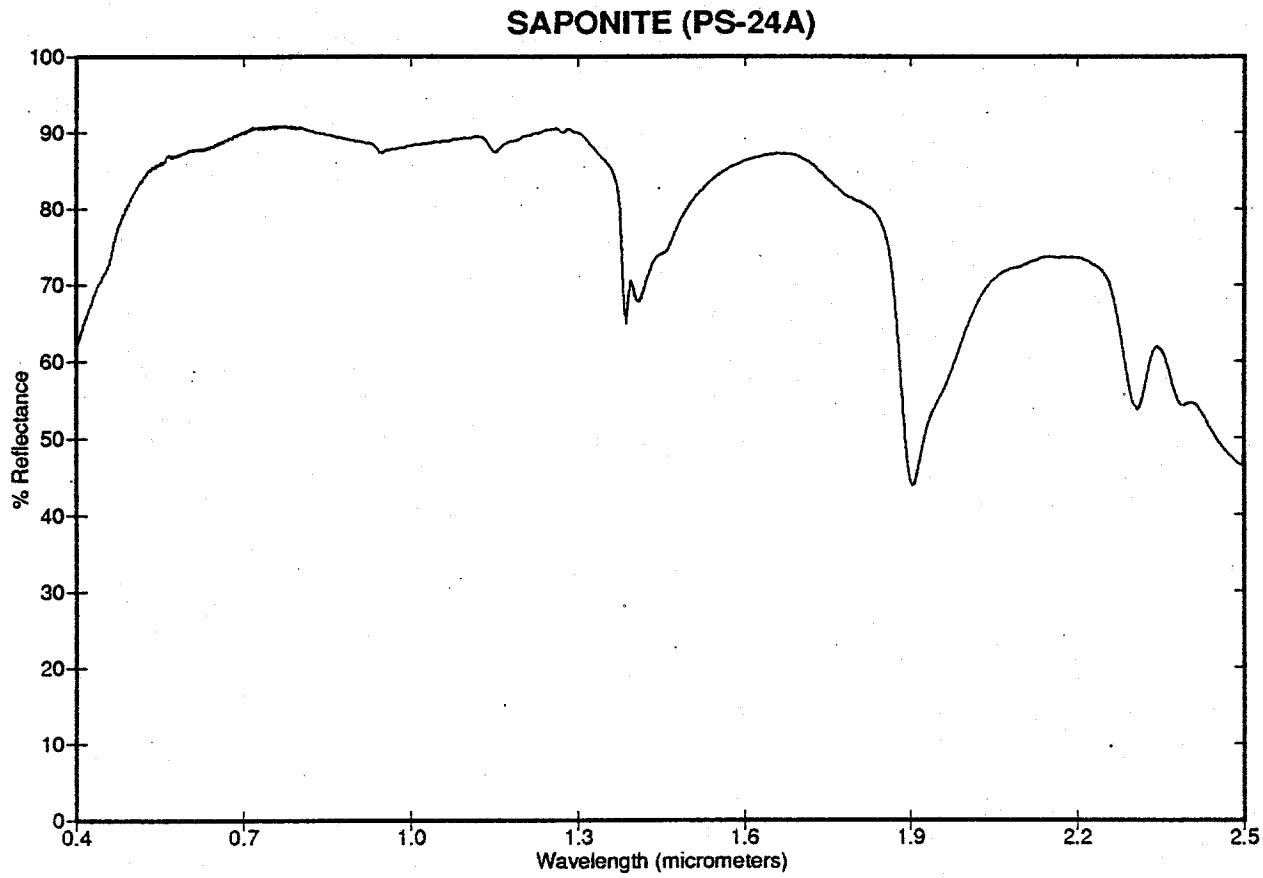
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.7380	1.7753	0.2370	1.5783

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 6.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.2280	6.6313	3.8935	0.6636
2.3320	2.2588	0.1279	1.0262
2.3880	1.8217	0.1435	0.4047

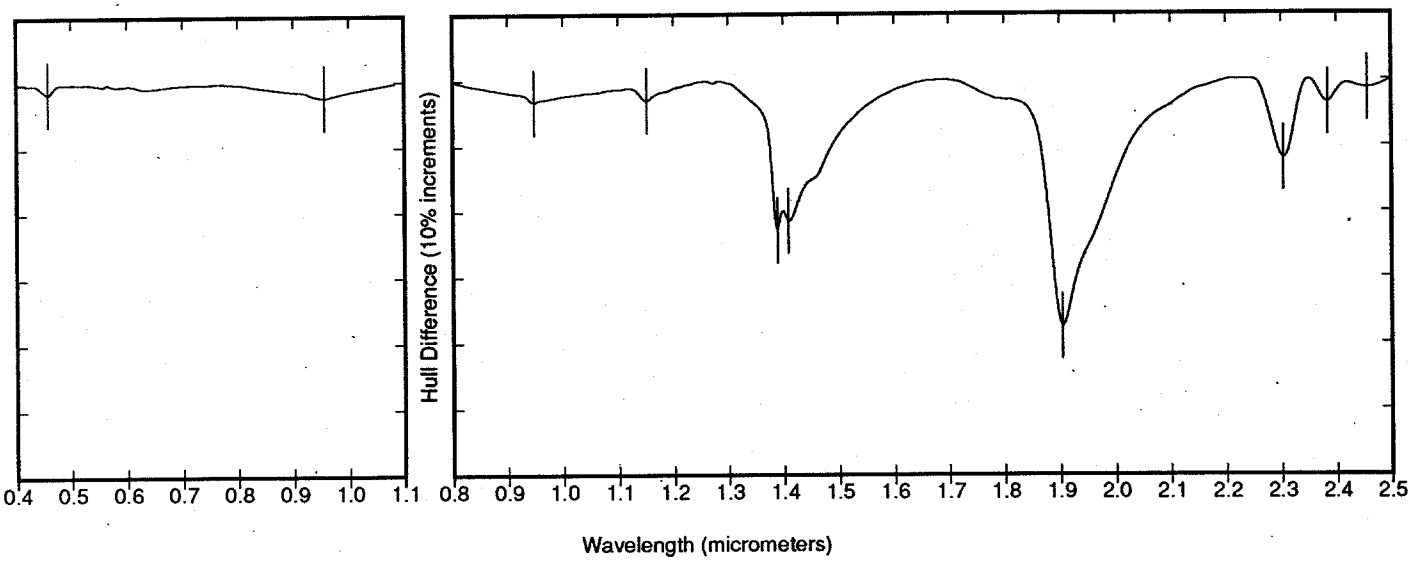
317



DESCRIPTION: SAPONITE
SAMPLE_NUM: PS-24A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: BALLARAT
SITE: BALLARAT
COLLECTOR: CLAY MINERAL SOCIETY
MINERALOGY: SAPONITE(A),TREMOLITE(M),HALITE(T),DIOPSIDE(T)
CHEMICAL FORMULA: $(Ca/2,Na)_{0.33}\ (Mg,Fe^{2+})_3\ (Si,Al)_4O_{10}(OH)_2 \bullet 4H_2O$

318

SAPONITE (PS-24A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9560	2.3241	0.3349	1.2093
0.4580	1.5141	0.0348	1.3270

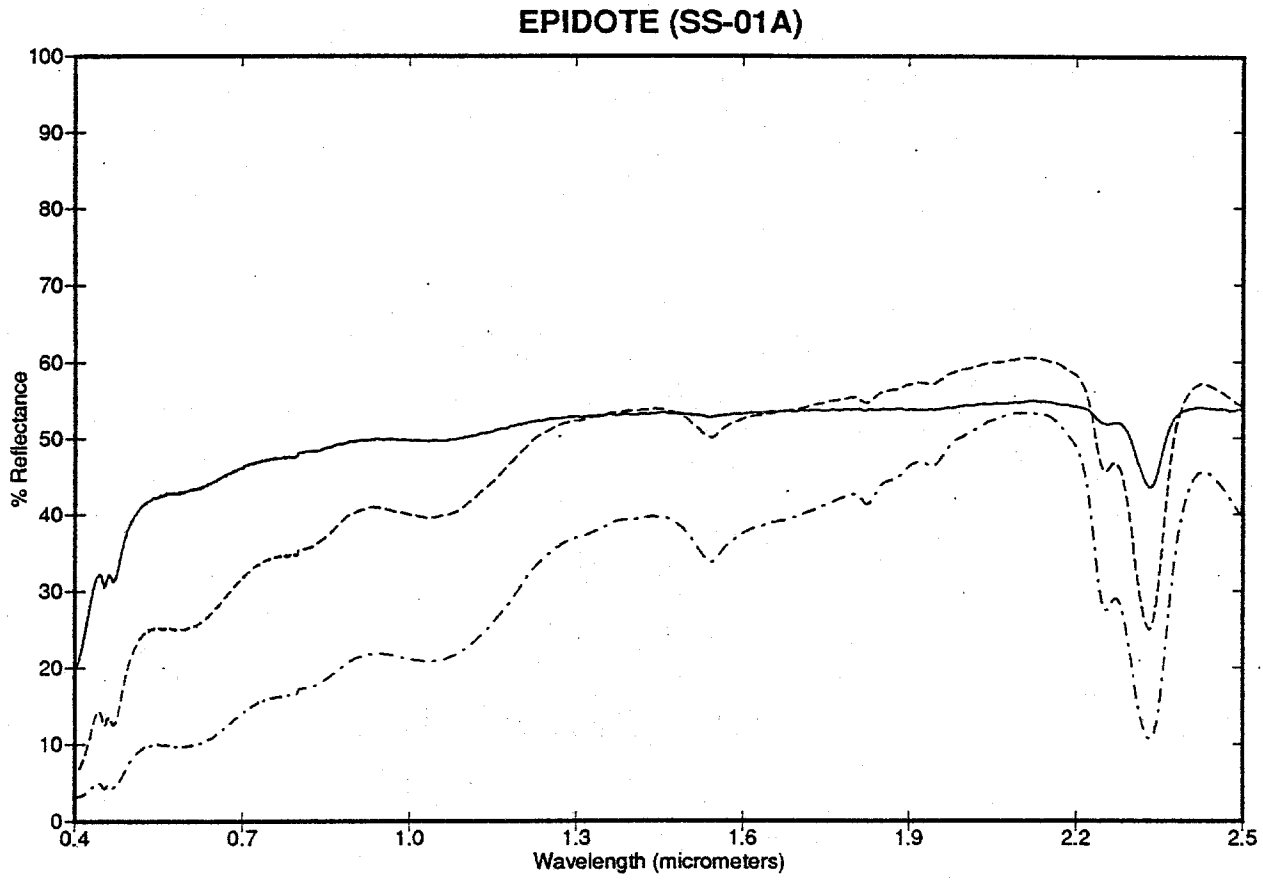
SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 8.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9040	37.4088	4.8168	0.4177
1.3880	22.8724	0.7195	1.8553
1.4080	21.4088	2.0086	0.0900
2.3040	11.9400	0.5525	1.1649
2.3840	3.5468	0.1315	0.8588
0.9480	3.2922	0.5696	0.5909
1.1520	3.0679	0.1887	0.4592
2.4560	1.3423	0.0721	0.9529

319

SOROSILICATES

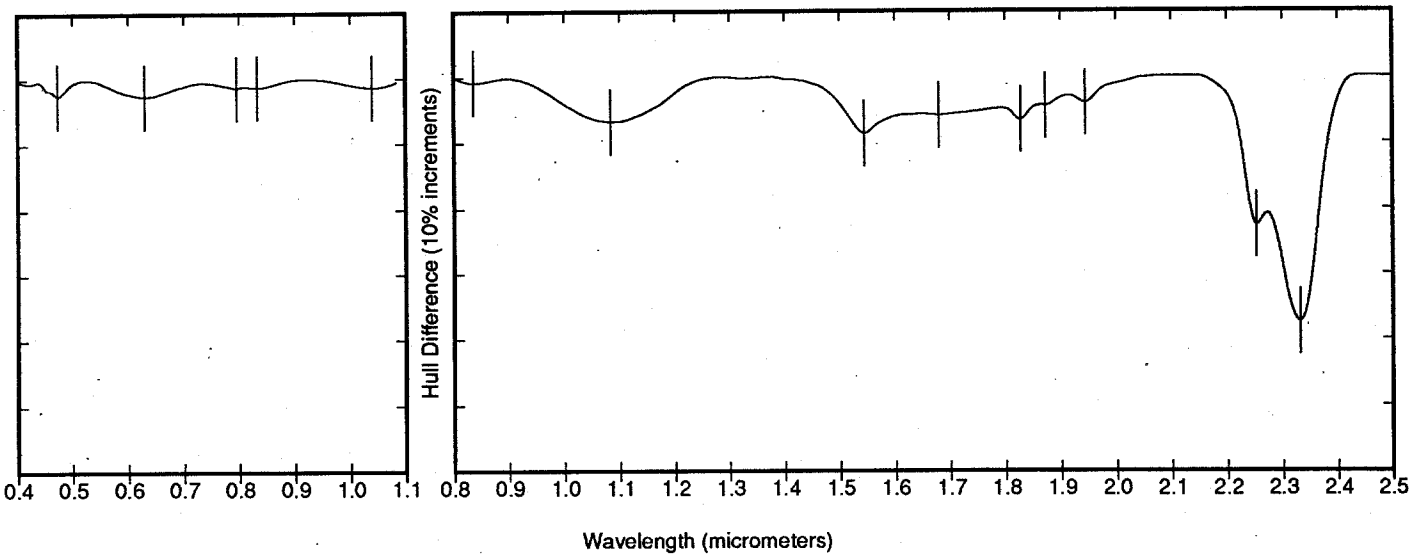
320



DESCRIPTION: EPIDOTE
SAMPLE_NUM: SS-01A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: BAJA CALIFORNIA NORTE
GEOGRAPHICAL_REGION: VALLE DE LA TRINIDAD
SITE: NULL
COLLECTOR: BURMINCO
MINERALOGY: EPIDOTE(A)
CHEMICAL FORMULA: $(Ca_{4.01}Mn_{0.02})\ (Al_{4.37}Fe^{3+}_{1.61})\ Si_{5.99}O_{24}(OH)_2$ *

321

EPIDOTE (SS-01A)



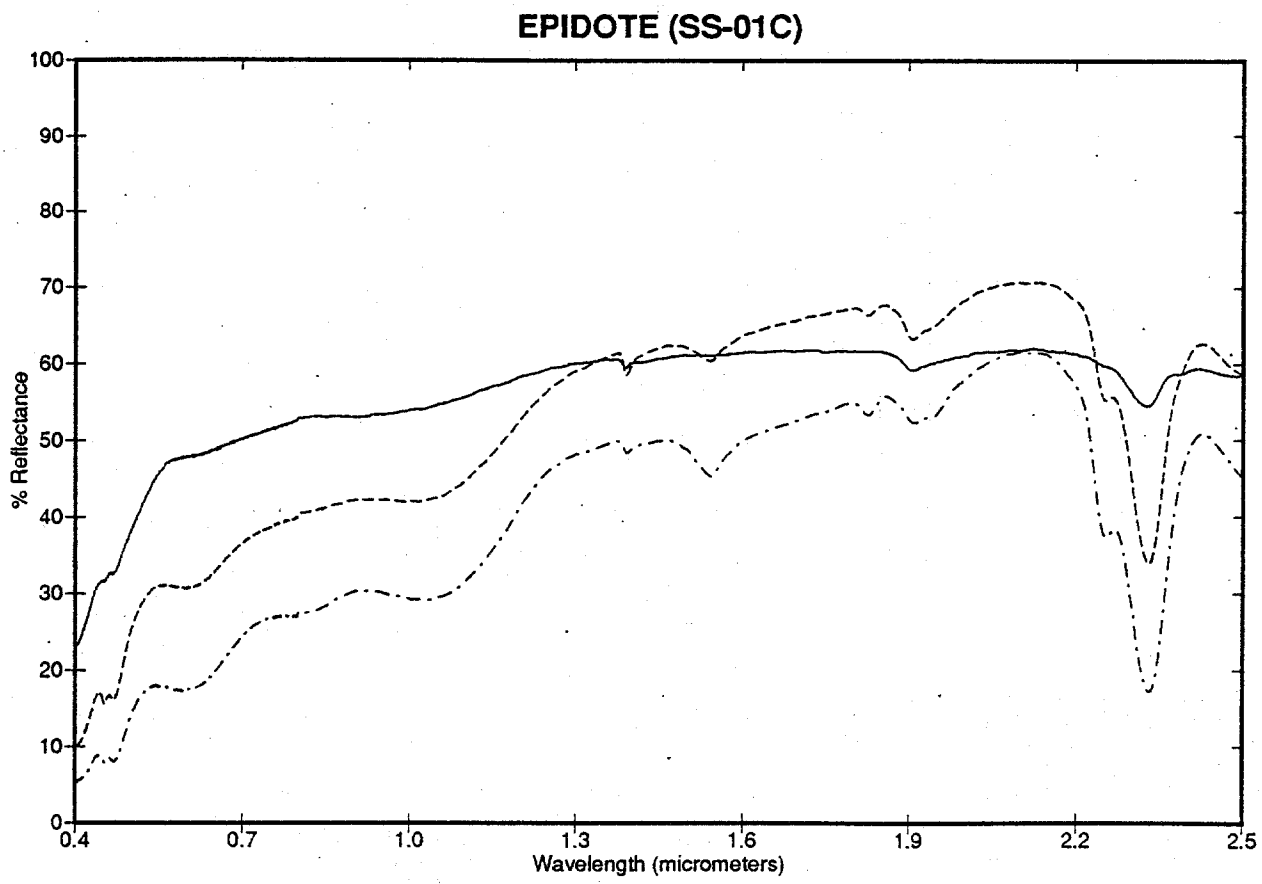
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6290	2.6213	0.3077	0.9336
0.4730	2.4949	0.1016	1.0492
0.7950	1.4040	0.0726	1.8292
1.0400	1.3691	0.1232	1.5426
0.8320	1.3046	0.0697	0.4101

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3320	37.3721	3.2228	1.2072
2.2520	22.6005	1.1039	1.5384
1.5440	8.6825	1.2167	0.5605
1.0840	6.8072	1.3353	0.9640
1.8280	6.6517	0.4695	1.2535
1.6800	5.9230	0.6430	0.1712
1.8720	4.4721	0.1789	0.1105
1.9440	4.0551	0.2661	0.5817
0.8360	0.8121	0.0459	0.6381

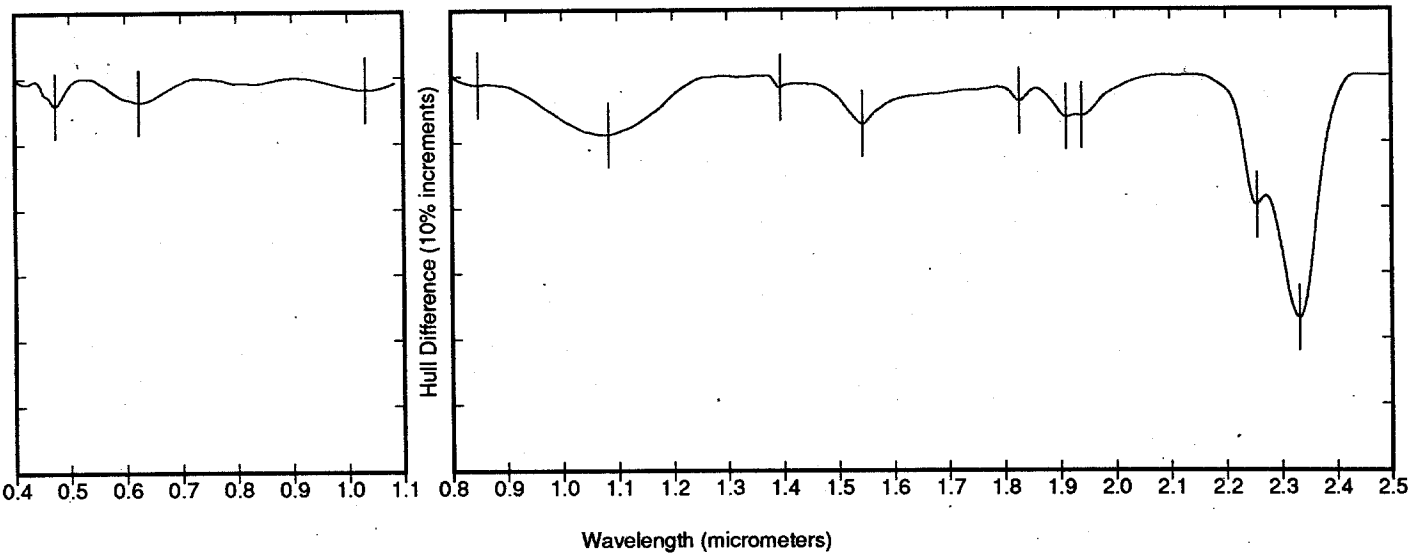
323



DESCRIPTION: EPIDOTE
SAMPLE_NUM: SS-01C
COUNTRY: USA
POLITICAL_SUBDIVISION: COLORADO
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: EPIDOTE(A),CALCITE(M),AMPHIBOLE(M)
CHEMICAL FORMULA: $(Ca_{4.00}Mn_{0.02})\ (Al_{4.31}Fe^{3+}_{1.63}Ti_{0.02})\ Si_{6.01}O_{24}(OH)_2$ *

323

EPIDOTE (SS-01C)



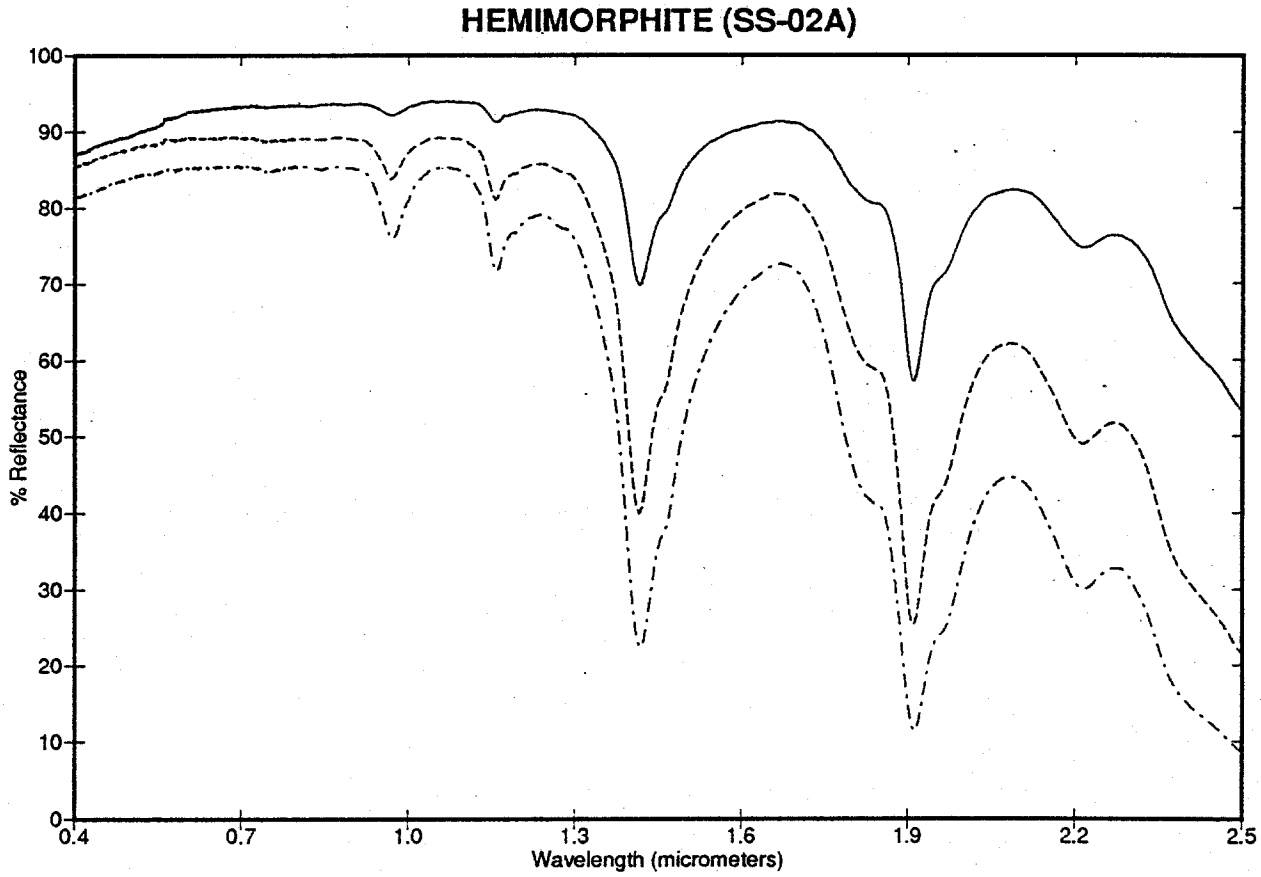
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4740	4.0612	0.1594	1.0909
0.6240	3.6342	0.3647	0.9702
1.0320	1.8720	0.1975	1.4743

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3320	36.9506	3.0808	1.1619
2.2560	19.7225	0.9218	2.0395
1.0840	8.9058	1.9569	1.3286
1.5440	7.3374	1.1780	0.4714
1.9120	6.2907	0.3316	1.7074
1.9400	6.0872	0.3576	0.1562
1.8280	3.8943	0.1935	1.1246
1.3960	1.7718	0.0482	0.7369
0.8480	1.2847	0.0554	2.6774

334



DESCRIPTION: HEMIMORPHITE
SAMPLE_NUM: SS-02A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: DURANGO
GEOGRAPHICAL_REGION: OJUELA MINE
SITE: OJUELA MINE
COLLECTOR: BURMINCO
MINERALOGY: HEMIMORPHITE(A),CALCITE(T)
CHEMICAL FORMULA: $Zn_4Si_2O_7(OH)_2 \bullet H_2O$

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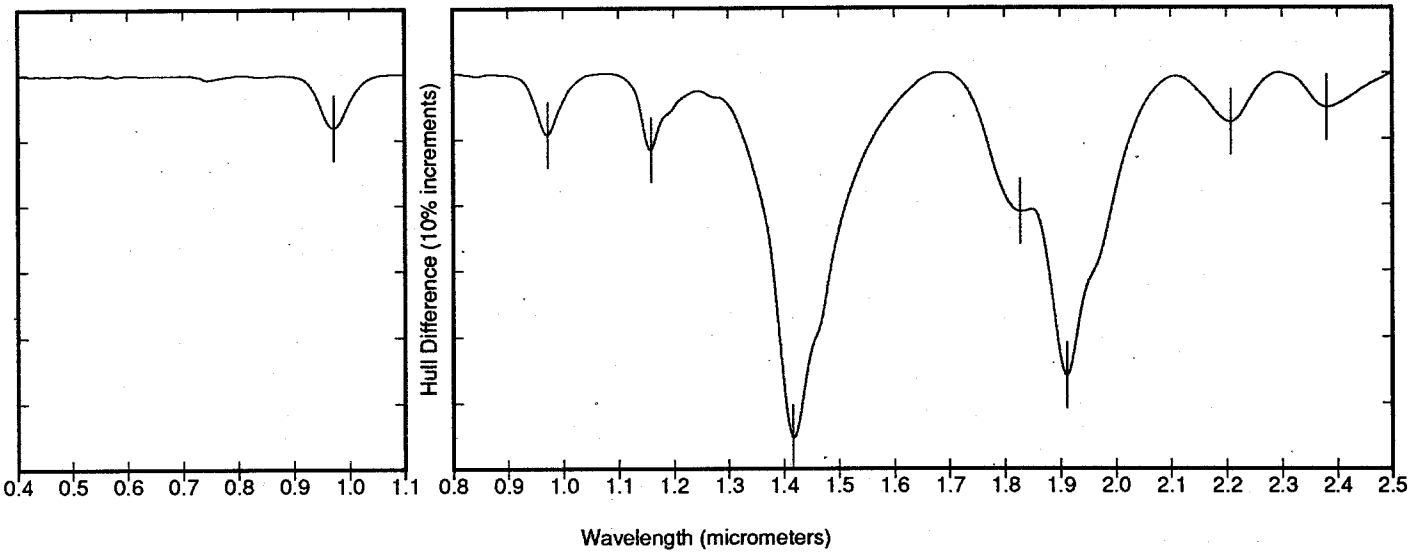
HEMIMORPHITE (SS-02A)



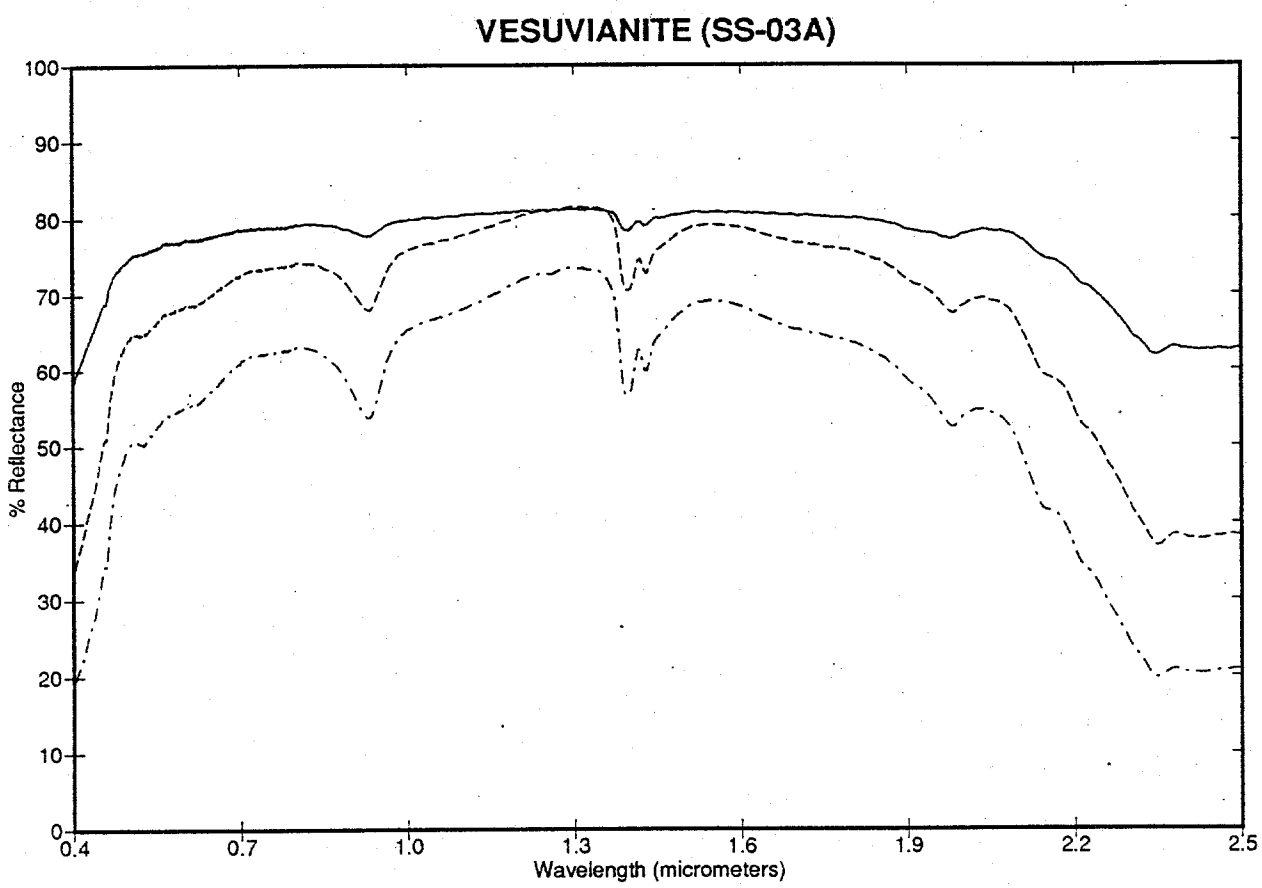
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9720	8.1590	0.5283	0.9466

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4160	55.2060	7.7215	0.6087
1.9120	45.8238	5.4756	0.5896
1.8280	21.1404	1.7067	3.0595
1.1600	11.6322	0.7333	0.5792
0.9720	9.3141	0.5295	0.9513
2.2080	7.5028	0.6616	1.3418
2.3800	5.2627	0.5304	0.5825

326



DESCRIPTION: VESUVIANITE
SAMPLE_NUM: SS-03A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: RIVERSIDE COUNTY
SITE: CRESTMORE QUARRY
COLLECTOR: BURMINCO
MINERALOGY: VESUVIANITE(A),CALCITE(T)
CHEMICAL FORMULA: $(Ca_{9.34}Mn_{0.01})\ (Mg_{1.37}Fe_{0.47})\ (Al_{4.53}Ti_{0.08})\ (Si_{8.69}Al_{0.31})\ O_{34}(OH)_4$*

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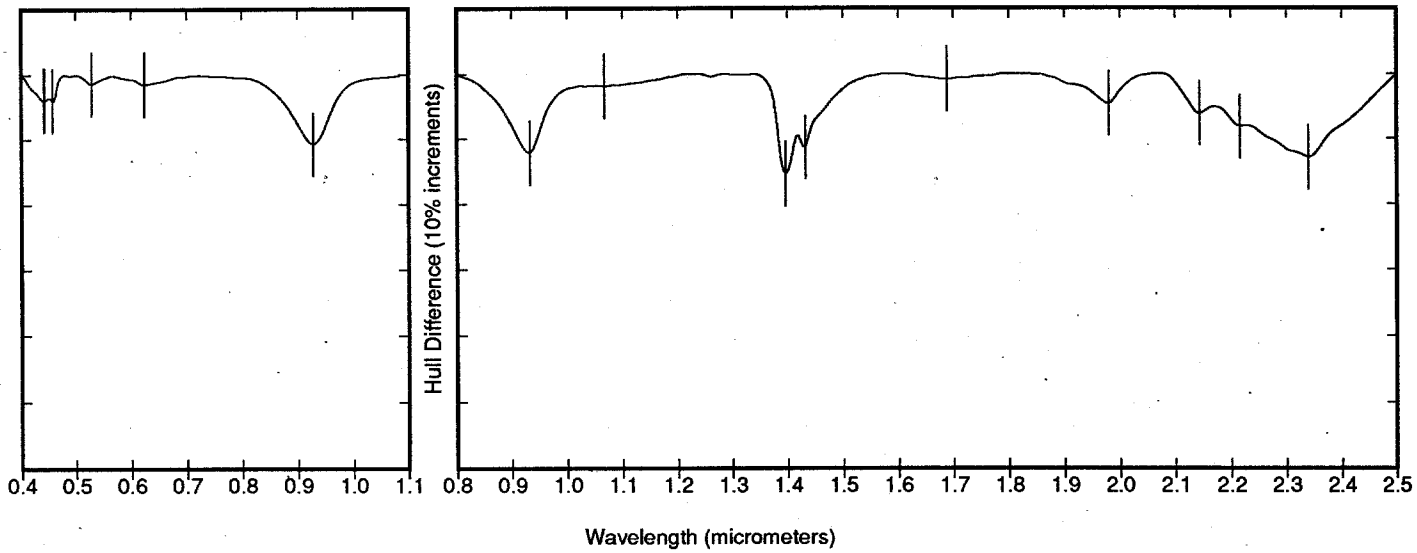
VESUVIANITE (SS-03A)



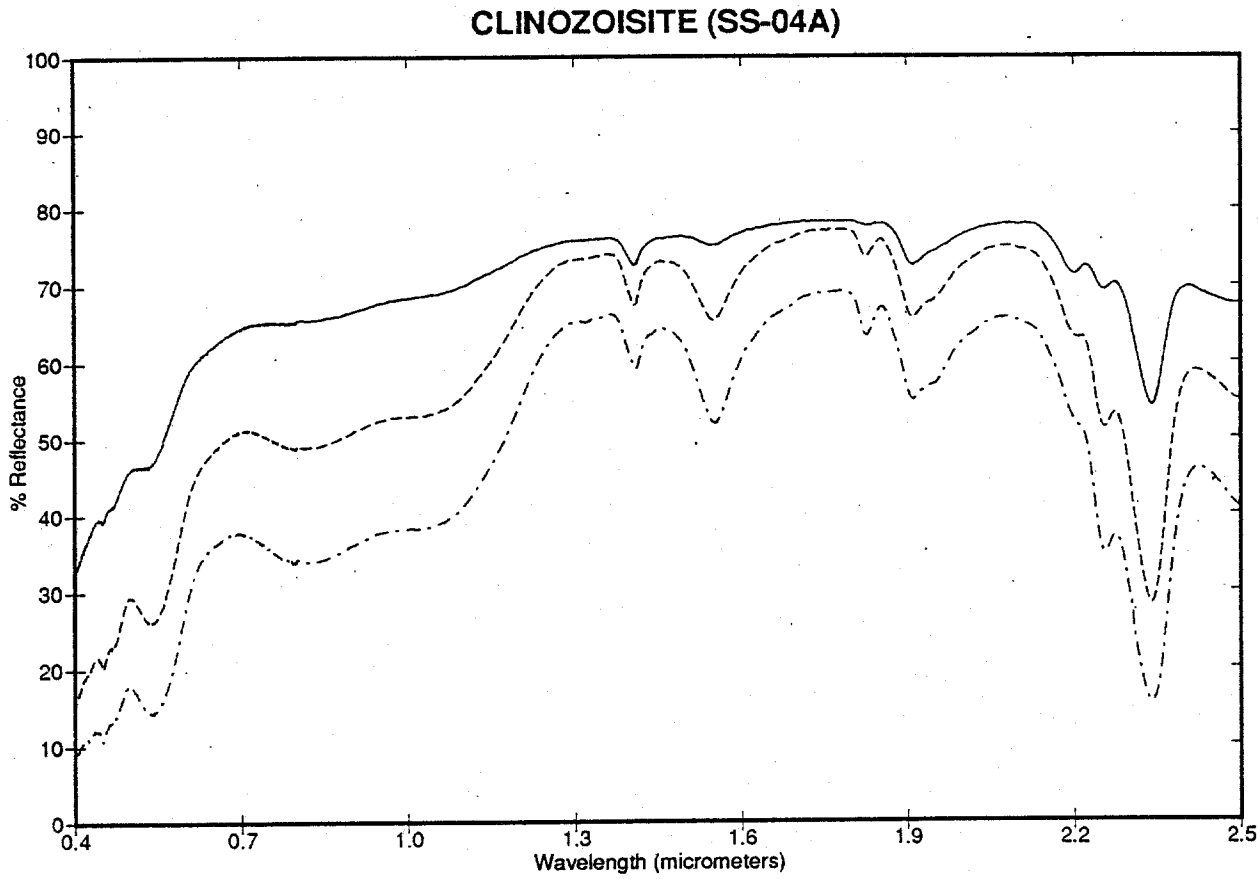
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9280	10.7282	0.9829	1.2010
0.4580	3.9978	0.0550	0.6736
0.4420	3.9081	0.1240	2.3606
0.6240	1.4698	0.0851	0.4175
0.5290	1.4056	0.0417	0.6948

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 11.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.3960	15.4312	0.5635	0.8713
2.3400	12.9370	2.2652	1.1776
0.9320	12.1733	1.1508	1.1493
1.4320	11.3370	0.5808	0.2841
2.2160	8.1443	0.3714	4.7158
2.1440	6.1403	0.3212	1.3917
1.9800	4.5903	0.3665	1.9274
1.0680	1.8400	0.1610	0.0469
1.6880	0.8000	0.0815	0.8143

328



DESCRIPTION: CLINOZOISITE
SAMPLE_NUM: SS-04A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: SONORA
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: WARD'S
MINERALOGY: CLINOZOISITE(A),QUARTZ(M),MICA(T)
CHEMICAL FORMULA: $Ca_2Al_3(SiO_4)_3(OH)$

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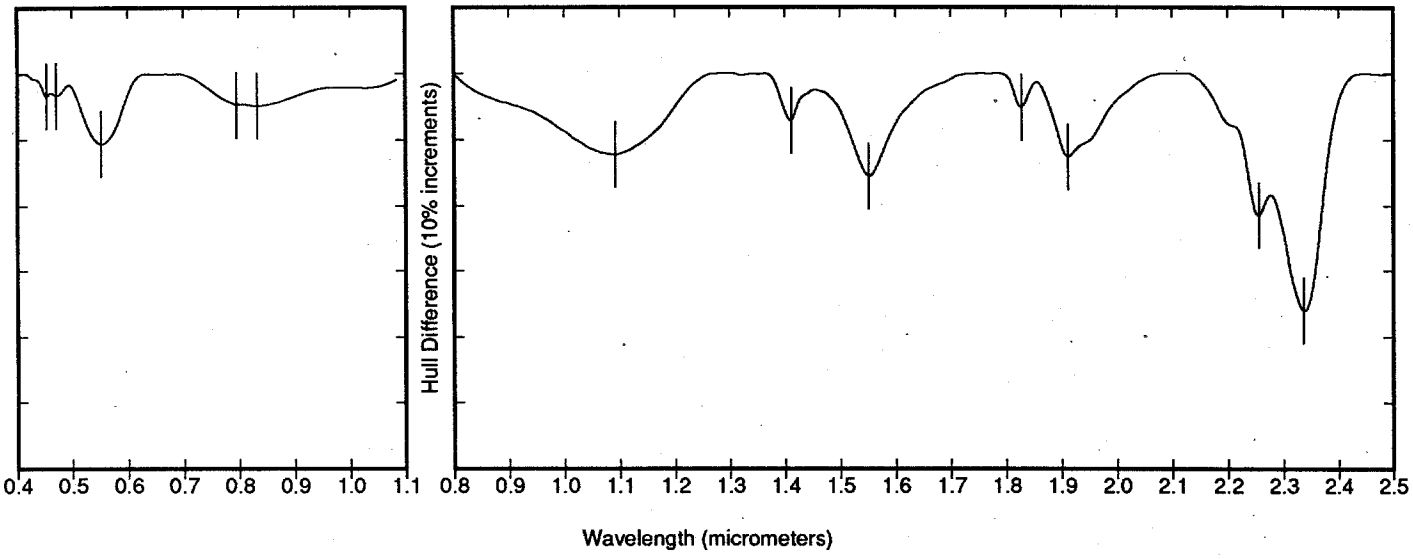
CLINOZOISITE (SS-04A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5510	10.5687	0.7963	0.9057
0.8320	4.8402	0.8528	0.2321
0.7950	4.7161	0.2422	16.2498
0.4530	3.3667	0.0747	1.7124
0.4710	3.2793	0.0860	0.4765

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3360	36.0271	3.0544	1.1290
2.2560	21.5264	1.3495	2.3959
1.5520	15.5820	1.6680	0.7982
1.9120	12.6167	1.2892	0.4170
1.0920	12.2858	3.1067	1.6427
1.4120	7.1592	0.3168	0.9416
1.8280	5.1500	0.1663	0.9583

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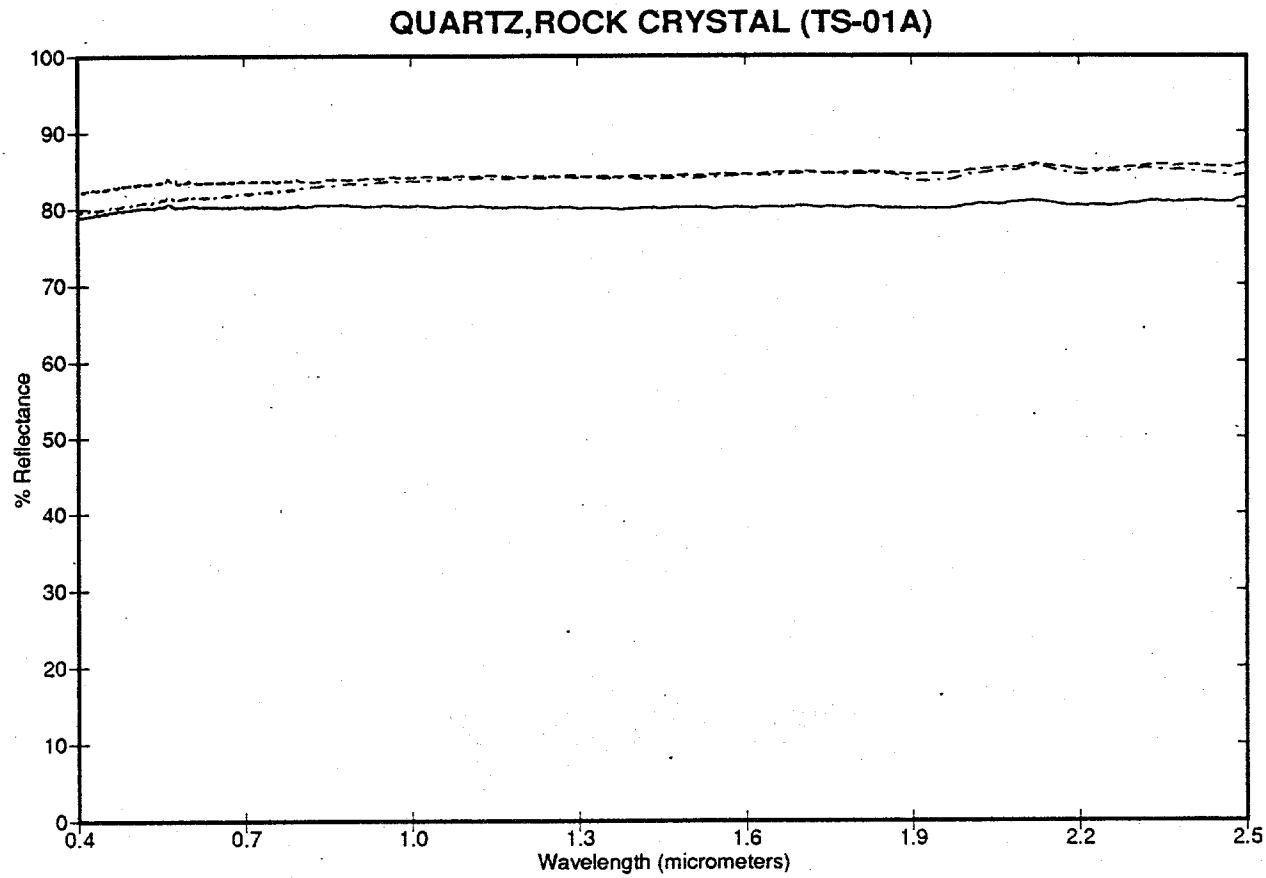
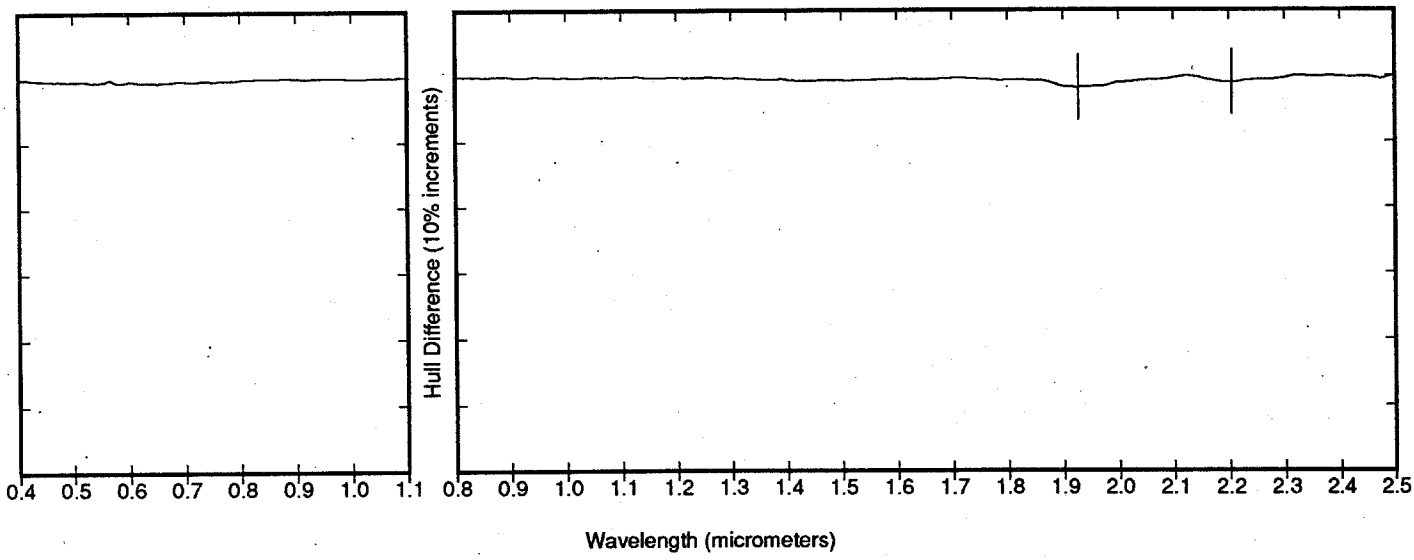
TECTOSILICATES



DESCRIPTION: QUARTZ,ROCK CRYSTAL
SAMPLE_NUM: TS-01A
COUNTRY: USA
POLITICAL_SUBDIVISION: ARKANSAS
GEOGRAPHICAL_REGION: MONTGOMERY COUNTY
SITE: MOUNT IDA
COLLECTOR: BURMINCO
MINERALOGY: QUARTZ(A)
CHEMICAL FORMULA: SiO_2

332

QUARTZ,ROCK CRYSTAL (TS-01A)

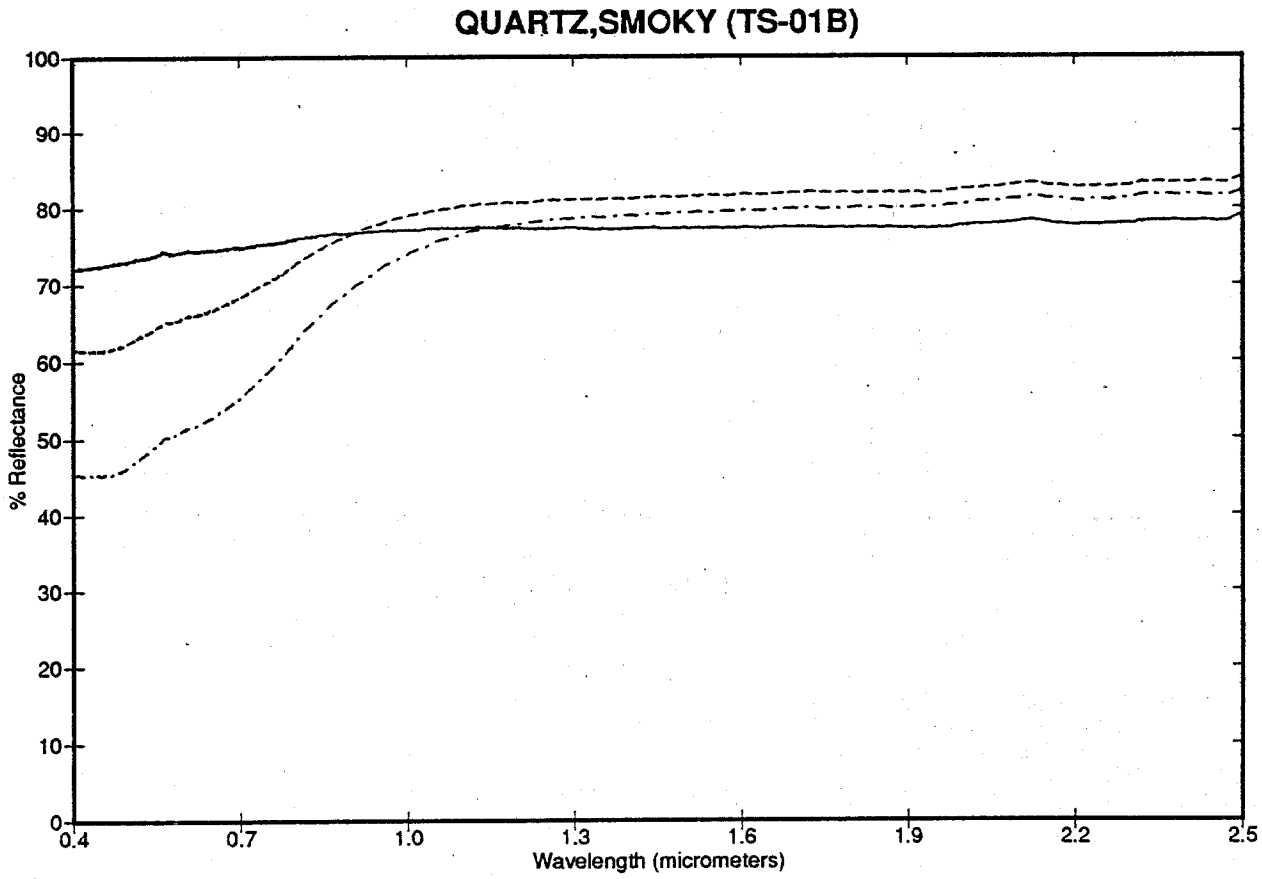


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 14.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9280	1.7230	0.6066	2.3686
2.2040	1.0180	0.1256	0.5710

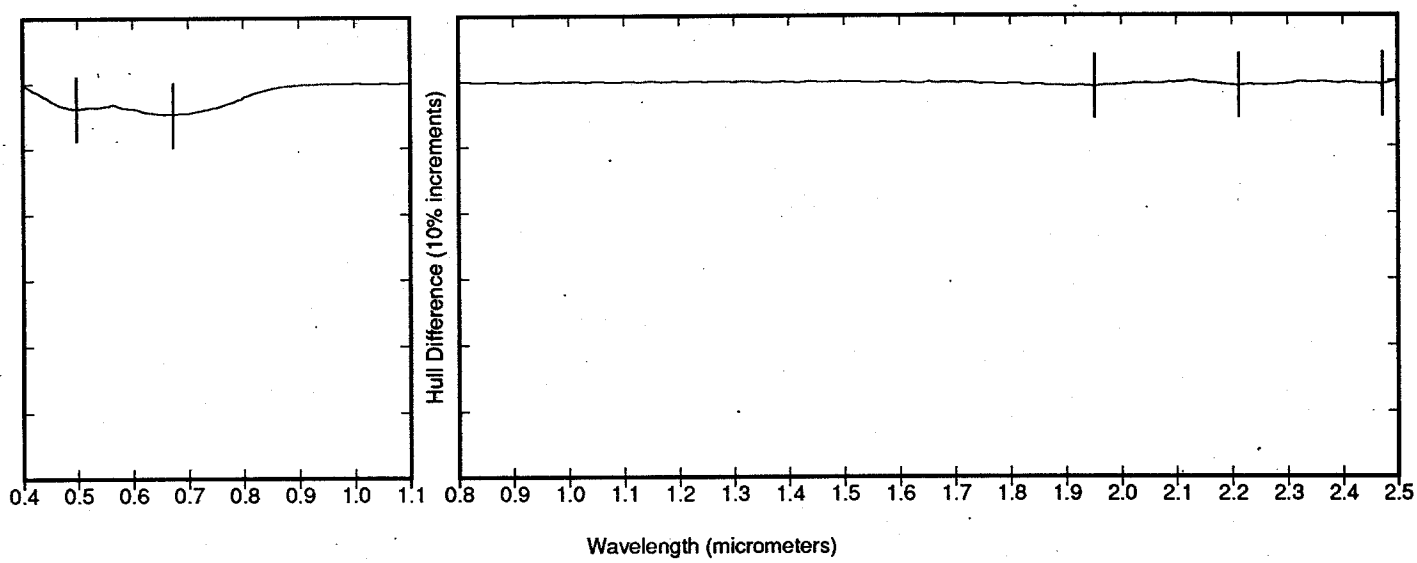
333



DESCRIPTION: QUARTZ,SMOKY
SAMPLE_NUM: TS-01B
COUNTRY: BRAZIL
POLITICAL_SUBDIVISION: MINAS GERAIS
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: BURMINCO
MINERALOGY: QUARTZ(A)
CHEMICAL FORMULA: SiO_2

334

QUARTZ,SMOKY (TS-01B)



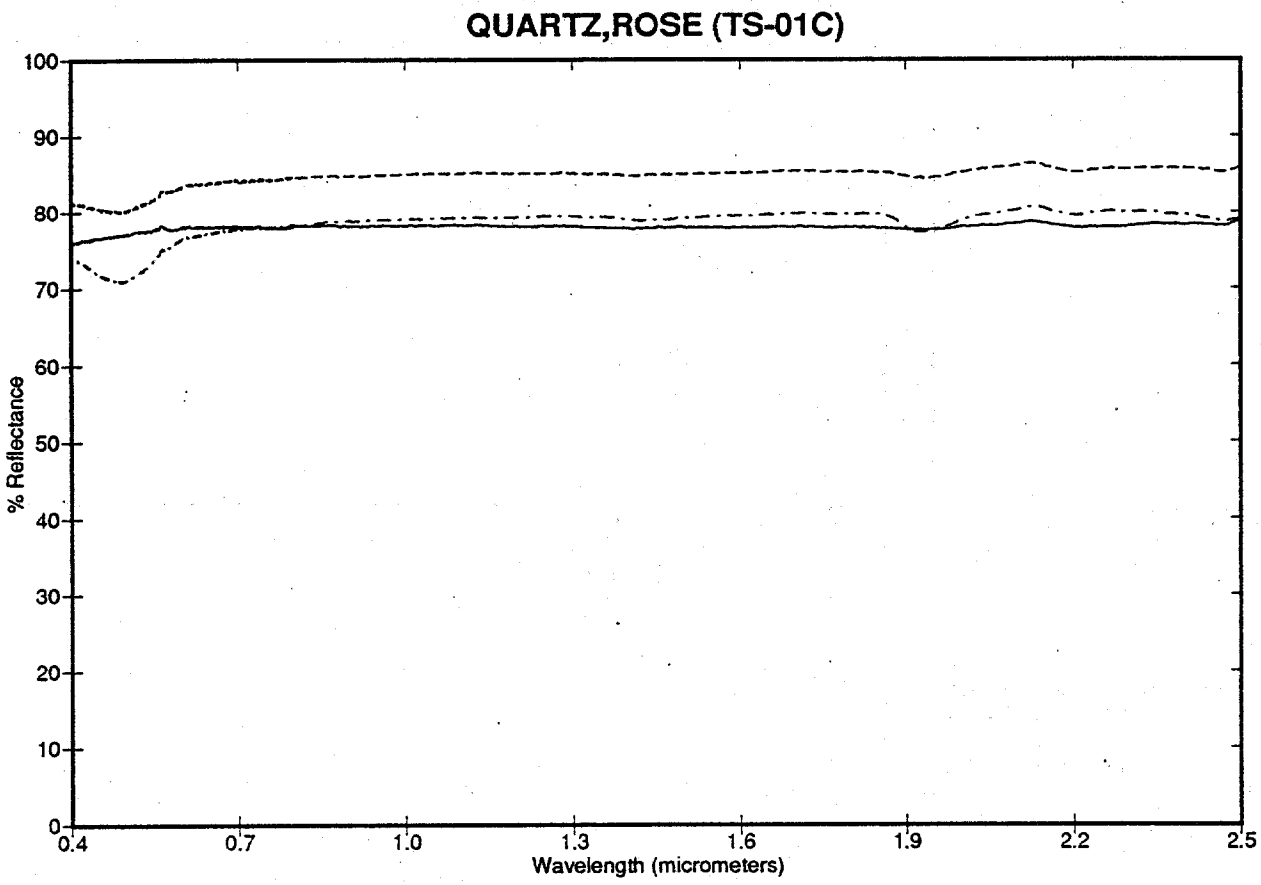
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6730	4.7891	1.0431	0.7757
0.4980	3.8920	0.4726	0.9433

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 11.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9520	0.8778	0.2205	1.8704
2.2120	0.8037	0.1071	0.5348
2.4720	0.5814	0.0377	3.5522

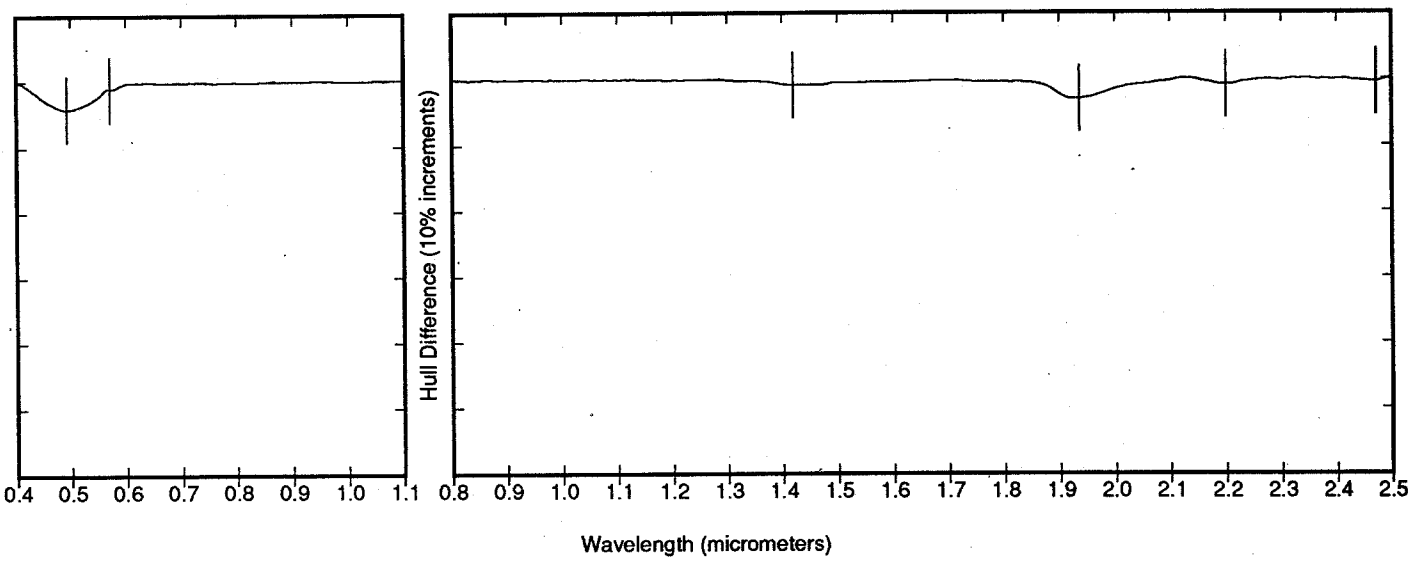
335



DESCRIPTION: QUARTZ,ROSE
SAMPLE_NUM: TS-01C
COUNTRY: USA
POLITICAL_SUBDIVISION: SOUTH DAKOTA
GEOGRAPHICAL_REGION: CUSTER COUNTY
SITE: CUSTER
COLLECTOR: WARD'S
MINERALOGY: QUARTZ(A)
CHEMICAL FORMULA: SiO_2

336

QUARTZ,ROSE (TS-01C)

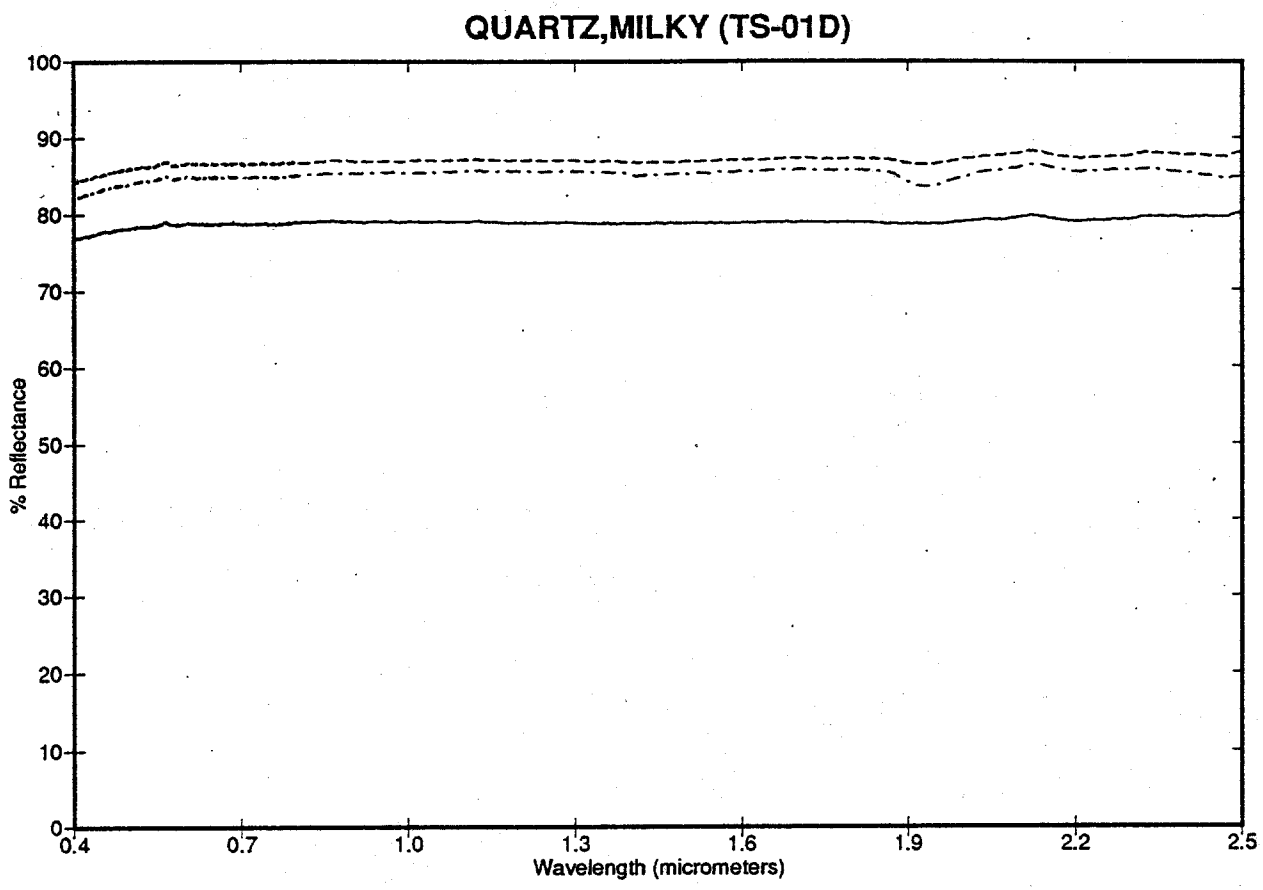


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4930	4.1810	0.4343	0.9420
0.5710	1.0929	0.0244	0.1507

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9360	3.0399	0.5524	1.2301
1.4200	0.9202	0.1401	0.6735
2.2000	0.8915	0.0707	0.8387
2.4720	0.5138	0.0265	3.0630



DESCRIPTION: QUARTZ,MILKY
SAMPLE_NUM: TS-01D
COUNTRY: USA
POLITICAL_SUBDIVISION: COLORADO
GEOGRAPHICAL_REGION: BUFFALO
SITE: BUFFALO
COLLECTOR: WARD'S
MINERALOGY: QUARTZ(A)
CHEMICAL FORMULA: SiO_2

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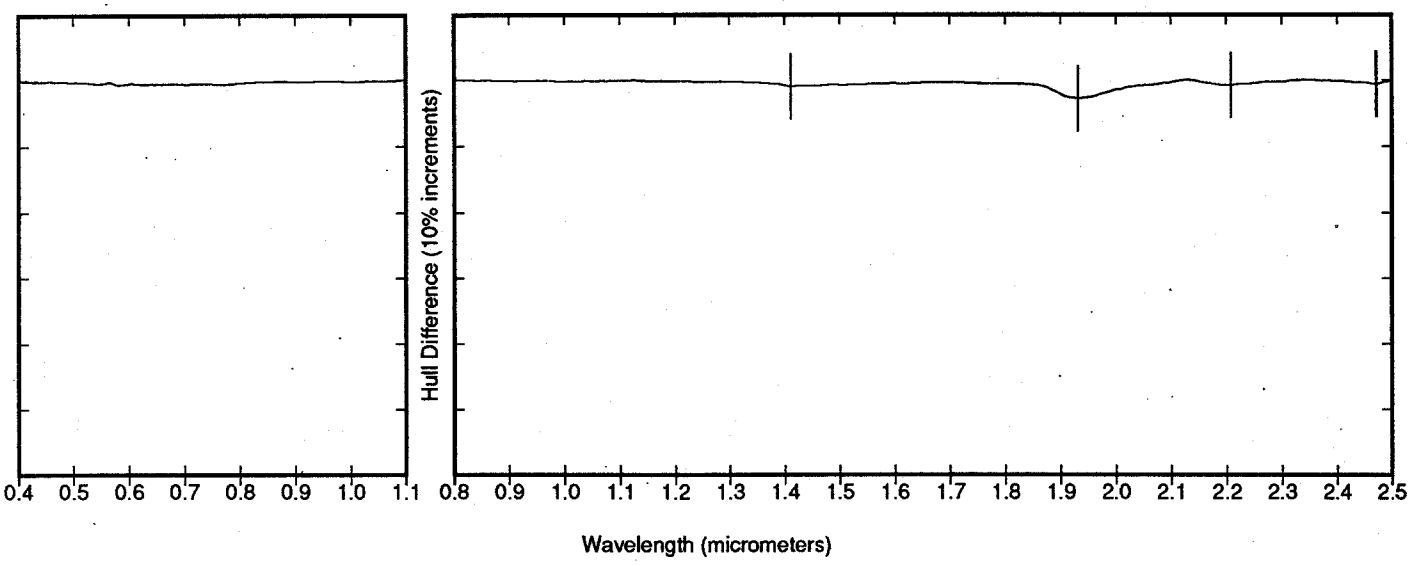
QUARTZ,MILKY (TS-01D)

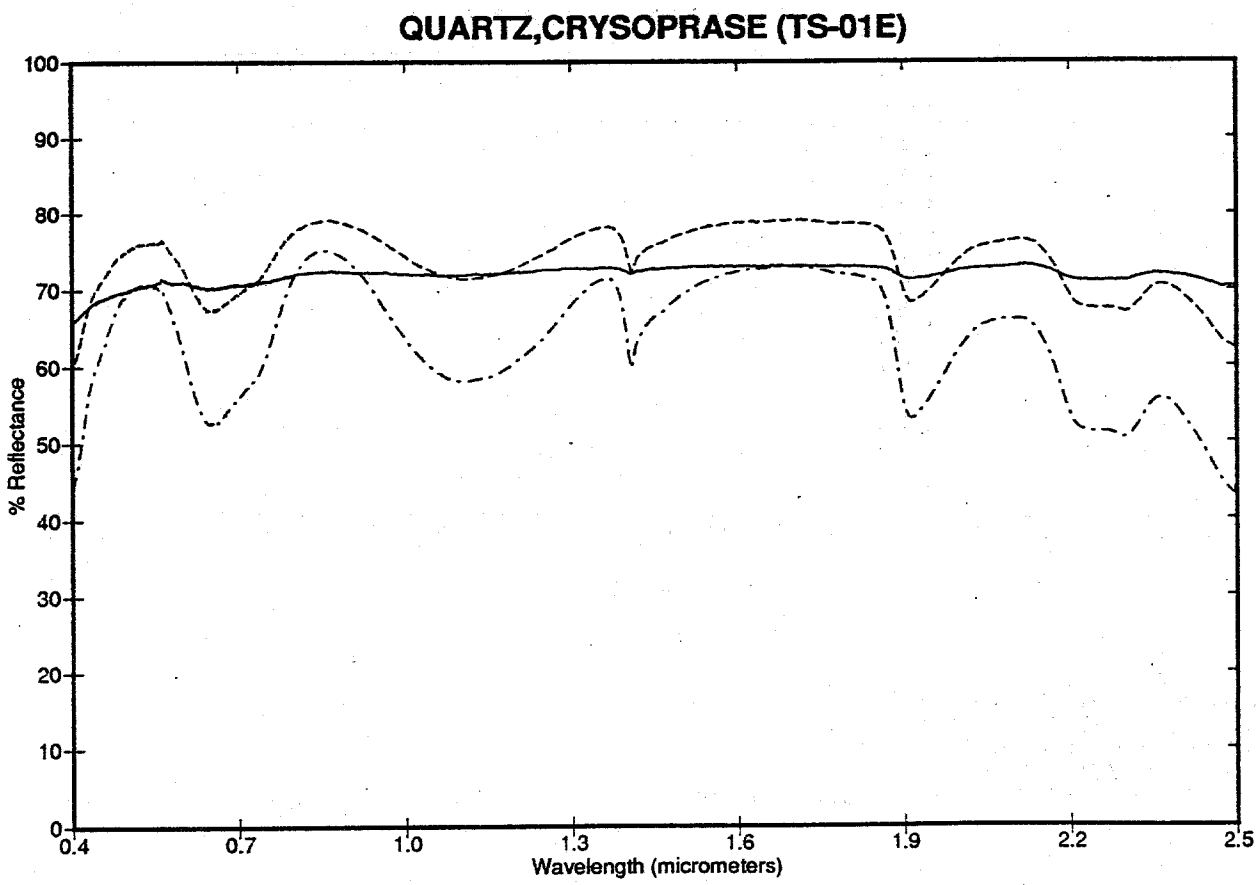


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9320	2.8338	0.5325	1.1194
1.4120	0.9849	0.2319	0.7281
2.2080	0.8059	0.0867	0.7594
2.4720	0.6083	0.0423	3.3711

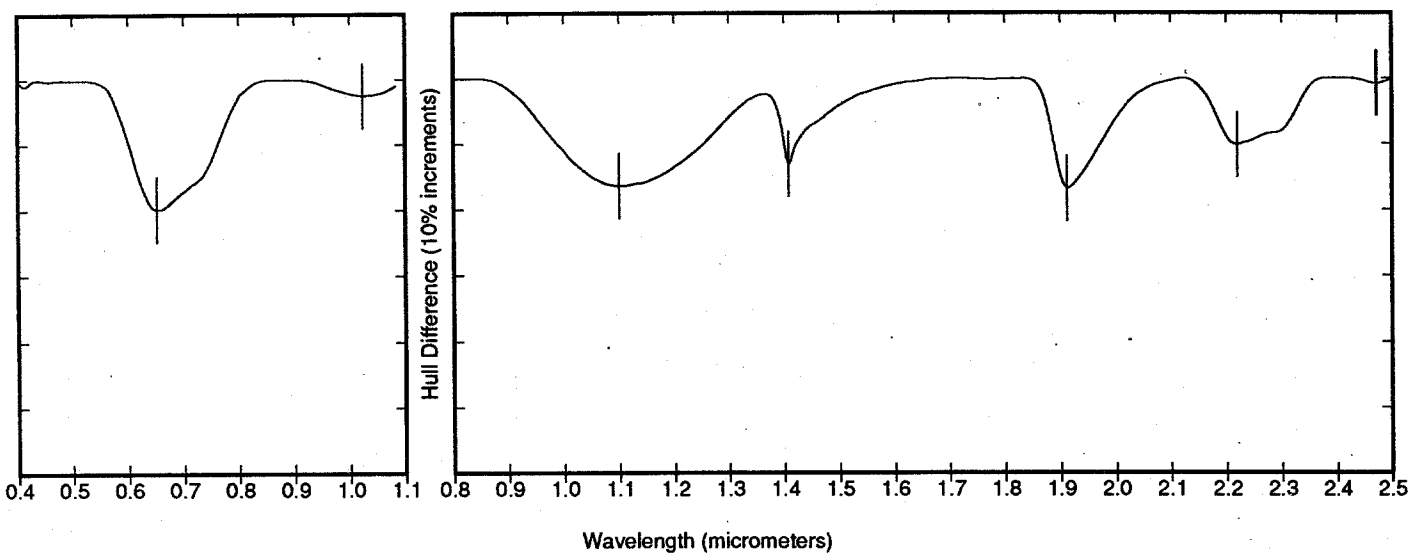
339



DESCRIPTION: QUARTZ,CRYSOPRASE
SAMPLE_NUM: TS-01E
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: QUARTZ(A)
CHEMICAL FORMULA: SiO_2

340

QUARTZ,CRYSOPRASE (TS-01E)



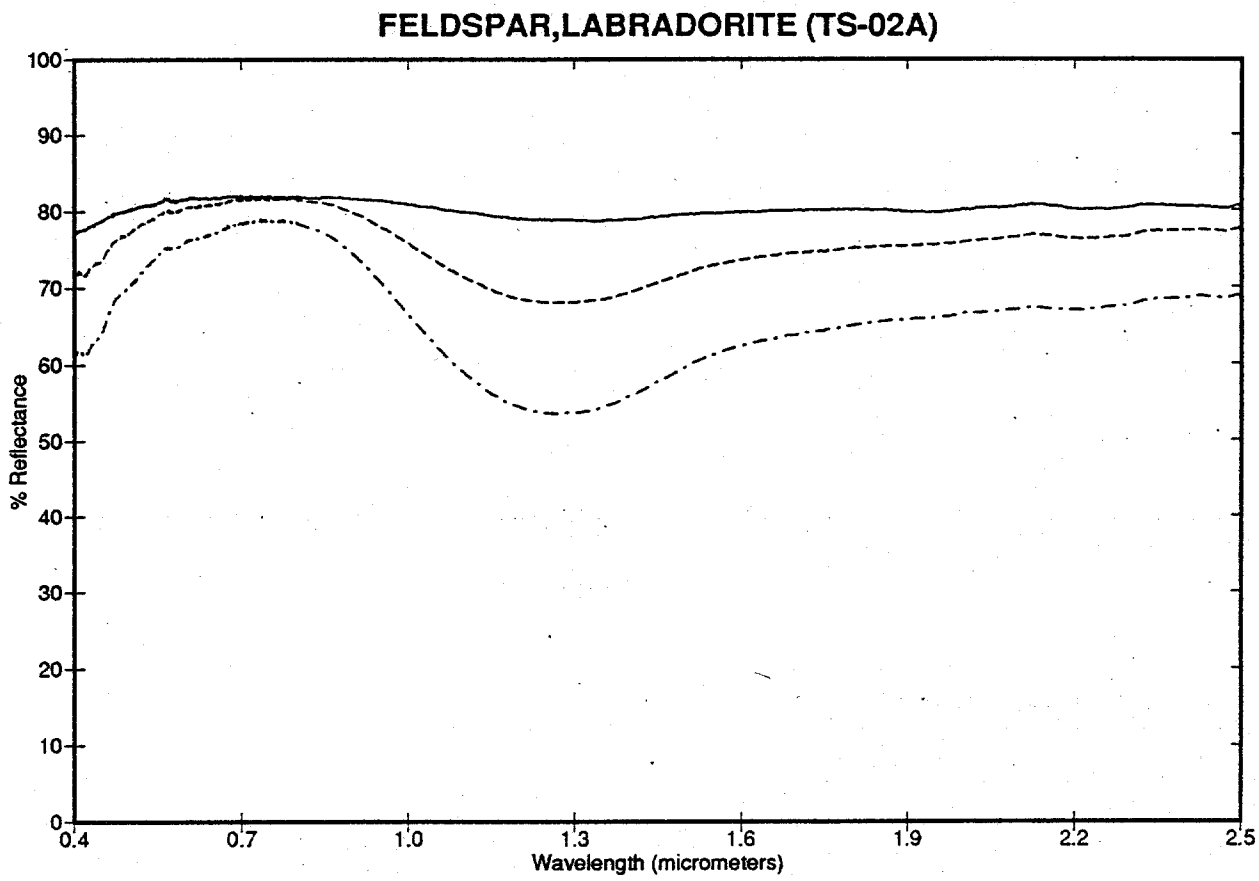
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 20.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6510	19.8591	3.1156	0.4910
1.0240	2.4937	0.2666	1.2044

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9120	16.8258	1.7900	0.3674
1.1000	16.4851	4.9078	0.7489
1.4080	13.1580	1.2081	0.2647
2.2200	10.1948	1.4278	0.4543
2.4720	0.8221	0.0345	1.4064

341



DESCRIPTION: FELDSPAR,LABRADORITE
SAMPLE_NUM: TS-02A
COUNTRY: MEXICO
POLITICAL_SUBDIVISION: SONORA
GEOGRAPHICAL_REGION: PINACATE
SITE: PINACATE
COLLECTOR: BURMINCO
MINERALOGY: LABRADORITE(A)
CHEMICAL FORMULA: $(Na_{0.46}K_{0.02}Ca_{0.51})\ Si_{2.49}Al_{1.51}O_8$*

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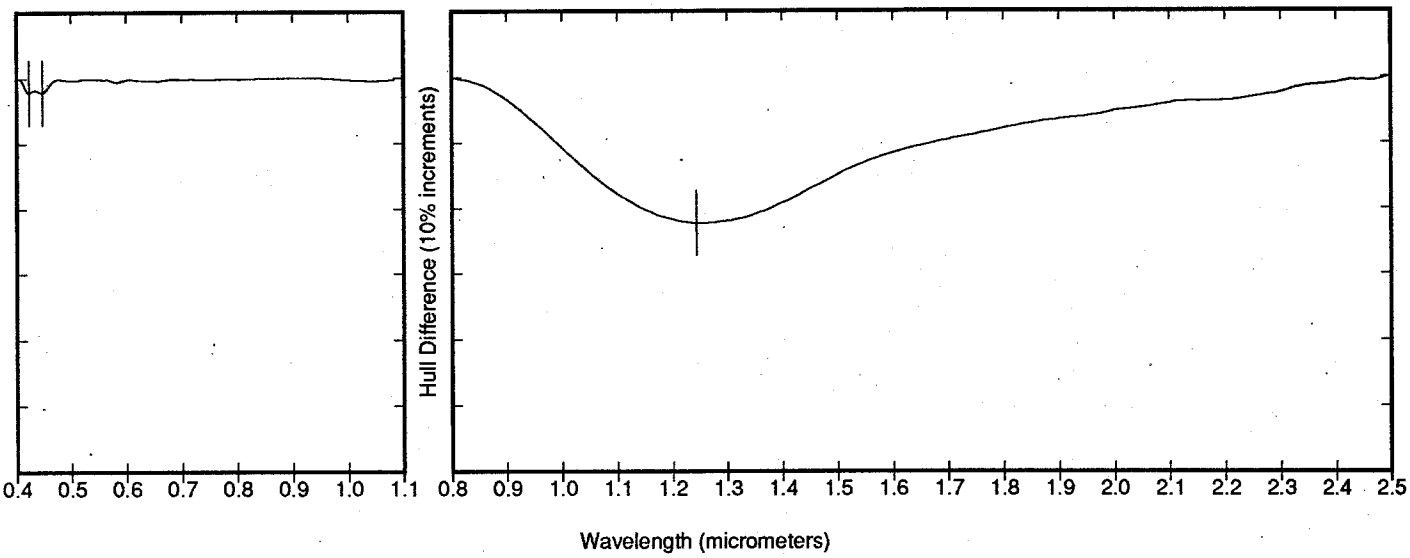
FELDSPAR,LABRADORITE (TS-02A)

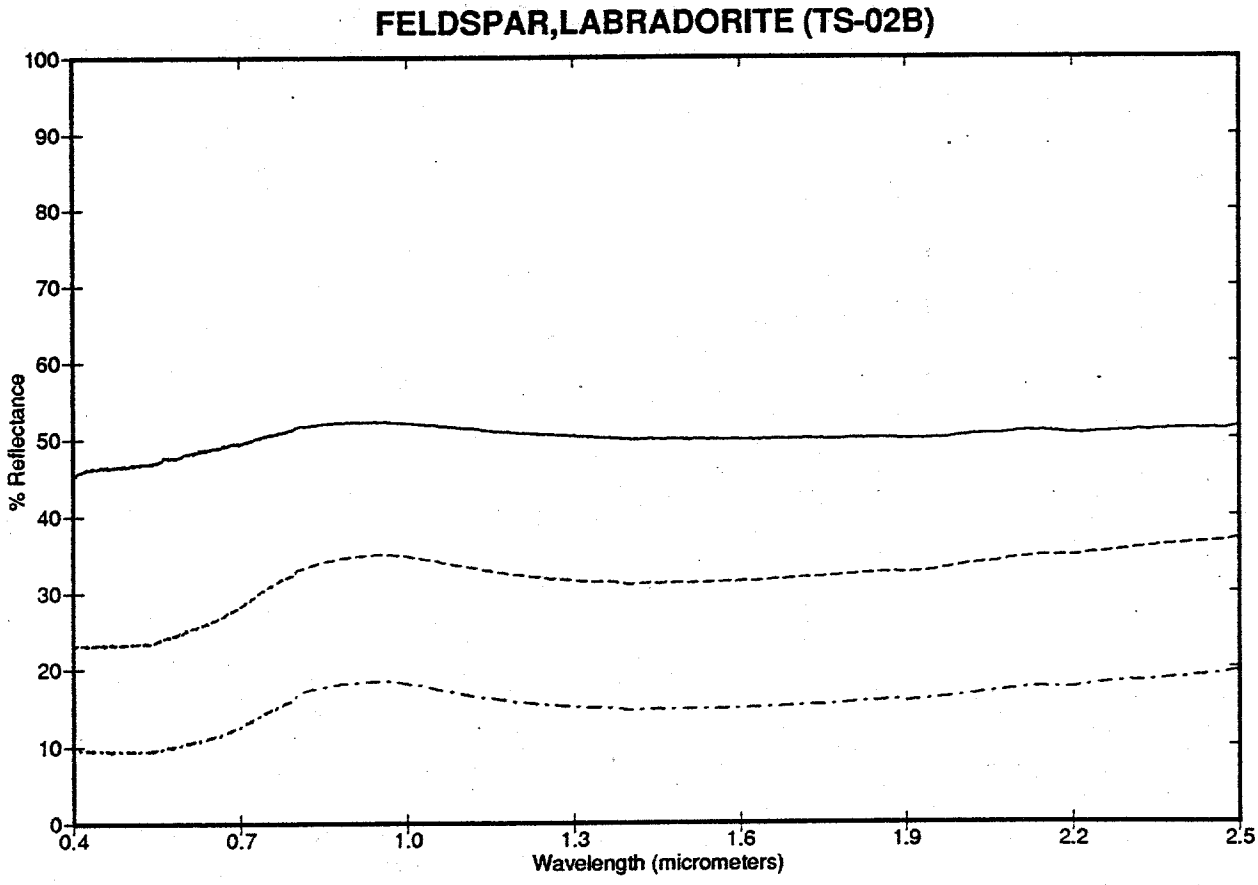


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.4230	2.1764	0.0436	0.8774
0.4470	2.1391	0.0536	0.8085

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

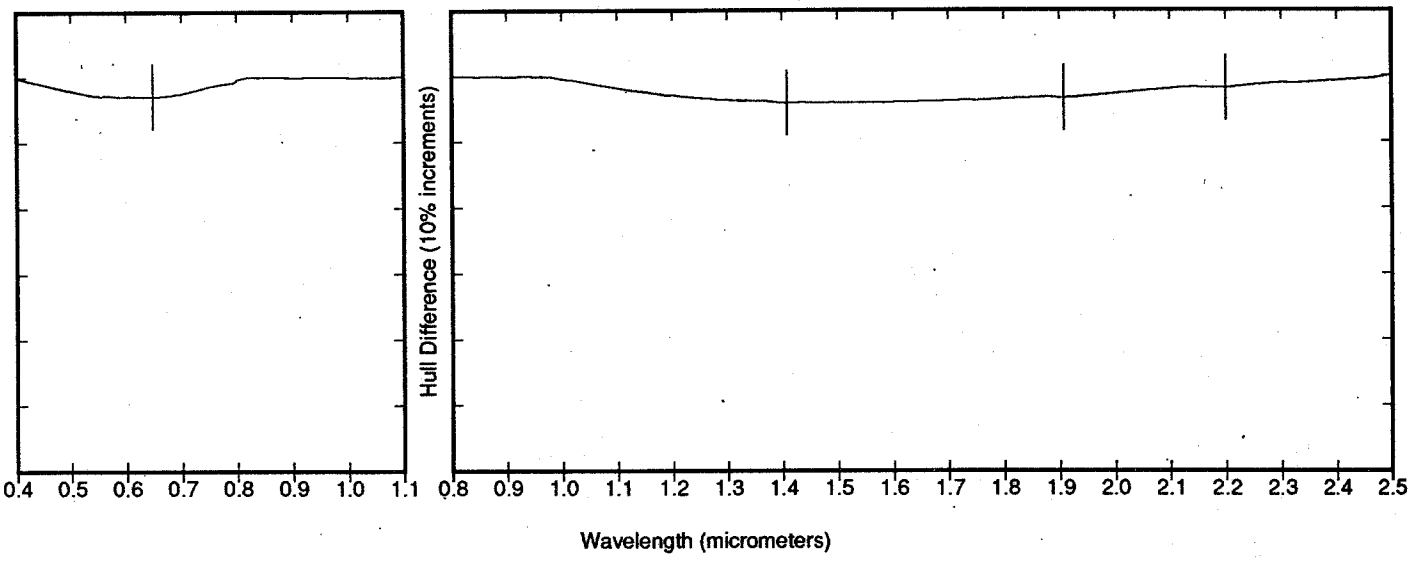
WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.2440	22.2149	16.1214	0.4814



DESCRIPTION: FELDSPAR,LABRADORITE
SAMPLE_NUM: TS-02B
COUNTRY: CANADA
POLITICAL_SUBDIVISION: QUEBEC
GEOGRAPHICAL_REGION: LAKE ST. JOHN
SITE: LAKE ST.JOHN
COLLECTOR: WARD'S
MINERALOGY: LABRADORITE(A)
CHEMICAL FORMULA: $(Na_{0.34}K_{0.01}Ca_{0.65})\ Si_{2.35}Al_{1.65}O_8$*

344

FELDSPAR,LABRADORITE (TS-02B)



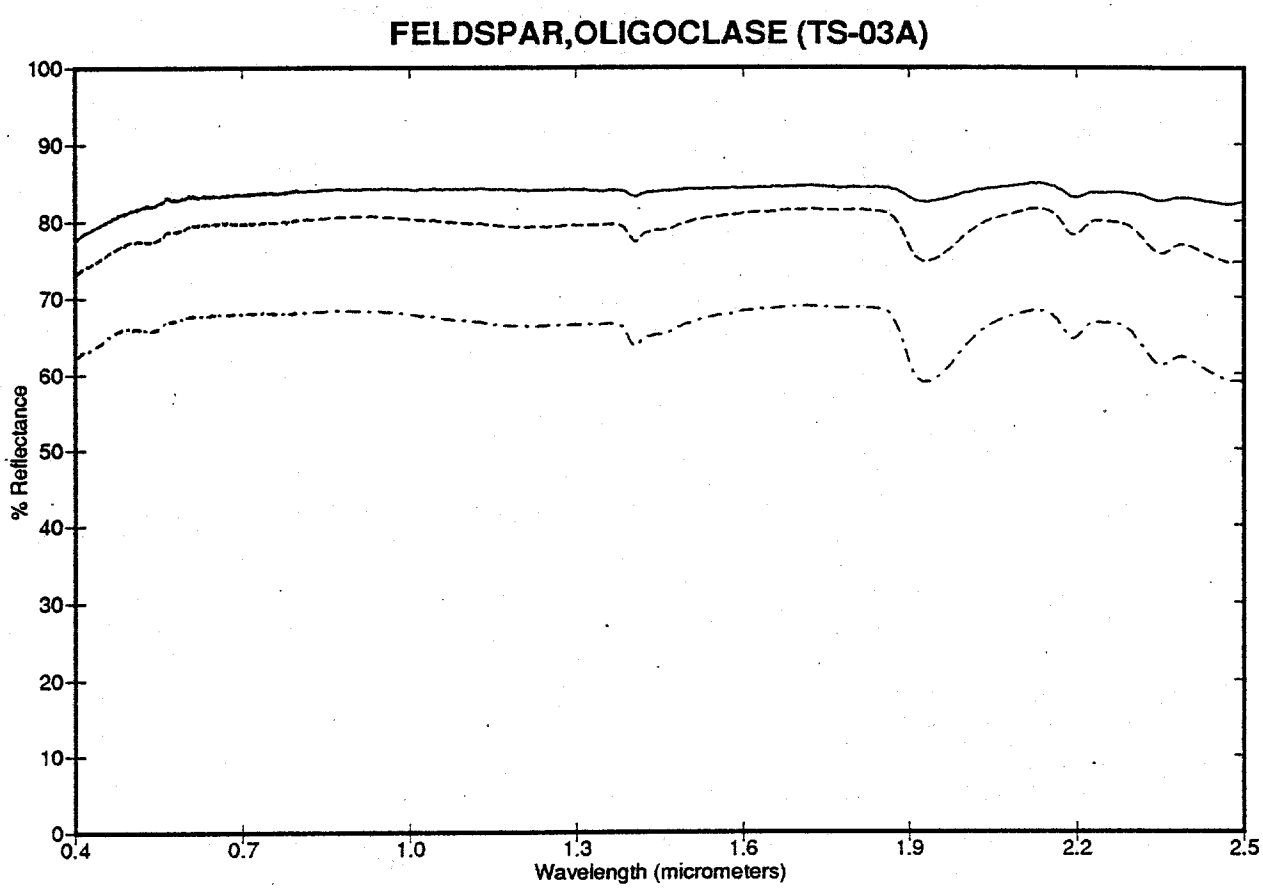
VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 27.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6480	2.9124	0.7951	1.7154

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 7.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4080	4.1463	2.9593	0.6048
1.9080	3.4116	0.6809	0.1099
2.2000	1.9068	0.3895	0.3347

345



DESCRIPTION: FELDSPAR,OLIGOCLASE
SAMPLE_NUM: TS-03A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: OLIGOCLASE(A)
CHEMICAL FORMULA: $(Na_{0.75}K_{0.03}Ca_{0.22})\ Si_{2.78}(Al_{1.21}Fe^{3+}_{0.01})O_8$ *

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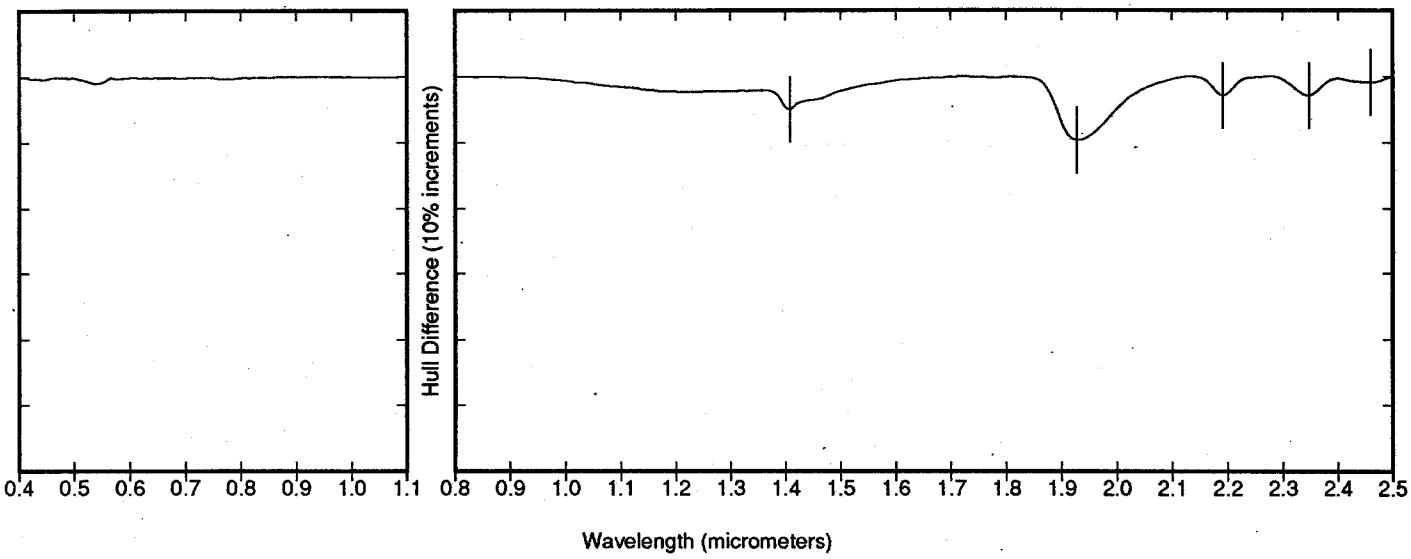
FELDSPAR,OLIGOCLASE (TS-03A)

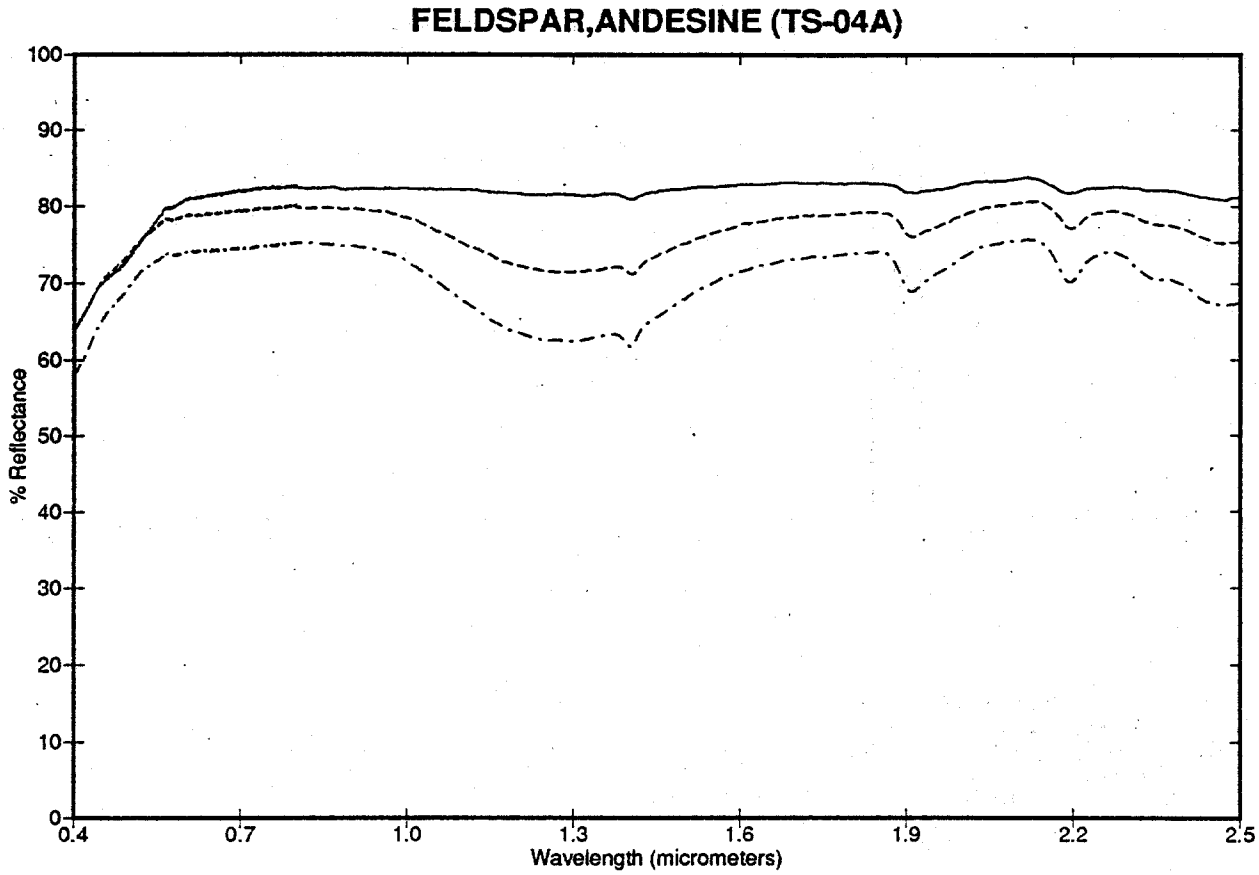


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9280	9.6706	1.1674	0.4827
1.4080	5.0222	1.3442	1.7427
2.1920	2.9097	0.1342	0.9111
2.3480	2.8982	0.1700	1.2138
2.4600	0.8908	0.0608	1.8723

347



DESCRIPTION: FELDSPAR,ANDESINE
SAMPLE_NUM: TS-04A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: ANDESINE(A)
CHEMICAL FORMULA: (Na,Ca) Al(Al,Si) Si_2O_8

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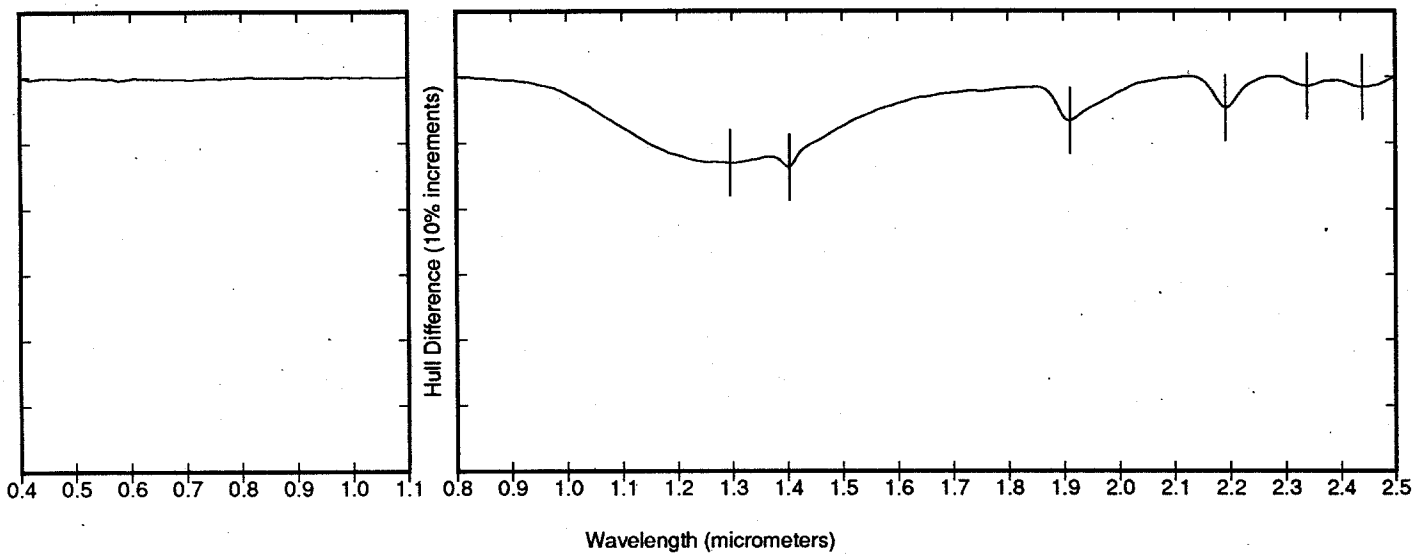
FELDSPAR,ANDESINE (TS-04A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 11.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4040	13.7088	2.6991	0.2600
1.2960	13.0645	3.6929	3.5419
1.9120	6.6972	0.7208	0.4669
2.1920	4.7560	0.2642	0.8105
2.4400	1.6190	0.1289	1.0883
2.3400	1.4429	0.0779	1.1835

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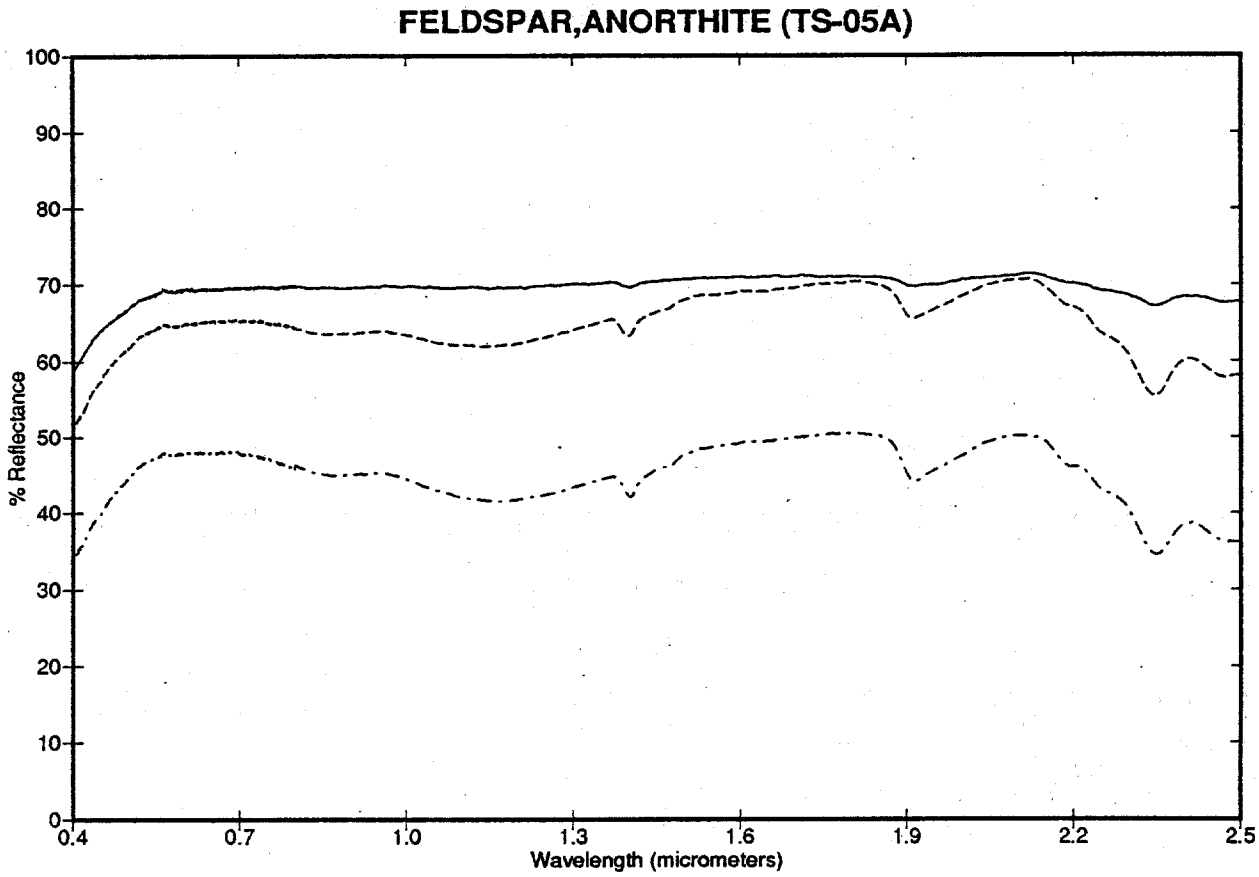

DESCRIPTION: FELDSPAR,ANORTHITE
SAMPLE_NUM: TS-05A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: ANORTHITE(A)
CHEMICAL FORMULA: $(Na_{0.07}Ca_{0.93})\ Si_{2.07}(Al_{1.91}Fe^{3+}_{0.02})\ O_8$ *

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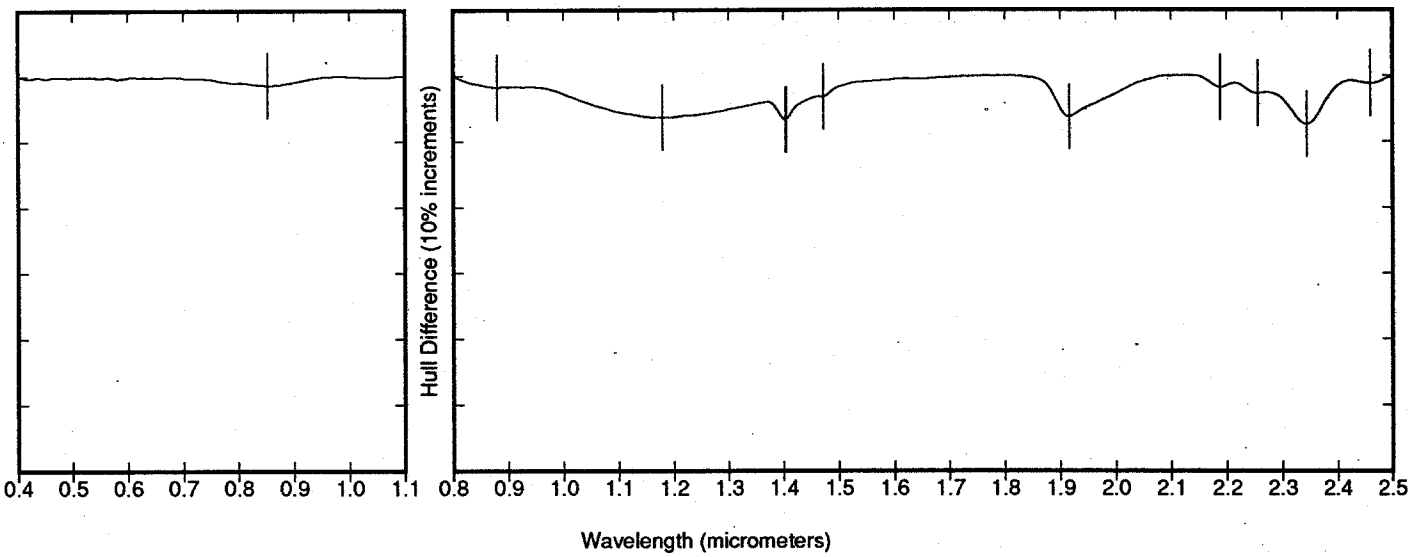
FELDSPAR,ANORTHITE (TS-05A)

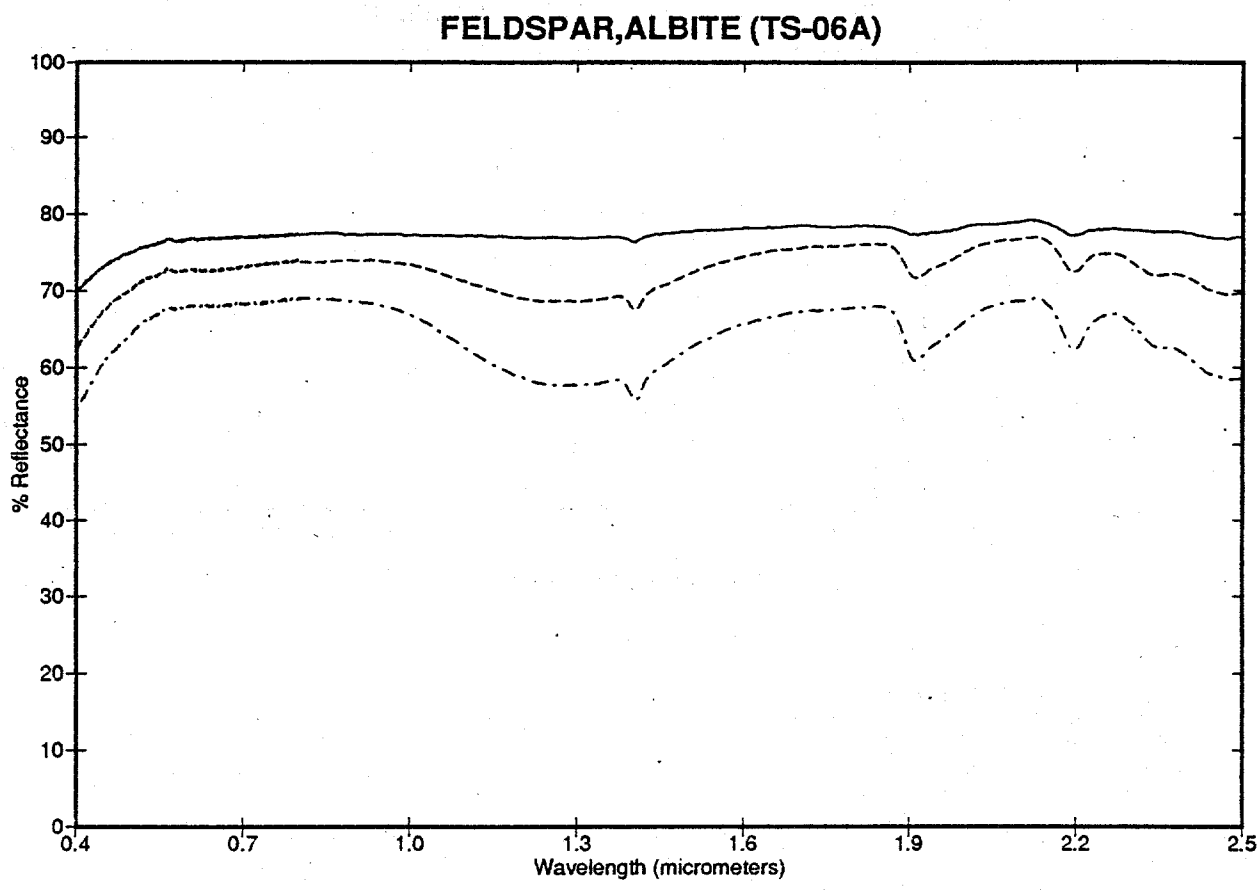


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.8520	1.3073	0.1387	0.7261

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.3440	7.4011	0.6270	1.1457
1.4040	6.6845	0.4459	0.7031
1.1800	6.3634	2.0609	1.0275
1.9160	6.2789	0.6725	0.4053
1.4720	3.2066	0.2427	0.1177
2.2560	2.7102	0.1271	2.0126
2.1880	1.8188	0.0745	1.0506
0.8800	1.7697	0.1774	1.0095
2.4600	1.2111	0.0627	1.1452



DESCRIPTION: FELDSPAR,ALBITE
SAMPLE_NUM: TS-06A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: ALBITE(A)
CHEMICAL FORMULA: $NaAlSi_3O_8$

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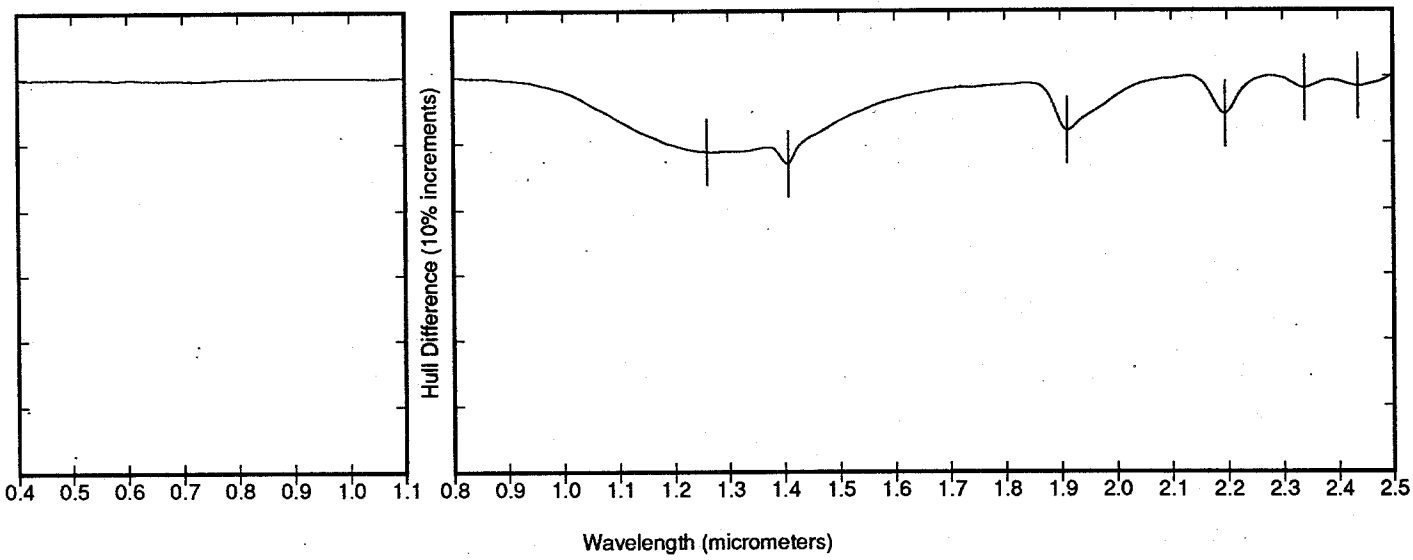
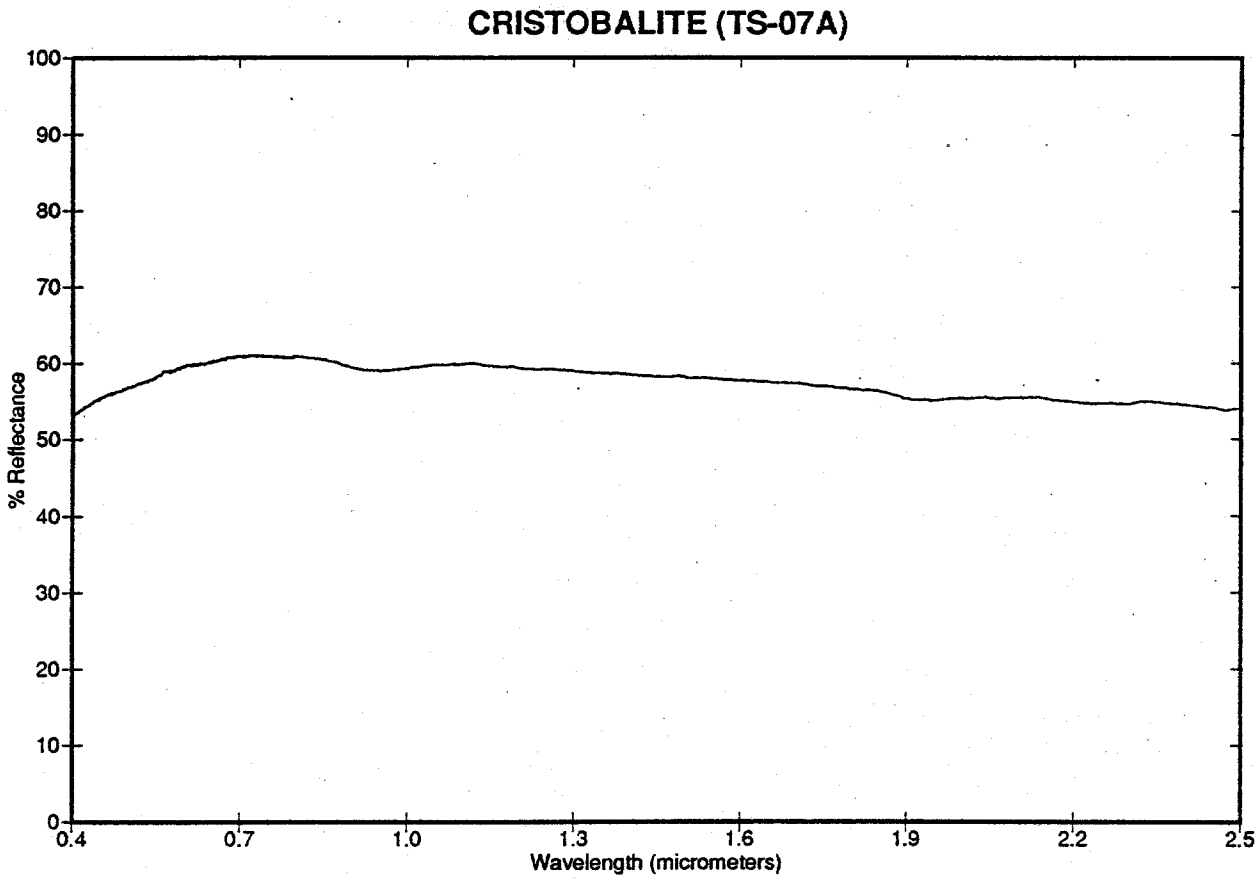
FELDSPAR,ALBITE (TS-06A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 10.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4080	13.1241	2.2977	0.2838
1.2600	11.3653	3.2528	1.7920
1.9120	8.1576	0.8704	0.4035
2.1960	5.7383	0.3150	0.9527
2.3400	1.8344	0.1113	0.8005
2.4360	1.5811	0.1098	0.7651



DESCRIPTION: CRISTOBALITE
SAMPLE_NUM: TS-07A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: INYO COUNTY
SITE: COSO RANGE,NEAR LITTLE LAKE
COLLECTOR: BURMINCO
MINERALOGY: CRISTOBALITE(A),SANIDINE(A)
CHEMICAL FORMULA: SiO_2

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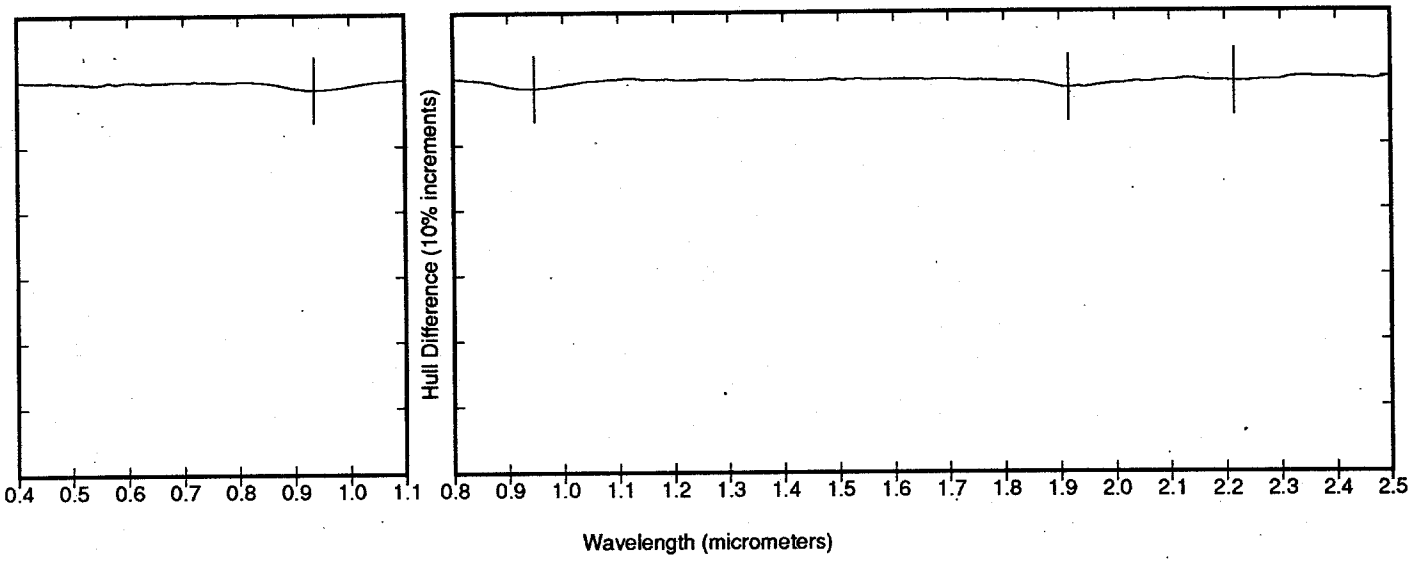
CRISTOBALITE (TS-07A)

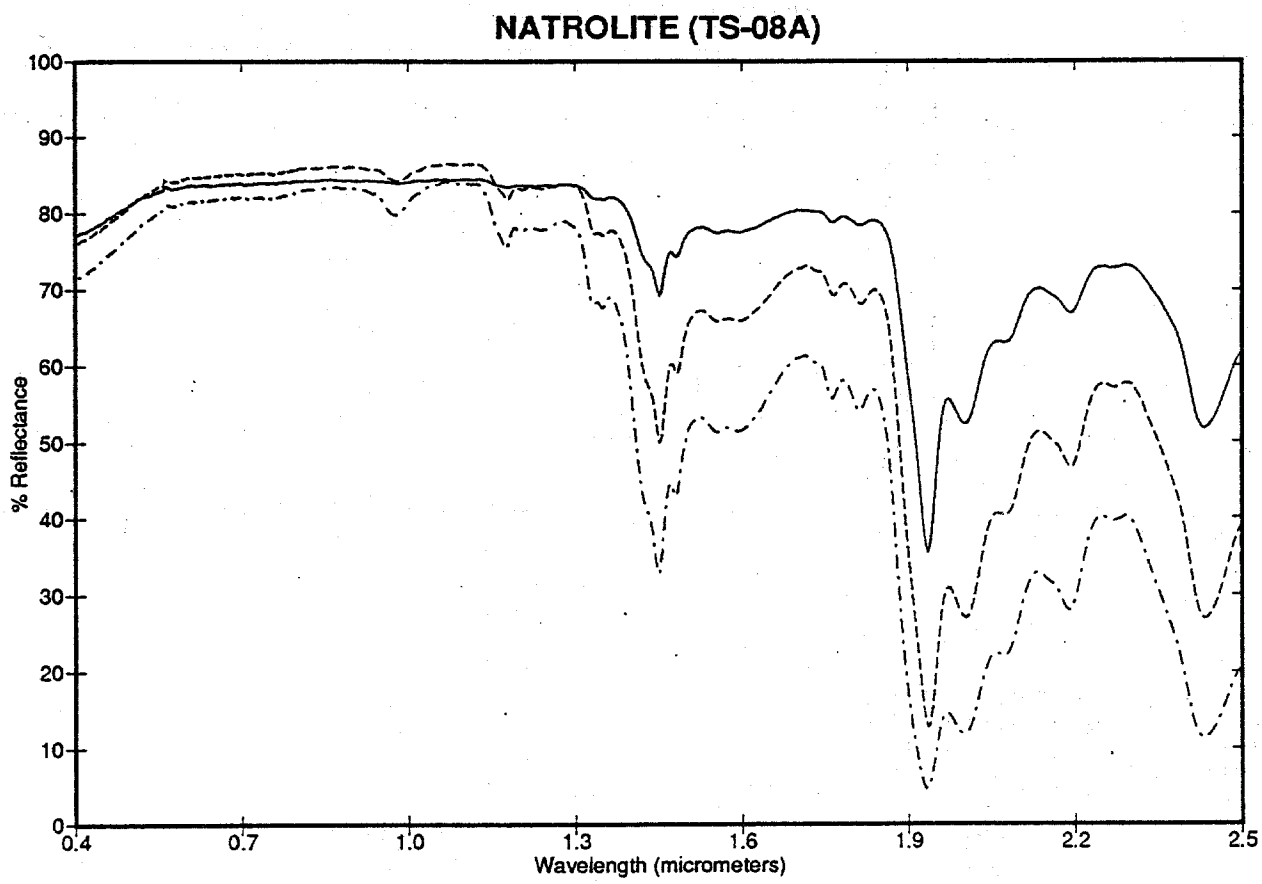


VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9360	1.3646	0.1916	0.8066

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9160	1.5789	0.4230	1.0664
0.9480	1.4783	0.2244	0.9769
2.2160	0.7030	0.0950	0.7337



DESCRIPTION: NATROLITE
SAMPLE_NUM: TS-08A
COUNTRY: INDIA
POLITICAL_SUBDIVISION: MAHARASHTRA
GEOGRAPHICAL_REGION: POONA
SITE: POONA
COLLECTOR: WARD'S
MINERALOGY: NATROLITE(A)
CHEMICAL FORMULA: $Na_2Al_2Si_3O_{10} \bullet 2H_2O$

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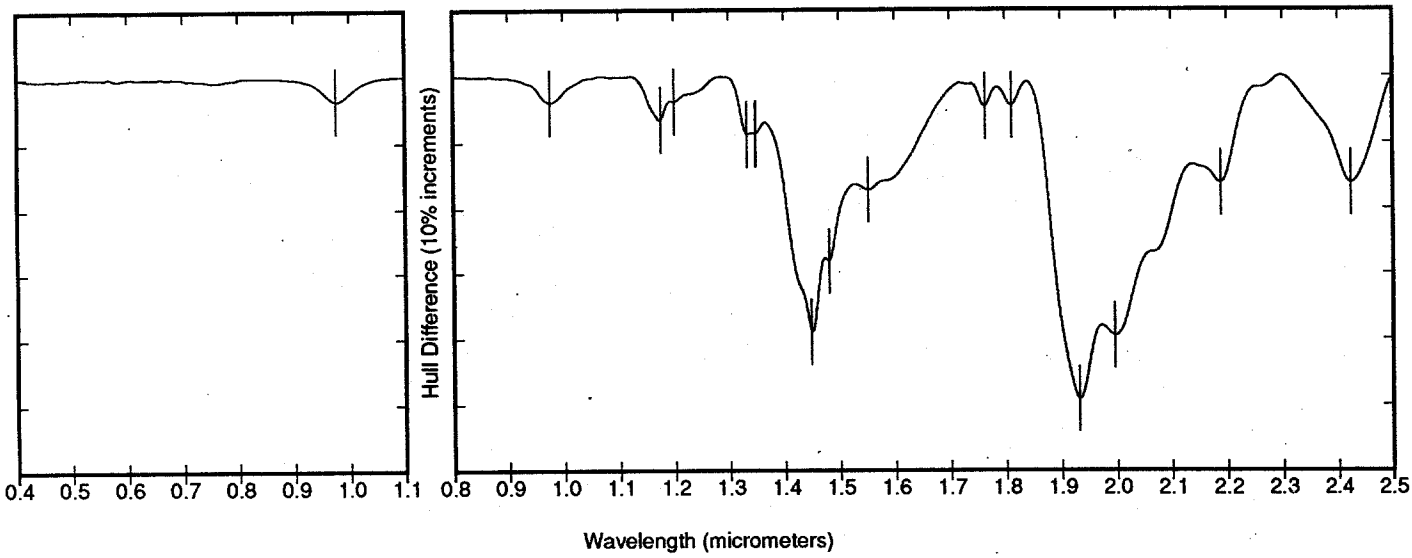
NATROLITE (TS-08A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9760	3.5446	0.2569	0.9415

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9320	49.1639	4.0581	1.3479
1.9960	39.5146	4.6739	0.2481
1.4480	38.8869	2.5912	2.2245
1.4800	28.0823	1.2716	0.2120
1.5520	17.1768	1.9974	0.2022
2.4240	16.1897	1.5260	1.1948
2.1880	16.1466	1.2590	1.2333
1.3320	8.7263	0.2272	1.1949
1.3480	8.6473	0.1596	0.2752
1.1760	6.5336	0.2575	1.7198
1.7640	4.5767	0.1633	1.4063
1.8120	4.4430	0.1466	1.1320
0.9760	3.9496	0.2685	0.9629
1.2000	3.7954	0.1825	0.0898

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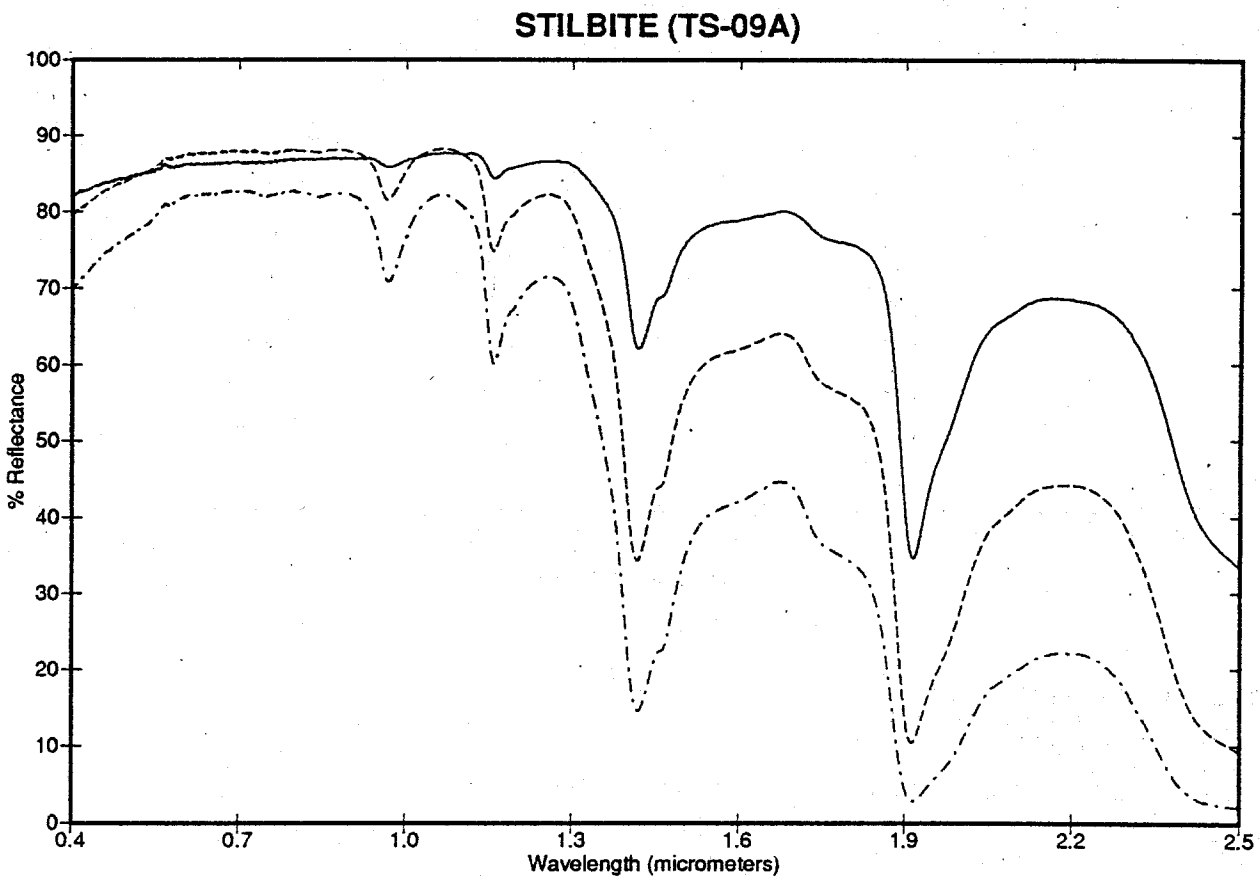

DESCRIPTION: STILBITE
SAMPLE_NUM: TS-09A
COUNTRY: INDIA
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: GRIEGER'S INC
MINERALOGY: STILBITE(A)
CHEMICAL FORMULA: $NaCa_2Al_5Si_3O_{36} \bullet 14H_2O$

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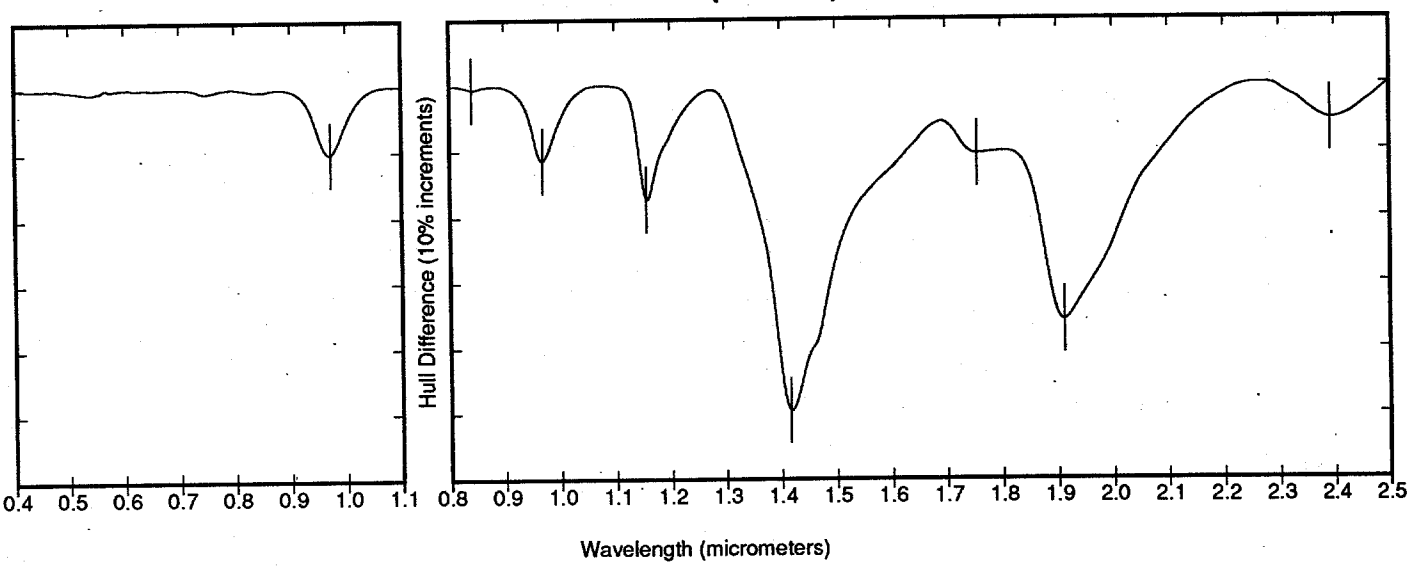
STILBITE (TS-09A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9720	10.2416	0.6958	0.9972

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.4160	49.4644	8.5095	0.4421
1.9120	35.6789	6.8862	0.4666
1.1560	17.3364	1.0673	0.3900
0.9680	11.4241	0.6832	0.7622
1.7560	10.5608	0.9897	1.1662
2.3920	5.4514	0.6564	0.8456
0.8400	0.5785	0.0189	0.7254

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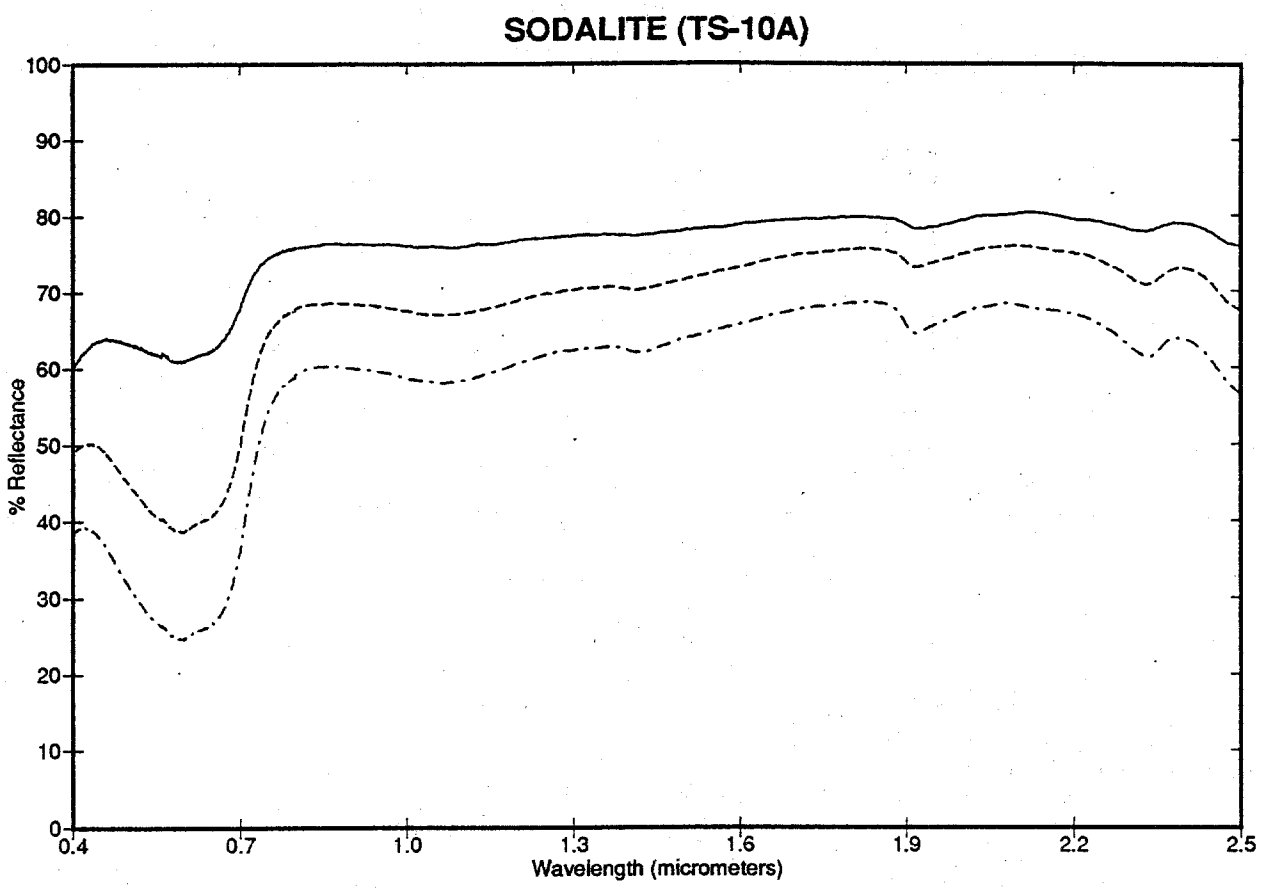

DESCRIPTION: SODALITE
SAMPLE_NUM: TS-10A
COUNTRY: CANADA
POLITICAL_SUBDIVISION: ONTARIO
GEOGRAPHICAL_REGION: HASTINGS COUNTY
SITE: BANCROFT
COLLECTOR: JPL
MINERALOGY: SODALITE(A),CALCITE(M)
CHEMICAL FORMULA: $Na_8Al_6Si_6O_{24}CL_2$

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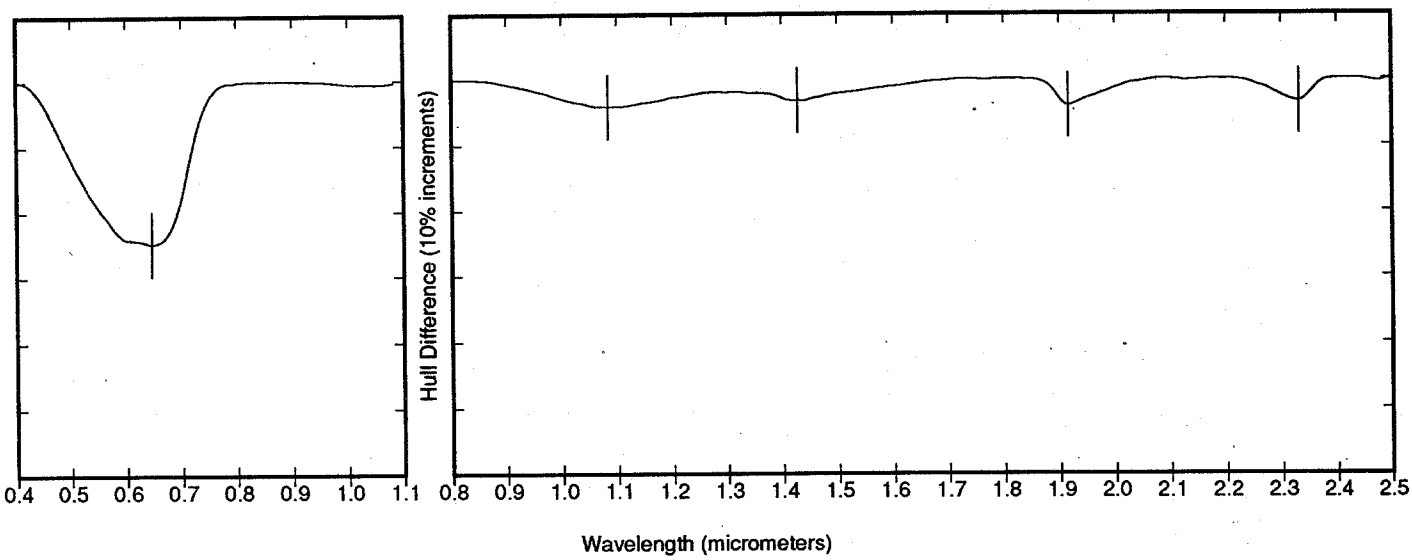
SODALITE (TS-10A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.6460	24.8015	5.1656	2.0130

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.0840	4.1405	1.1809	0.7221
1.9160	4.0450	0.3926	0.4058
2.3320	3.4091	0.2795	2.1240
1.4280	3.2266	0.6613	0.5853

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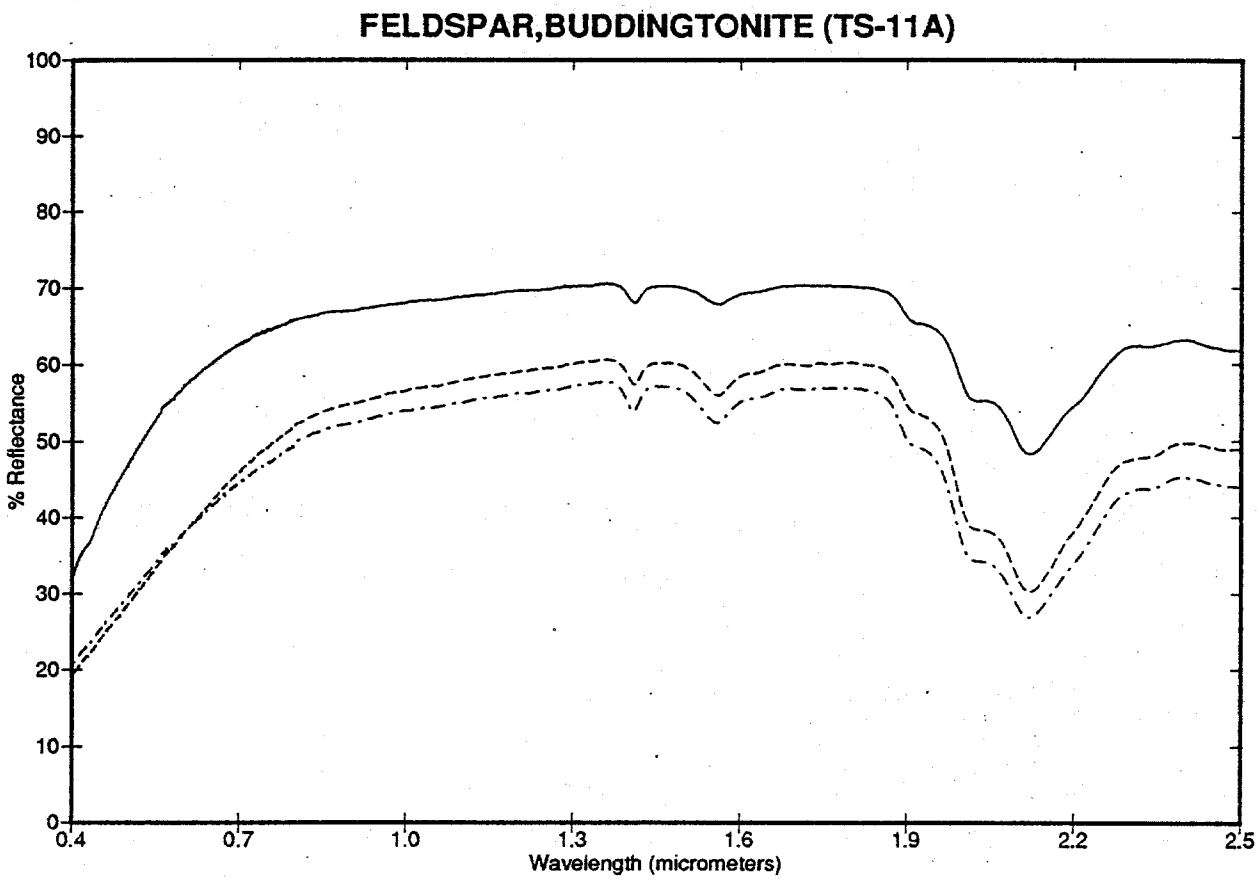

DESCRIPTION: FELDSPAR,BUDDINGTONITE
SAMPLE_NUM: TS-11A
COUNTRY: USA
POLITICAL_SUBDIVISION: CALIFORNIA
GEOGRAPHICAL_REGION: LAKE COUNTY
SITE: SULFUR BANK
COLLECTOR: KROHN,DENNIS
MINERALOGY: BUDDINGTONITE(A),ILLITE/SMECTITE CLAY(A)
CHEMICAL FORMULA: $(NH_4)\ AlSi_3O_8 \bullet 0.5H_2O$

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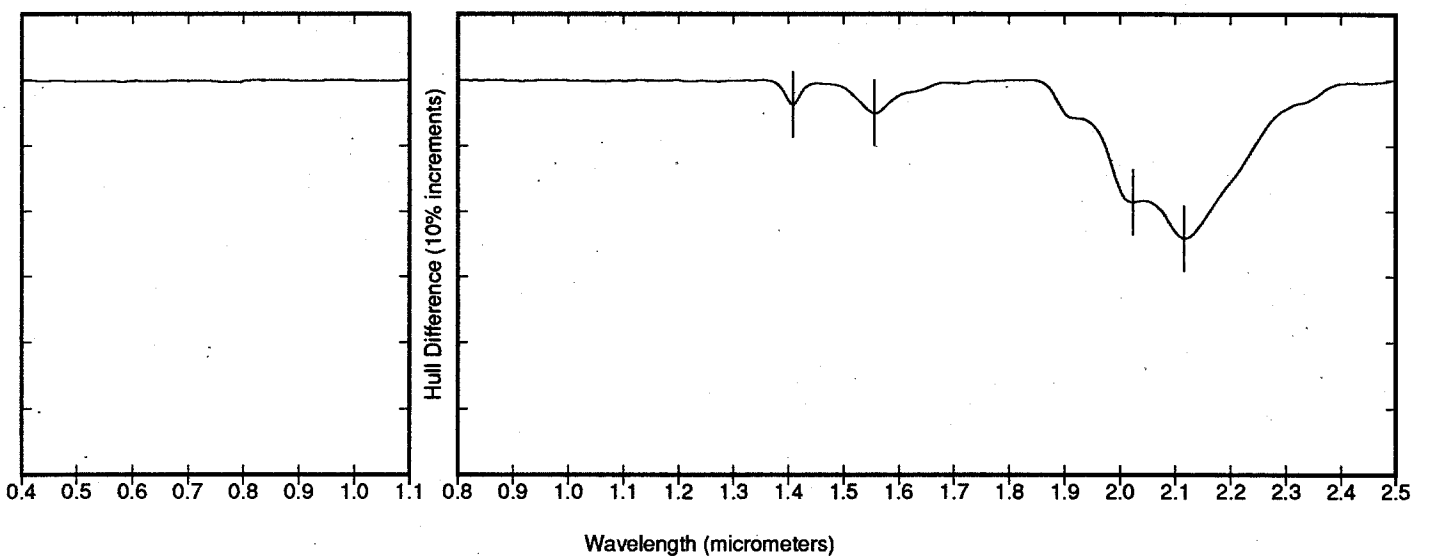
FELDSPAR,BUDDINGTONITE (TS-11A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.1160	24.1620	4.6503	0.5899
2.0240	18.5743	1.5085	9.1732
1.5560	5.0094	0.5230	0.6877
1.4080	3.7286	0.1902	1.8305

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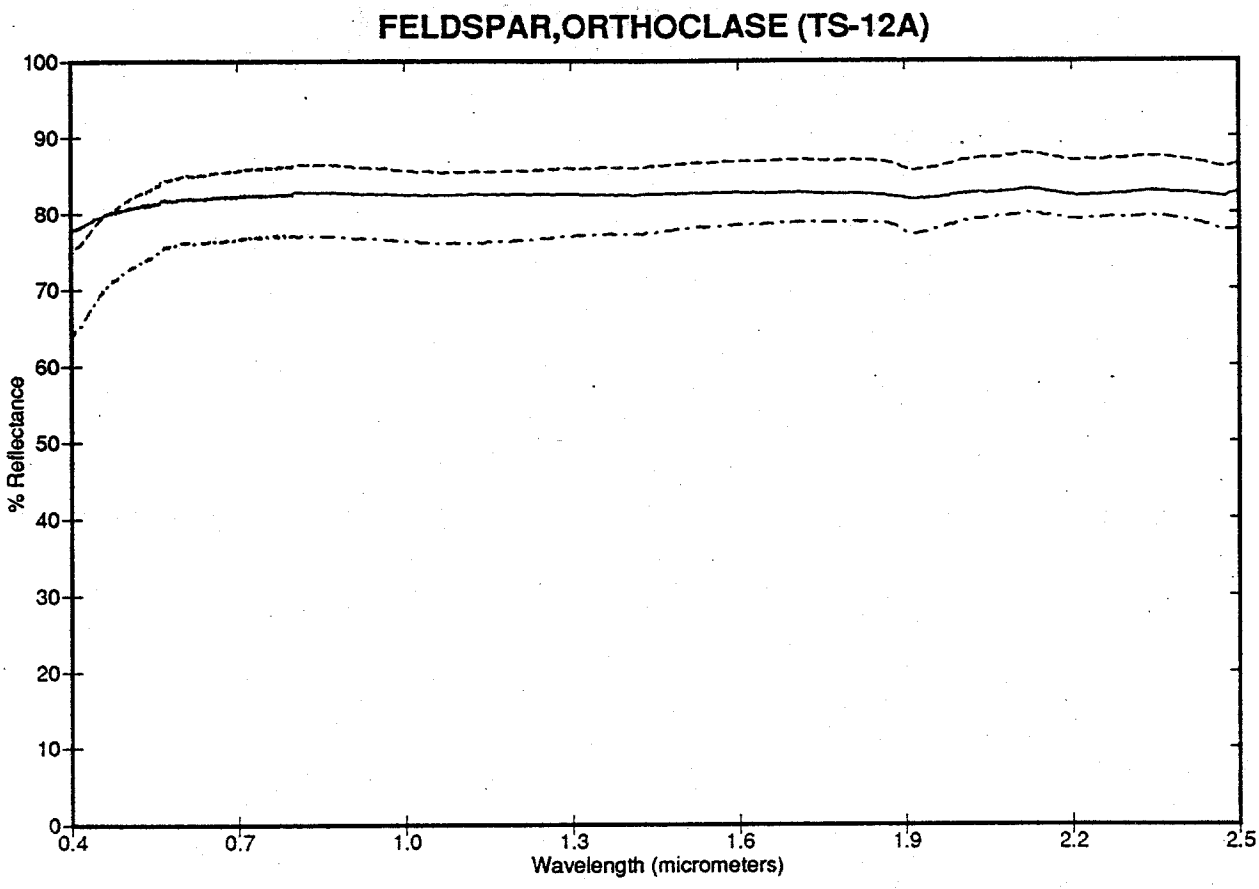

DESCRIPTION: FELDSPAR,ORTHOCLASE
SAMPLE_NUM: TS-12A
COUNTRY: INDIA
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: BURMINCO
MINERALOGY: ORTHOCLASE(A),ALBITE(T)
CHEMICAL FORMULA: $(K_{0.69}Na_{0.29}Ca_{0.01})\ Si_{2.99}Al_{1.01}O_8$*

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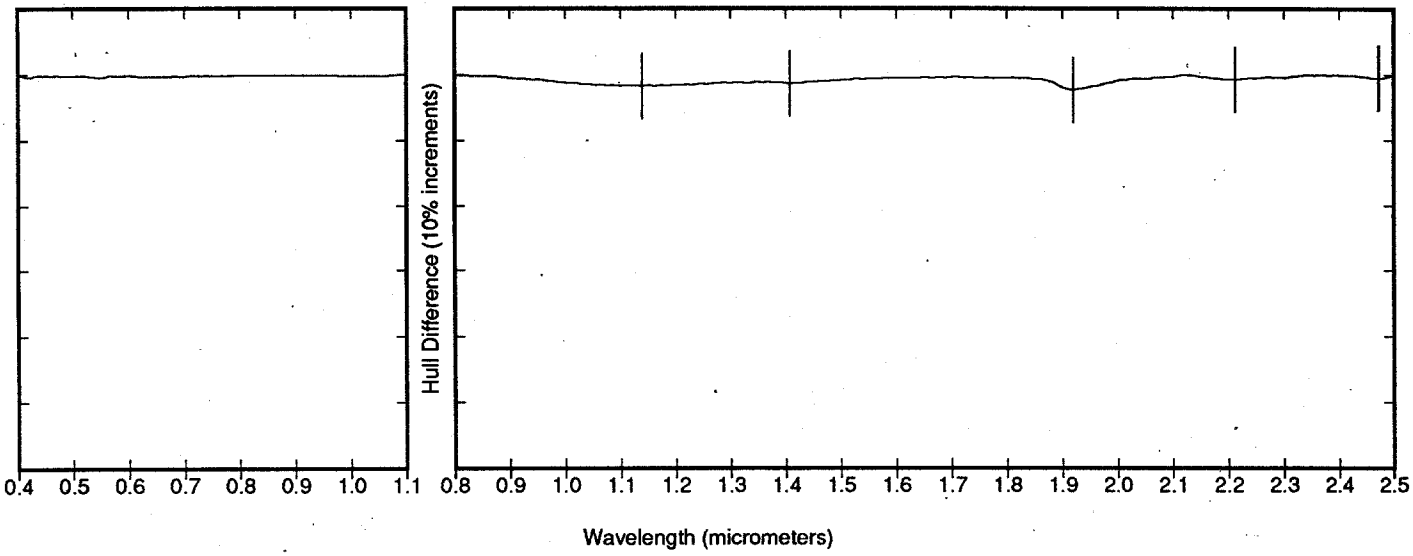
FELDSPAR,ORTHOCLASE (TS-12A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9200	2.3098	0.3676	0.9336
1.1400	1.7443	0.6630	0.9175
1.4080	1.3472	0.2061	0.1097
2.2120	0.7246	0.0774	0.9385
2.4720	0.5100	0.0322	2.5966

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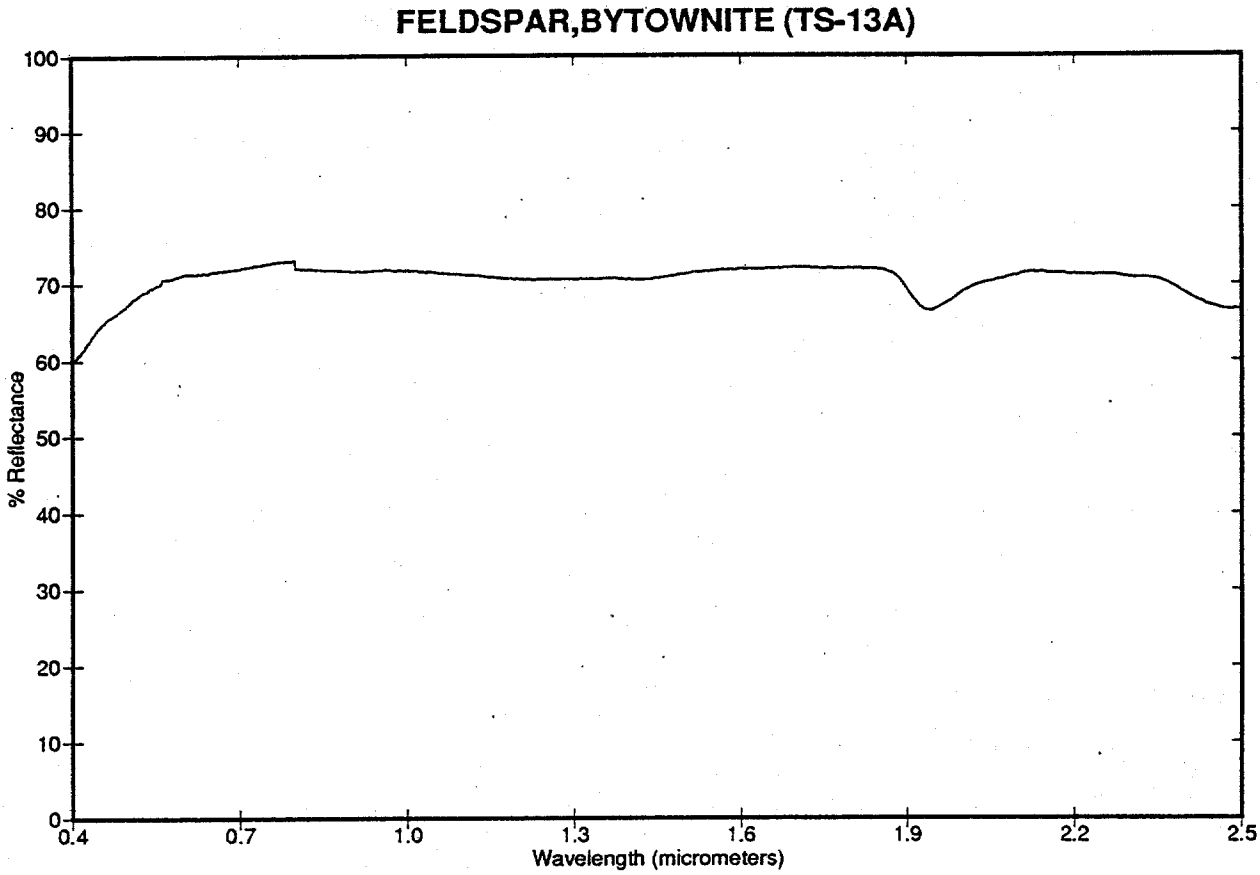

DESCRIPTION: FELDSPAR,BYTOWNITE
SAMPLE_NUM: TS-13A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: BYTOWNITE(A)
CHEMICAL FORMULA: (Na,Ca) Al(Al,Si) Si_2O_8

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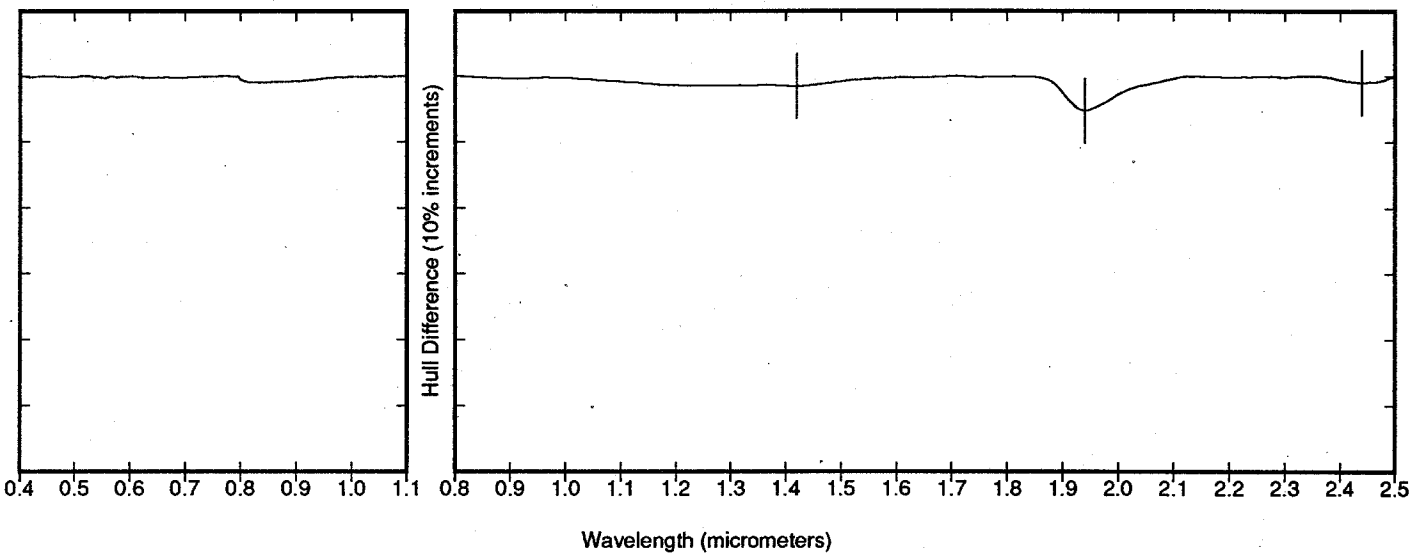
FELDSPAR,BYTOWNITE (TS-13A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9400	5.3150	0.6911	0.6119
1.4200	1.5605	0.6907	4.0155
2.4400	1.0075	0.0828	1.0701

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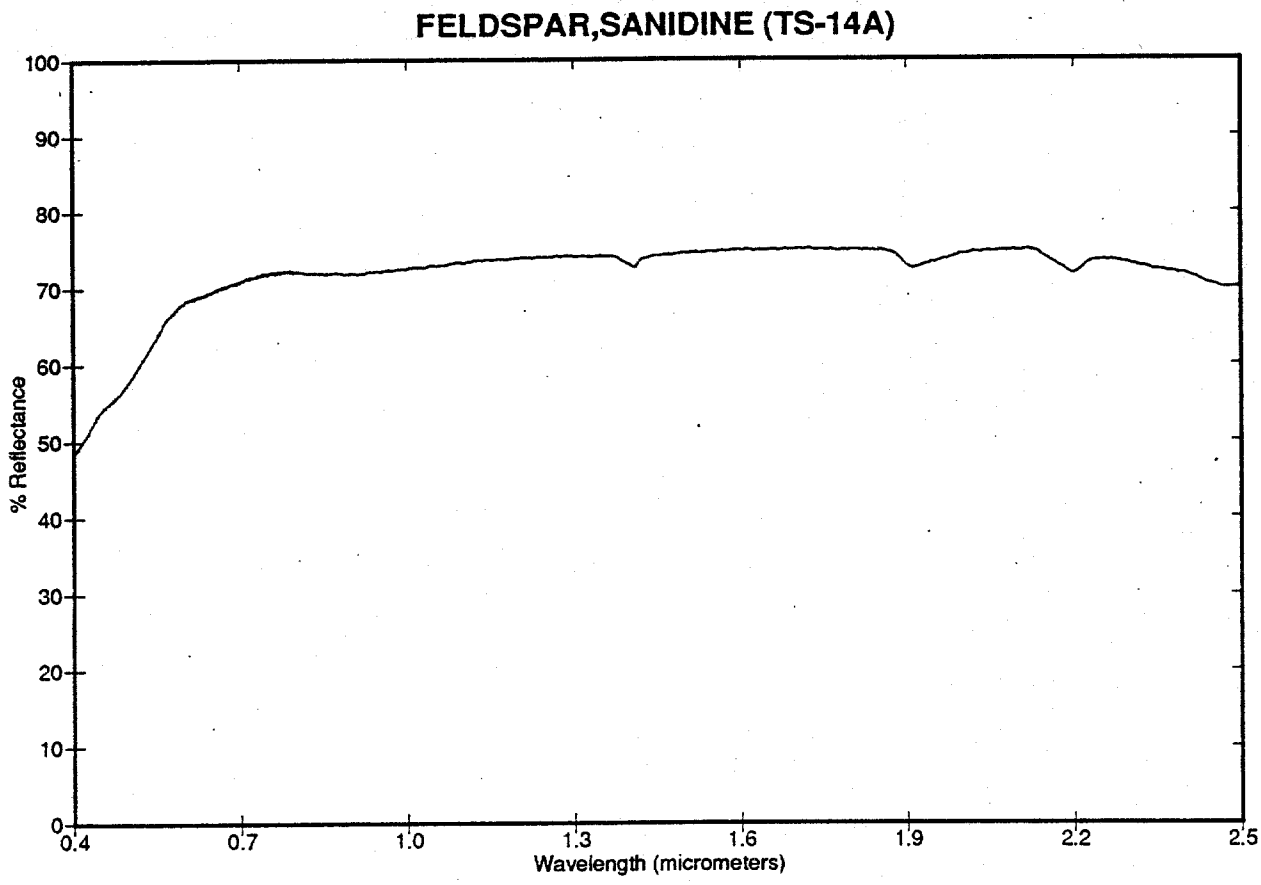

DESCRIPTION: FELDSPAR,SANIDINE
SAMPLE_NUM: TS-14A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: SANIDINE(A)
CHEMICAL FORMULA: (K,Na) $AlSi_3O_8$

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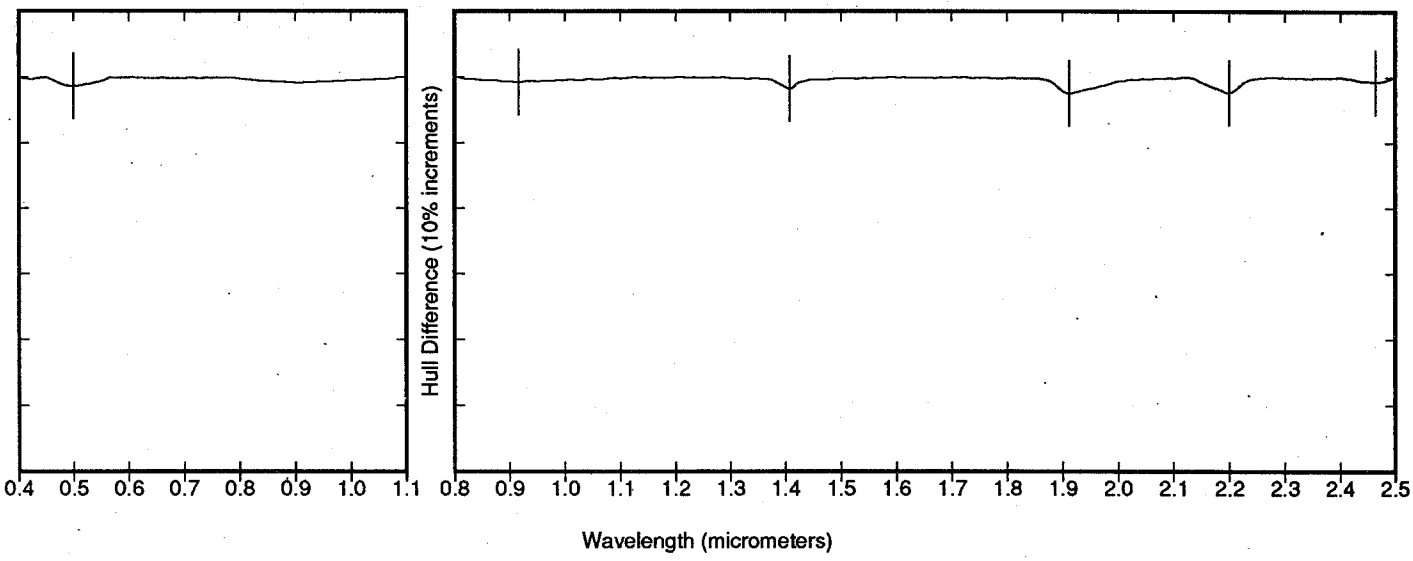
FELDSPAR,SANIDINE (TS-14A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 17.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5000	1.3578	0.1005	0.7481

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 13.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9120	2.4789	0.2484	0.4296
2.2000	2.3387	0.1480	1.4583
1.4080	1.7877	0.1278	0.8165
0.9160	0.8125	0.1390	0.6166
2.4640	0.7362	0.0423	1.6534

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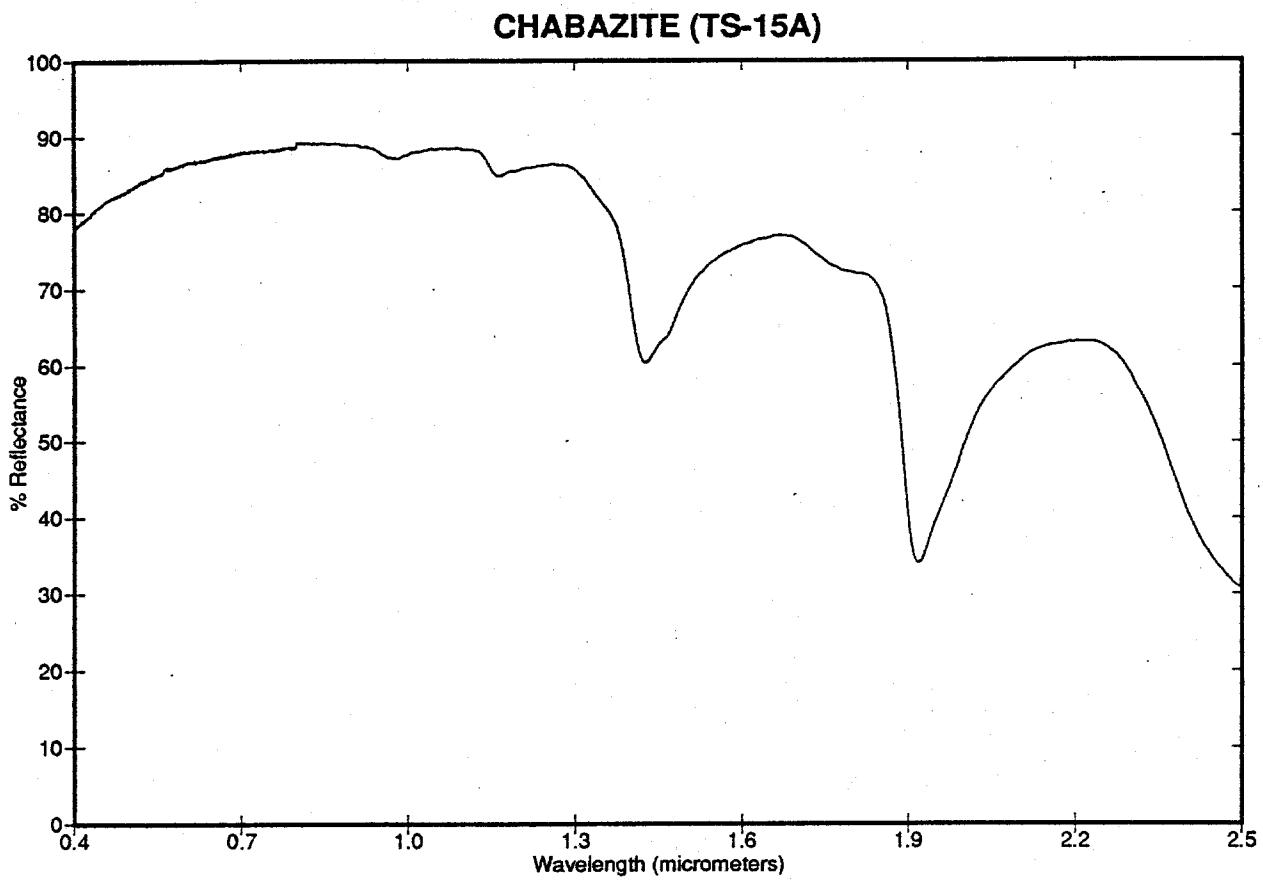

DESCRIPTION: CHABAZITE
SAMPLE_NUM: TS-15A
COUNTRY: USA
POLITICAL_SUBDIVISION: OREGON
GEOGRAPHICAL_REGION: GRANT COUNTY
SITE: RITTER HOT SPRINGS
COLLECTOR: BURMINCO
MINERALOGY: CHABAZITE(A)
CHEMICAL FORMULA: $CaAl_2Si_4O_{12} \bullet 6H_2O$

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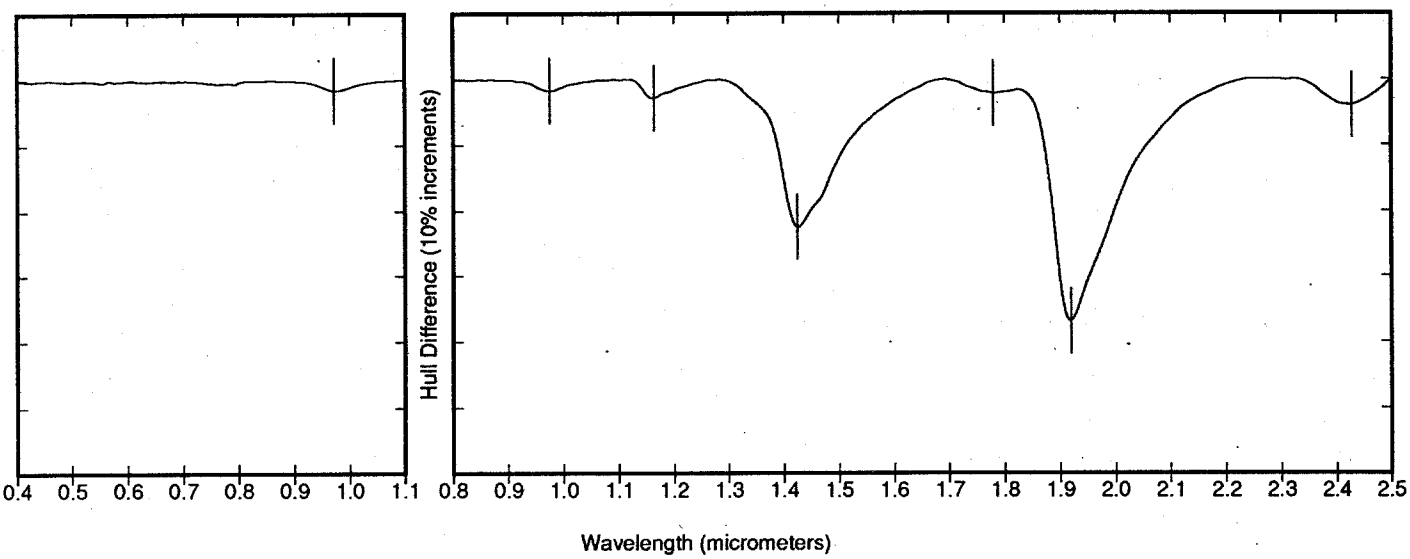
CHABAZITE (TS-15A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9720	1.5306	0.1201	0.7204

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9200	36.8338	5.1840	0.3816
1.4240	22.4590	3.1132	0.4273
2.4280	3.9620	0.3922	1.3073
1.1640	2.8628	0.1919	0.4644
1.7800	2.1542	0.1878	1.1995
0.9760	1.6907	0.1265	0.8359

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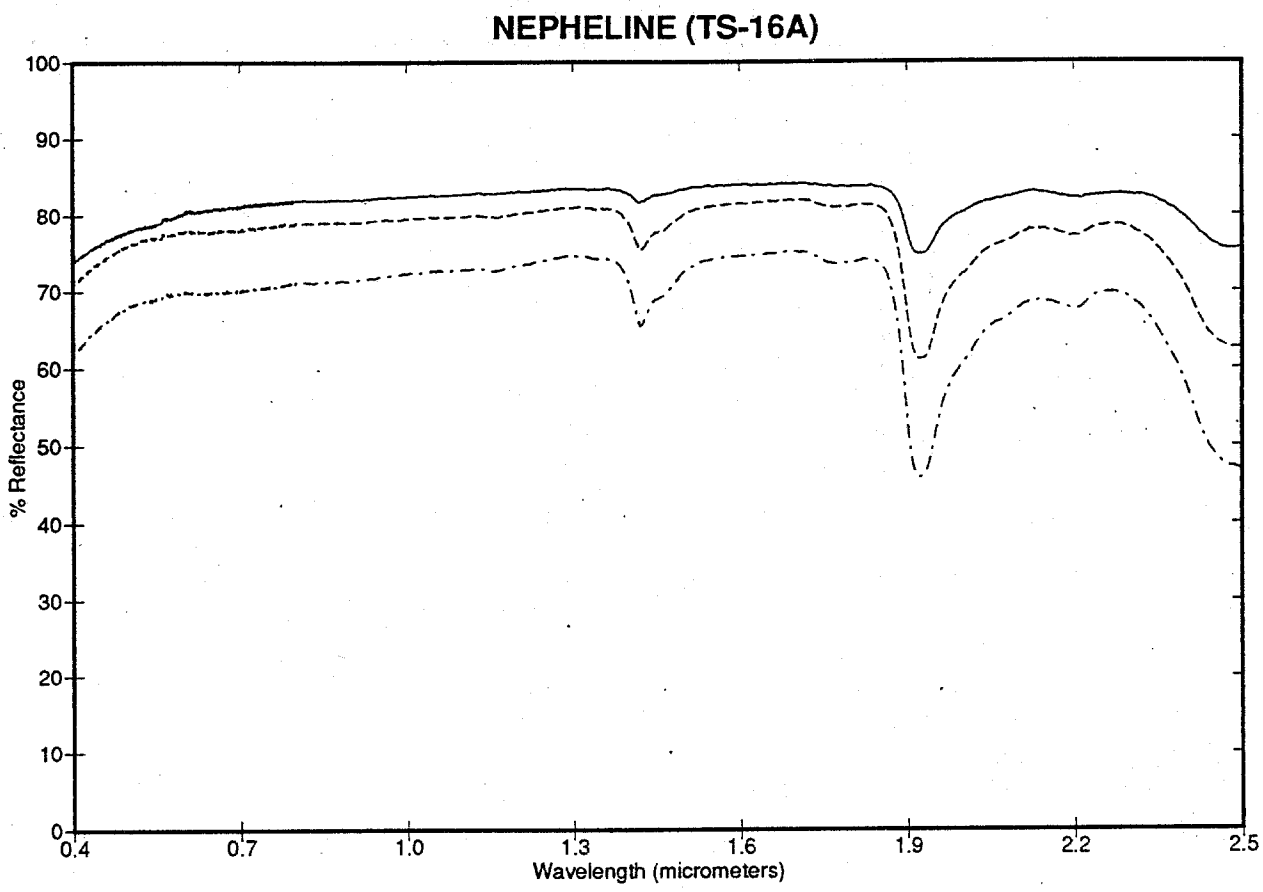

DESCRIPTION: NEPHELINE
SAMPLE_NUM: TS-16A
COUNTRY: CANADA
POLITICAL_SUBDIVISION: ONTARIO
GEOGRAPHICAL_REGION: HASTINGS COUNTY
SITE: BANCROFT
COLLECTOR: WARD'S
MINERALOGY: NEPHELINE(A),CANCRINITE(M),BIOTITE(M),ALKALI FELDSPAR(M)
CHEMICAL FORMULA: (Na,K) $AlSiO_4$

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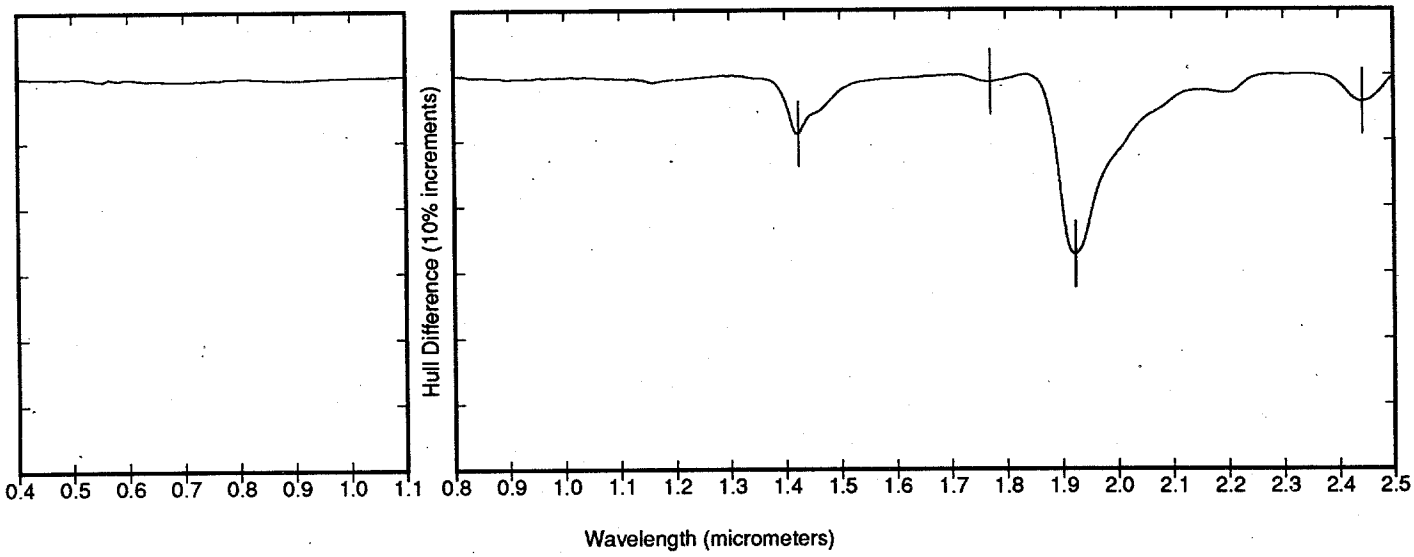
NEPHELINE (TS-16A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 19.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9240	27.3586	3.4534	0.3652
1.4240	8.9915	0.9909	0.8407
2.4440	4.1785	0.2998	1.0947
1.7720	1.0977	0.0681	0.9970

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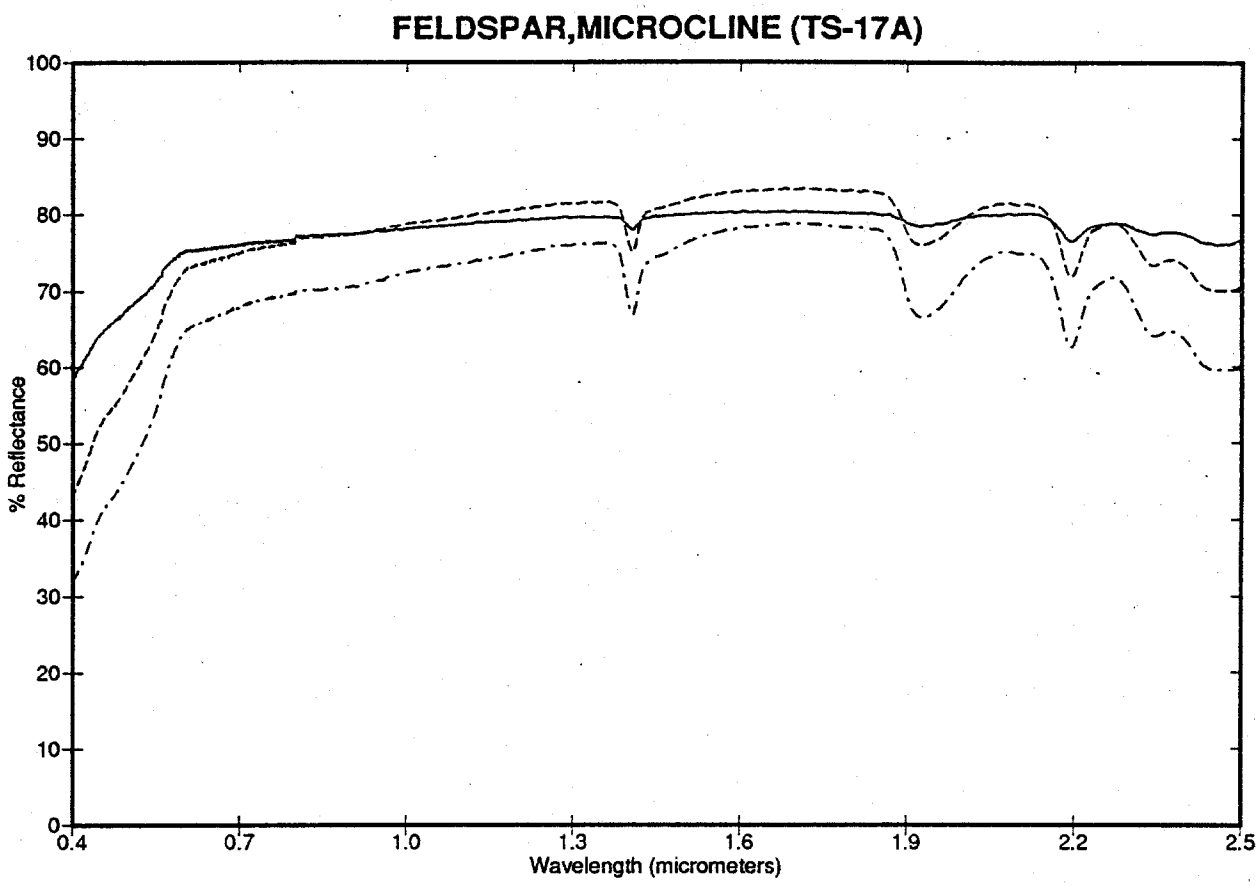

DESCRIPTION: FELDSPAR,MICROCLINE
SAMPLE_NUM: TS-17A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: MICROCLINE(A)
CHEMICAL FORMULA: $(K_{0.97}Na_{0.03})\ Si_3AlO_8$*

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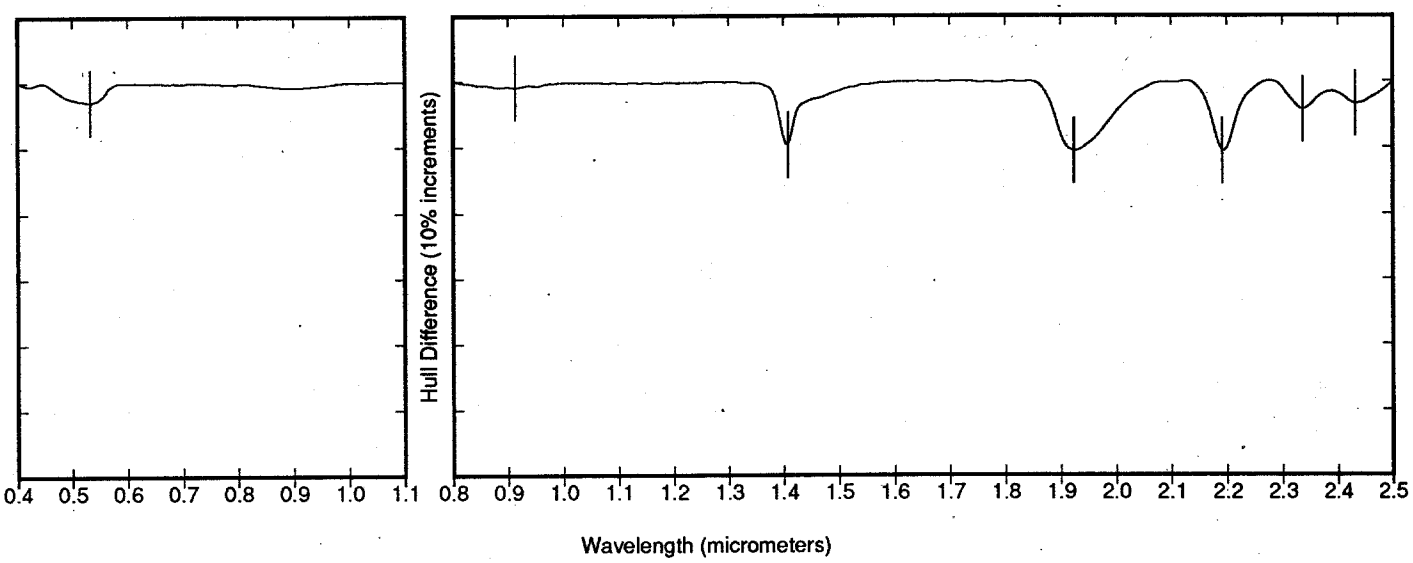
FELDSPAR,MICROCLINE (TS-17A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.5320	2.9772	0.2420	1.8843

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 12.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
2.1920	10.6408	0.5610	0.7781
1.9240	10.5690	1.1688	0.4776
1.4080	9.6275	0.5801	0.5436
2.3360	4.2808	0.2655	0.7473
2.4320	3.3993	0.2444	0.6910
0.9120	0.9415	0.1721	0.5978

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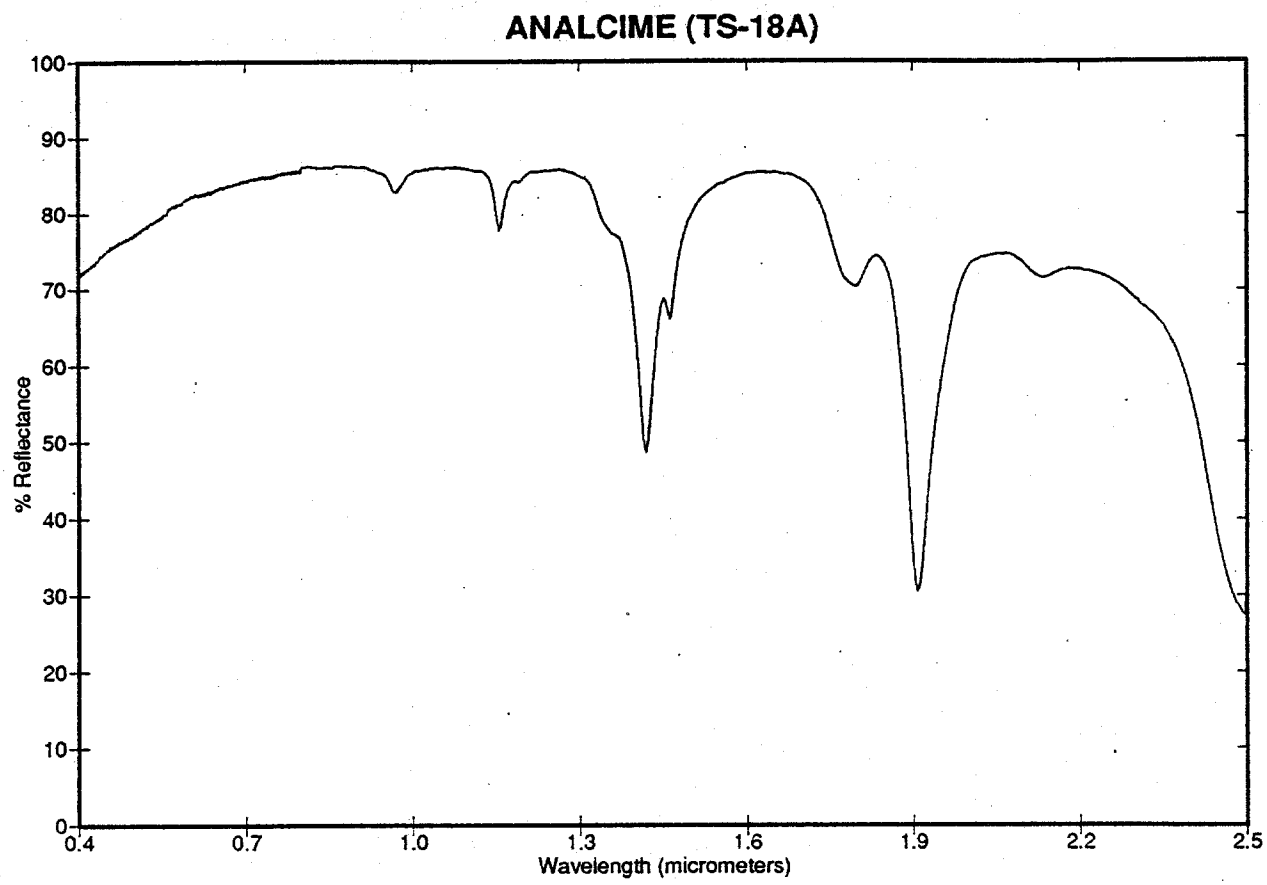

DESCRIPTION: ANALCIME
SAMPLE_NUM: TS-18A
COUNTRY: NULL
POLITICAL_SUBDIVISION: NULL
GEOGRAPHICAL_REGION: NULL
SITE: NULL
COLLECTOR: JPL
MINERALOGY: ANALCIME(A)
CHEMICAL FORMULA: $NaAlSi_2O_6 \bullet H_2O$

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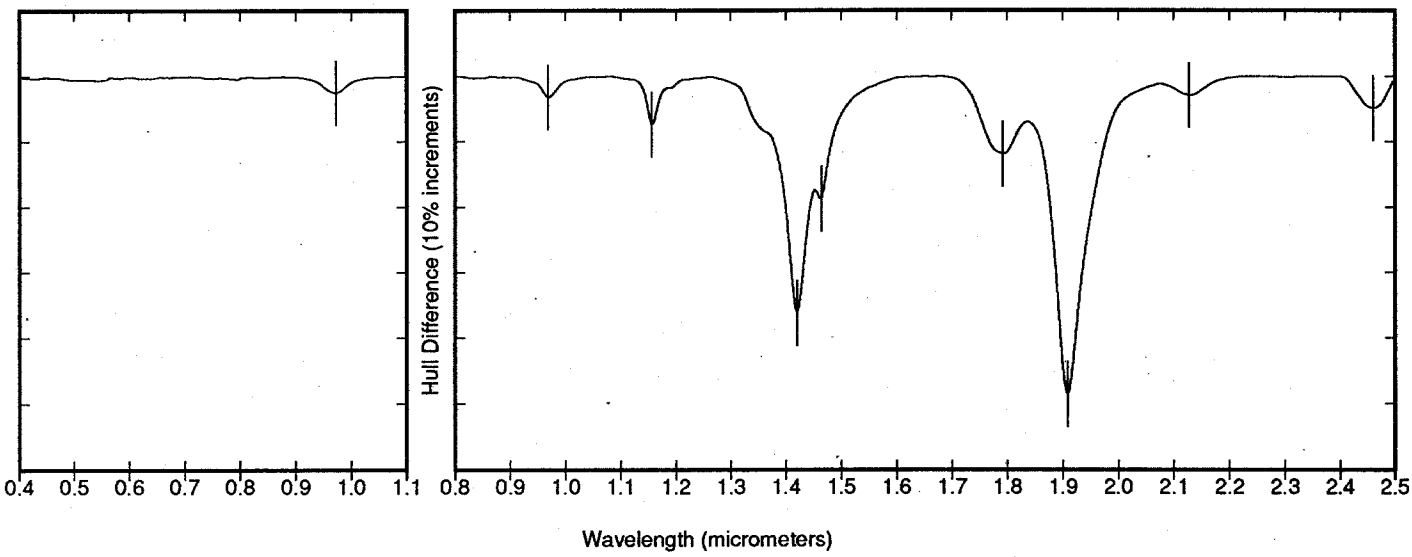
ANALCIME (TS-18A)



VISIBLE-NEAR IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 1.0000
SMOOTHING AVERAGE = 9.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 9.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
0.9720	2.4838	0.1517	1.1996

SHORTWAVE IR PARAMETERS SELECTED
NUMBER OF FEATURES TO SEARCH FOR = 15
MINIMUM DEPTH FOR A FEATURE = 0.5000
SMOOTHING AVERAGE = 3.0000
NEGATIVE SLOPE CHANGE REQUIRED TO CLOSE A FEATURE = 5.0000

WAVELENGTH	DEPTH	AREA	ASYMMETRY
1.9080	48.5051	3.7570	0.6894
1.4200	36.1482	2.1786	1.6291
1.4640	18.7376	0.8442	0.3478
1.7920	11.9352	0.9475	1.2770
1.1560	7.3650	0.2662	0.5896
2.4600	4.9100	0.2755	1.1925
0.9680	3.2229	0.1447	0.7850
2.1280	2.9175	0.2135	0.9674

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APPENDIX C
TEST CASE STUDIES

TEST CASE STUDIES

Case studies are provided to test, in detail, the various facets of the feature-finding algorithm described in section 5.3. Figures are presented for each case study that list the input values, the parameters used with the algorithm, the result and a graph of the spectrum after smoothing and before feature searching. The input parameter list includes 4 fields: the number of parameter sets (features) to search for (NPAR), the minimum acceptable feature depth (DMIN), the number of values on either side of the central value to use for smoothing (NSMOOTH) and the absolute slope change required to close a feature (ABS). The resulting list includes 4 fields for each absorption feature. These are the Wavelength Position, Depth, Area and Asymmetry.

Case 1 is a simple 9-point spectrum with a single symmetric absorption feature centered on x=5.0, which extends to x=3.0 on the left-hand side (LHS) and to x=7.0 on the right-hand side (RHS). The y values of the points to the left and right of the feature are all 2.0, the y maximum value in the spectrum (Figure C-1). Initially the minimum value at x=5.0, y=1.5 is located and saved. The x value of the minimum is the wavelength of the first and deepest feature. Tests are then performed on the minimum value in order to locate the left edge. First, the x value of the minimum is tested to see if it is the first value in the spectrum. If the x value is not the first value, a second test is performed to see if the y value of the minimum is equal to the maximum value in the spectrum. Since both tests are false, the slope is calculated between the minimum value (x=5.0) and the point to its left (x=4.0). The slope change between these points is positive so the tests outlined above are performed on the point to the left (x=4.0). The x value is not the first value in the spectrum, nor is the y value at x=4.0 equal to the maximum y value in the spectrum, so the slope is calculated between the points at x=4.0 and x=3.0. The slope

change is positive so the edge tests are performed on the point at x=3.0. This value is not the first value in the spectrum, however, the y value is equal to the maximum y value of 2.0, and so this test is true and the point (x=3.0, y=2.0) is considered to mark the left edge of the first and deepest feature.

A similar set of tests are used to find the right edge of the feature. First, the minimum value is examined to determine if it is the last value in the spectrum. This test is false so a second test is perfomed on the y value at the minimum to see if it is equal to the maximum value in the spectrum. This second test is also false so the slope is calculated between the minimum (x=5.0) and the point to its right (x=6.0). The slope is positive, and so the tests outlined above are performed on the point at x=6.0. Again, both tests are false so the slope is calculated between x=6.0 and x=7.0. The slope is positive so the point at x=7.0 is evaluated. The second test on this point is true, that is, the y value is equal to the maximum y value in the spectrum, and so this point is considered to mark the right edge of the feature. The y values of the points within and including the feature edges are then set to the maximum y value and the spectrum is searched for the second feature. In the second search, the minimum y value is equal to the maximum y value; i.e., all the y values are set to 2.0 and the spectrum is flat. If this occurs, searching stops; the area, asymmetry and depth of the first and only feature found are calculated.

The area of the feature is calculated in two steps. First the area of the LHS of the feature is calculated. This involves summing the area of the trapezoid and triangle that fill the LHS of the feature. The trapezoid consists of the four points x=5.0,y=1.5; x=5.0,y=2.0; x=4.0,y=1.75; x=4.0,y=2.0. The triangle consists of the three points x=4.0,y=1.75; x=4.0,y=2.0 and x=3.0,y=2.0. The sum of the areas of the trapezoid and triangle equals 0.5. The same procedure is adopted to calculate the area of the RHS of

the feature, which is also equal to 0.5. The area of the feature is the sum of the left and right areas and equals 1.0. The asymmetry is calculated as the area on the LHS divided by the area on the RHS and equals 1.0, which indicates that the feature is symmetric.

Finally, the depth of the feature is calculated. The depth is equal to the maximum y value in the spectrum (2.0) minus the y value of the minimum (1.5) and equals 0.5.

Case 2 utilizes the same input data as case 1, however, the spectrum was smoothed before feature searching. A moving average of 3 was used, or 1 value on either side of the central value (NSMOOTH=1). The spectrum after smoothing is shown in Figure C-2. The input values at x=1.0 and x=9.0 are excluded from feature searching since a moving average cannot be calculated for these points, and the left and right edges of the spectrum are now located at x=2.0, y=2.0 and x=8.0, y=2.0. Smoothing effectively broadens the feature. The edges of the feature are now mapped at x=2.0 and x=8.0 by using the procedure outlined for case 1. The left and right edges of the feature were identified by the test that checks to see if the x value is equal to the first or last value in the spectrum. The left- and right-edge values are also the maximum values in the spectrum, but the maximum value test was not reached since the first/last value test precedes the maximum value test. The area and asymmetry of this feature was calculated in the manner described for case 1.

Case 3 is similar to case 1 except that the feature in the input data is asymmetric and extends to the edges of the spectrum (Figure C-3). The asymmetry results in a smaller area on the RHS than on the LHS and an asymmetry value greater than 1.0 (As=1.19).

Case 4 has three absorption features, one at either edge of the spectrum and one in the center (Figure C-4). The features on the ends of the spectrum are incomplete, only

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containing half a feature. Both edge features would be eliminated in the continuum-removal procedure. The feature-finding algorithm has also been designed so that if a minimum occurs on either edge of the spectrum, it is ignored. Initially the algorithm identifies the minimum at x=1.0. In a case where there are two minima both with the same depth, the minimum with the smallest x value is processed first. The minimum is then evaluated to find the left edge. The first test for the left edge involves checking to see whether it is the first value in the spectrum. The minimum passes this test so the left edge is considered to occur at x=1.0 (the minimum). The minimum is then examined to find the right edge. The minimum is not the last value in the spectrum nor is it equal to the maximum value in the spectrum, so the slope is calculated between it and the point at x=2.0. Since the slope is positive, the point at x=2.0 is evaluated. This point is not the last value but is equal to the maximum value in the spectrum, and so the right edge is mapped at x=2.0.

The feature is then "filled in," or values within the feature are set to the maximum value. In this case, the y value at x=1.0 is set to the maximum y value (y=2.0). Since the minimum occurred at the first value, it is ignored and the spectrum is searched again for the first feature. Ignoring the feature means that the NPAR is not incremented, and so when the next feature is found, its characteristics overwrite those of the feature on the spectrum end. The minimum value is then located at x=9.0. This new minimum is tested in order to locate the left edge of the feature. Since x=9.0 is not the first value in the spectrum, nor is the y value the maximum value in the spectrum, the slope is calculated between it and the point to its left (x=8.0). The point at x=8.0 is evaluated and passes the second test, i.e., it is equal to the maximum value in the spectrum, and this point is identified as the left edge of the feature. The minimum is then examined to find the right

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edge and passes the first test, which checks whether it is the last value in the spectrum, and so it is considered to mark the right edge. Next, the feature is "filled in," or the y value at x=9.0 is set to the maximum value in the spectrum. Since the minimum occurred at the last spectral value, it is ignored and the spectrum is searched for the first feature. The spectrum at this point is identical to case 1, and a single feature is found with the same parameters as those obtained with case 1.

Case 5 has two absorption features located at x=5.0 and x=9.0 (Figure C-5). The feature at x=9.0 is the deepest feature in the spectrum. Initially the minimum at x=9.0 is identified. The search then begins for the left edge of the feature. The minimum value is tested to see if it is either the first value or equal to the maximum value in the spectrum. Neither test is true, so the slope is calculated between the points at x=8.0 and x=9.0. The slope is positive so the point at x=8.0 is evaluated. This point is not the first point in the spectrum nor is it equal to the maximum y value, so the slope is calculated between x=7.0 and x=8.0. The slope change is zero and so the point at x=7.0 is evaluated. Again, this point is not the first point nor is it equal to the maximum, so the slope is calculated between x=7.0 and x=6.0. The slope change is zero so the point x=6.0 is evaluated. The x value of this point is not the first value in the spectrum nor is the y value equal to the maximum value in the spectrum, so the slope between x=6.0 and x=5.0 is calculated. The slope change is negative; this is the first case where a negative slope change has been encountered. Note that the left slope change is calculated by using the formula:

$$\frac{H_{i-1}-H_i}{W_i-W_{i-1}}$$

where

H = Hull Difference

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W = Wavelength

i = index

In the above case, the slope change = -0.25, since this value is greater than the absolute slope change required to close a feature (ABS=0.2), the point at x=6.0 marks the left edge of the feature. The minimum is then examined to find the right edge. Since the minimum is the last value in the spectrum, it is considered to be the right edge of the feature. The feature is then "filled in," and the y values at x=6.0, x=7.0, x=8.0 and x=9.0 are set to y max, which is equal to 2.0.

As discussed in case 4, if a minimum occurs on the edge of a spectrum, it is ignored, and the search begins for the first feature. The minimum now occurs at x=5.0, and the left edge is located at x=3.0, as described in case 1. The search then begins for the right edge of the feature. This involves examining the minimum to see if it is either the last value in the spectrum or the maximum value in the spectrum. Since neither test is true, the slope is calculated between x=5.0 and x=6.0. The slope is positive, so the point at x=6.0 is evaluated. This point is not the edge of the spectrum, but it is equal to the maximum y value in the spectrum. Note that the y value was set to 2.0 in the previous search, and so this point is considered to mark the edge of the first and only feature. The area and asymmetry values are derived by using the procedure discussed with case 1. The feature is asymmetric, with the area on the LHS being greater than the area on the RHS, which results in an asymmetry value greater than 1.

Case 6 uses the same input data as case 5, however, the spectrum was smoothed before feature searching (Figure C-6). Smoothing produces a spectrum similar to case 5 except that the negative slope change now occurs between x=6.0 and x=7.0. Smoothing reduces the negative slope change so that it is less than the absolute slope

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change required to close a feature (ABS=0.2). As a result, the point at x=7.0 is not recognized as the edge, and the feature finder continues traversing left until it encounters the beginning of the spectrum at x=2.0, which it interprets as the edge of the feature. The right edge of the feature is identified at x=8.0, since it is the last value in the spectrum. The feature is then "filled in," and the y values at x=3.0, 4.0, 5.0, 6.0, 7.0, 8.0, and 9.0 are set to the maximum y value of 2.0. Since the minimum occurs in the last point in the spectrum, it is ignored and the spectrum is searched again. However, all the values are now equal to the maximum y value, and if the minimum value in the spectrum is equal to the maximum value (the spectrum is a horizontal line), searching stops, and no features are listed in the output.

Case 7 is the same input data as Case 6, and the spectrum is smoothed (Figure C-7). However, the negative slope change required to close a feature is reduced (ABS=0.01). The negative slope change at x=7.0 is now greater than the user-specified value, and so x=7.0 is considered to mark the edge of the feature whose minimum is located at x=8.0. This feature is "filled in," and since x=8.0 is the last value in the spectrum, it is ignored and the spectrum is searched again. The minimum now occurs at x=5.0. The Y values at x=5.0 and x=6.0 are the same; when this occurs, the lowest wavelength value is interpreted as the minimum. The left edge of this feature is identified at x=2.0 since it is the first value in the spectrum. The right edge of the spectrum is identified at x=7.0 since the the y value at x=7.0 is equal to the maximum y value in the spectrum.

Case 8 has three absorption features located at x=5.0, x=1.0 and x=8.0 (Figure C-8). The deepest feature occurs at x=5.0. The edges of this feature are marked by negative slope changes at x=2.0 and x=7.0, both these slope changes are equal to -0.25.

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The equation used to calculate the right slope was:

$$\frac{H_{i+1}-H_i}{W_{i+1}-W_i}$$

where:

H = Hull Difference

W = Wavelength

i = index

This feature is then filled in, and the spectrum is searched for the next feature. This occurs at x=1.0. Since this minimum is the first value in the spectrum, it is "filled in" and ignored, and the search continues for the second feature. It is worth noting that had the number of features found been incremented when the edge feature was found, the search would have stopped since the number of parameter sets to search for would have been met. The next minimum occurs at x=8.0, with edges at x=7.0 and x=9.0. The edge at x=7.0 is identified because it is equal to 3.0 (the maximum value). In the input data, the y value at x=7.0 was y=2.0, but this point was reset after the first feature was found to be 3.0. The right edge is identified because it is the last value in the spectrum. The area, asymmetry, and depth of these features were calculated in the manner described for other test cases.

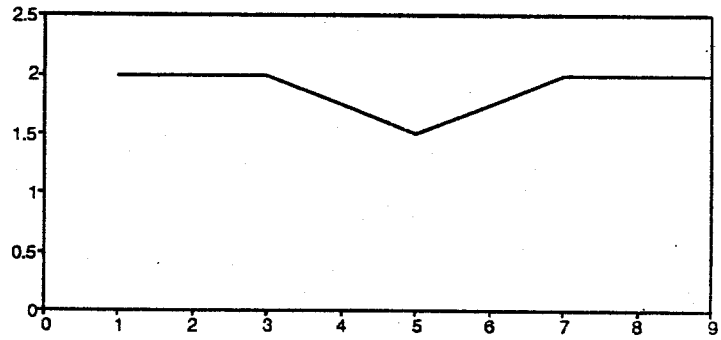
Case 9 has several absorption features located at x=6.0, x=4.0, x=8.0, x=2.0 and x=10.0 (Figure C-9). All these features are found, but the number of features to search for has been increased to NPAR=5. The features at x=4.0, x=6.0 and x=2.0, x=10.0 have the same depths. If a shorter wavelength feature has the same depth as a longer wavelength feature, the shorter wavelength feature is always found first and listed first in the output.

Case 10 is the same input data as case 9, however, the spectrum was smoothed before feature searching, and the absolute slope change required to close a feature was reduced to 0.02 (Figure C-10). In this case, smoothing has the effect of reducing the number of features, shifting the position of the minima in the original data, reducing the area of the features found, and introducing asymmetry. Case 10 indicates that smoothing should be undertaken cautiously, and users should be aware that it may broaden features and may shift the location of their minima.

Input Data	
X	Y
1	2
2	2
3	2
4	1.75
5	1.5
6	1.75
7	2
8	2
9	2

Input Parameters

NPAR=2 ; DMIN=0.0 ; NSMOOTH=0 ; ABS=0.2



Result

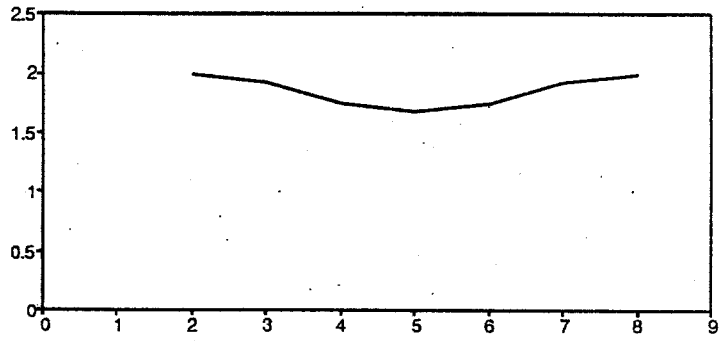
Wavelength	Depth	Area	Asymmetry
5.0	0.5	1.0	1.0

Figure C-1. Input data, parameters, spectrum and result for test case 1.

Input Data	
X	Y
1	2
2	2
3	2
4	1.75
5	1.5
6	1.75
7	2
8	2
9	2

Input Parameters

NPAR=2 ; DMIN=0.0 ; NSMOOTH=1 ; ABS=0.2



Result

Wavelength	Depth	Area	Asymmetry
5.0	0.33	1.0	1.0

Figure C-2. Input data, parameters, spectrum and result for test case 2.

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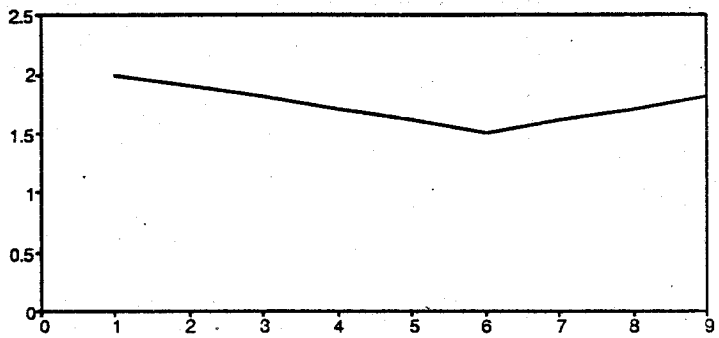
Input Data	
X	Y
1	2
2	1.9
3	1.8
4	1.7
5	1.6
6	1.5
7	1.6
8	1.7
9	1.8

Input Parameters

NPAR=2 ; DMIN=0.0 ; NSMOOTH=0 ; ABS=0.2



Result

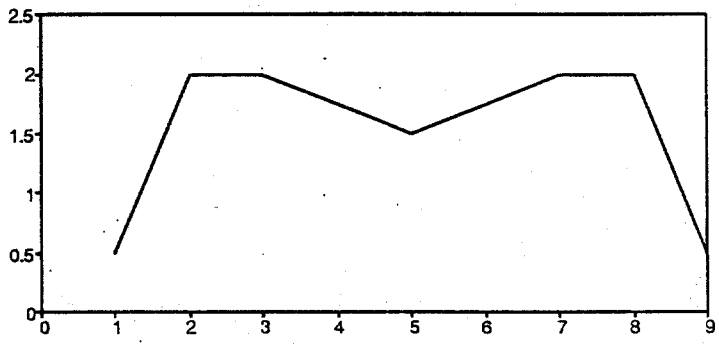
Wavelength	Depth	Area	Asymmetry
6.0	0.5	2.3	1.19

Figure C-3. Input data, parameters, spectrum and result for test case 3.

Input Data	
X	Y
1	0.5
2	2
3	2
4	1.75
5	1.5
6	1.75
7	2
8	2
9	0.5

Input Parameters

NPAR=2 ; DMIN=0.0 ; NSMOOTH=0 ; ABS=0.2



Result

Wavelength	Depth	Area	Asymmetry
5.0	0.5	1.0	1.0

Figure C-4. Input data, parameters, spectrum and result for test case 4.

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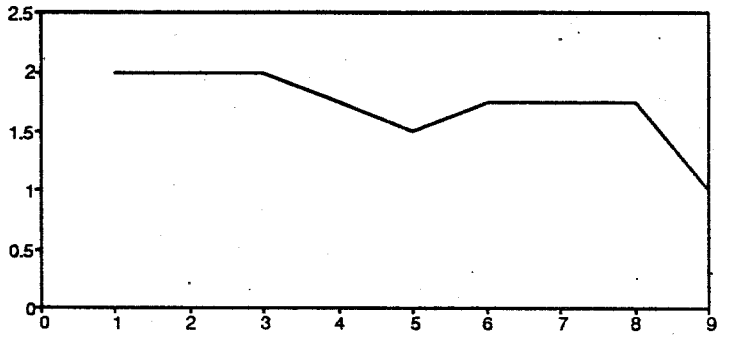
Input Data		Input Parameters			
X	Y	NPAR=2 ; DMIN=0.0 ; NSMOOTH=0 ; ABS=0.2			
1	2				
2	2				
3	2				
4	1.75				
5	1.5				
6	1.75				
7	1.75				
8	1.75	Result			
9	1.0	Wavelength	Depth	Area	Asymmetry
		5.0	0.5	0.88	1.33

Figure C-5. Input data, parameters, spectrum and result for test case 5.

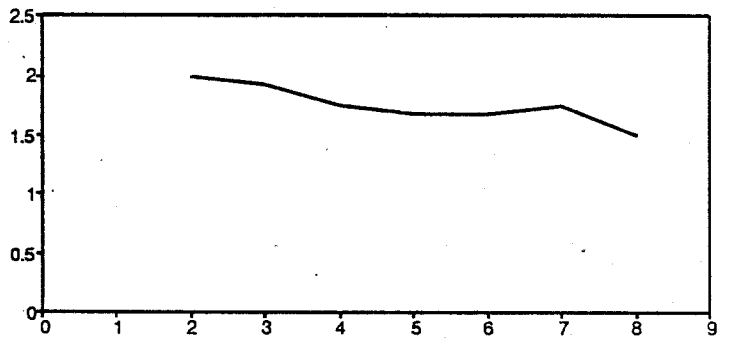
Input Data		Input Parameters
X	Y	NPAR=2 ; DMIN=0.0 ; NSMOOTH=1 ; ABS=0.2
1	2	
2	2	
3	2	
4	1.75	
5	1.5	
6	1.75	
7	1.75	
8	1.75	Result
9	1.0	NO FEATURES FOUND

Figure C-6. Input data, parameters, spectrum and result for test case 6.

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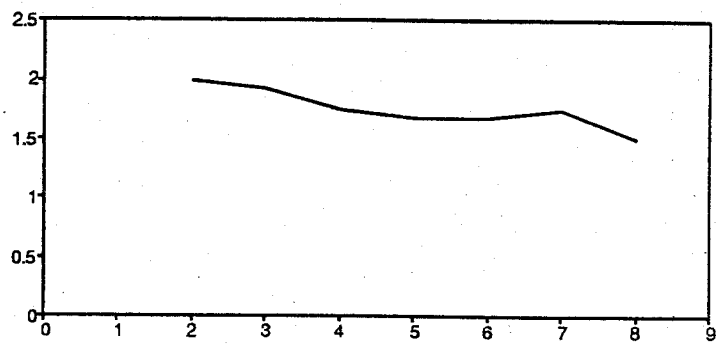
Input Data	
X	Y
1	2
2	2
3	2
4	1.75
5	1.5
6	1.75
7	1.75
8	1.75
9	1.0

Input Parameters

NPAR=2 ; DMIN=0.0 ; NSMOOTH=1 ; ABS=0.01



Result

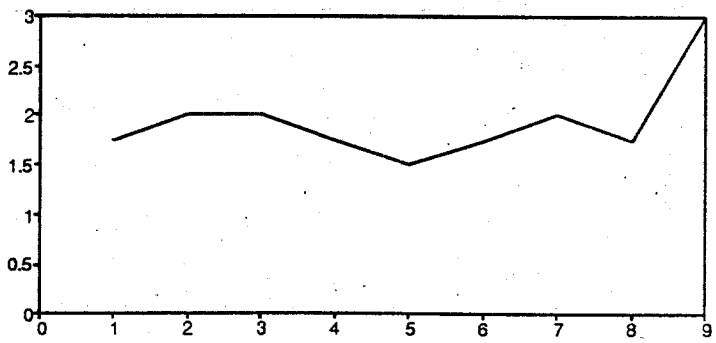
Wavelength	Depth	Area	Asymmetry
5.0	0.33	1.13	0.8

Figure C-7. Input data, parameters, spectrum and result for test case 7.

Input Data	
X	Y
1	1.75
2	2
3	2
4	1.75
5	1.5
6	1.75
7	2.0
8	1.75
9	3.0

Input Parameters

NPAR=2 ; DMIN=0.0 ; NSMOOTH=0 ; ABS=0.2



Result

Wavelength	Depth	Area	Asymmetry
5.0	1.5	6.0	1.4
8.0	1.25	1.75	1.8

Figure C-8. Input data, parameters, spectrum and result for test case 8.

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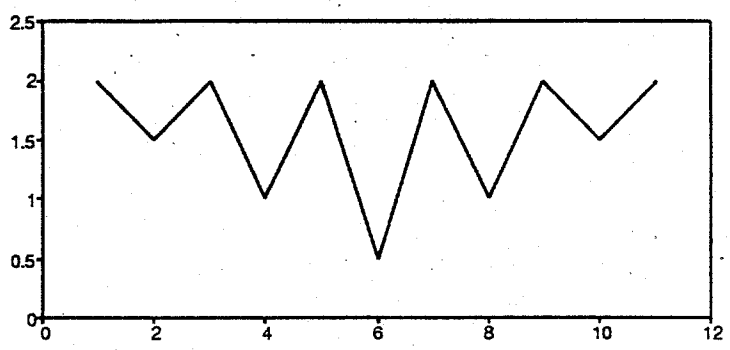
Input Data	
X	Y
1	2
2	1.5
3	2
4	1.0
5	2.0
6	0.5
7	2.0
8	1.0
9	2.0
10	1.5
11	2.0

Input Parameters

NPAR=5 ; DMIN=0.0 ; NSMOOTH=0 ; ABS=0.2



Result

Wavelength	Depth	Area	Asymmetry
6.0	1.5	1.5	1.0
4.0	1.0	1.0	1.0
8.0	1.0	1.0	1.0
2.0	0.5	0.5	1.0
10.0	0.5	0.5	1.0

Figure C-9. Input data, parameters, spectrum and result for test case 9.

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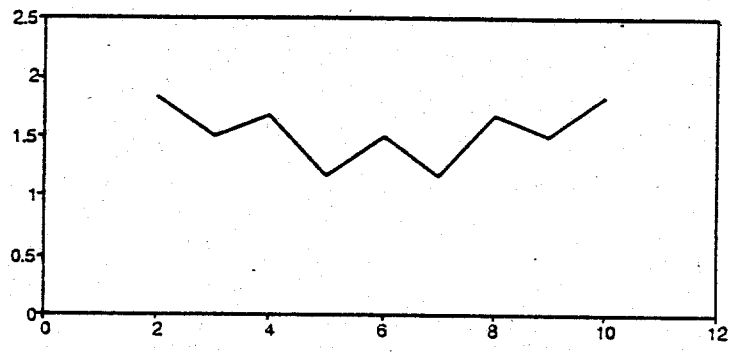
Input Data	
X	Y
1	2
2	1.5
3	2
4	1.0
5	2.0
6	0.5
7	2.0
8	1.0
9	2.0
10	1.5
11	2.0

Input Parameters

NPAR=5 ; DMIN=0.0 ; NSMOOTH=1 ; ABS=0.02



Result

Wavelength	Depth	Area	Asymmetry
5.0	0.67	0.92	0.83
7.0	0.67	0.92	1.2
3.0	0.33	0.42	0.67
9.0	0.33	0.42	1.5

Figure C-10. Input data, parameters, spectrum and result for test case 10.

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JET PROPULSION LABORATORY **INTEROFFICE MEMORANDUM**

April 4, 1994

TO: Margery Fea

FROM: Cindy Grove

SUBJECT: Enclosed publication

Enclosed is a copy of JPL Publication 92-2. This document also contains three PC disks which can be obtained by contacting:

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