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Spectral Reflectances of Natural Targets for Use in Remote Sensing Studies

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16. Abstract

A collection of spectral reflectances of 156 natural targets is presented in a uniform format. For each target both a graphical plot and a digital tabulation of reflectance is given. The data were taken from the literature and include laboratory, field, and aircraft measurements. A discussion of the different measurements of reflectance is given, along with the changes in apparent reflectance when targets are viewed through the atmosphere. The salient features of the reflectance curves of common target types are presented and discussed.

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Introduction

Remote sensing studies devoted to the development of spacecraft sensors have need of a representative selection of spectral reflectances of natural targets in order to determine the optimum number and location of spectral bands and sensitivity requirements. For example, Schappell et al. (1976) utilized reflectances of ground features in the design of a video guidance, landing, and imaging system for space missions; Begni (1982) selected the spectral bands for the SPOT satellite by taking into account both the spectral signatures of ground objects and the modifications introduced by the atmosphere; and Huck et al. (1984) studied spacecraft sensor responses and data processing algorithms for identifying Earth features by using a selection of spectral reflectances taken from the literature. Although several excellent sources of reflectance data are available, such as the agricultural data base from Purdue University Laboratory for Applications of Remote Sensing (Biehl et al. 1982) and the geologic data base from the Jet Propulsion Laboratory (Kahle et al. 1981), these data bases are limited in target selection and are usually available only in computer compatible format. Thus there is a need for a set of reflectance data that is representative of natural targets. The purpose of this report is to present a collection of uniformly digitized spectral reflectances of natural targets in a common format.

The spectral reflectance data were taken from the literature and include laboratory, field, and aircraft measurements. Since the reflectance of most natural targets may be influenced by the measurement technique, the techniques for the measurement of reflectance are discussed with emphasis on their major differences and sources of error. Most of the data have been derived from laboratory or field measurements. There is much interest, however, in the remote sensing of natural targets from both airborne and spaceborne platforms. Therefore, the appendix discusses the changes in apparent reflectance when a target is viewed through the atmosphere.

The target reflectances have been divided into six categories: agriculture; trees; shrubs and grasses; rocks and soils; water, snow, and clouds; and miscellaneous. The 156 reflectance curves included are a representation of what is available in the literature; they are not necessarily the most preferred sets of data for a listing of this kind. There is a similarity among reflectances of many of the targets, and thus a representative reflectance curve for each of the major types is presented along with a discussion of its salient features.

All the data were digitized from copies of documents and archived on magnetic tape for further processing. Each reflectance curve presented represents the data originally shown by the author. A test of the data transcription method indicated an error of less than 1 percent in the digitization process.

Symbols and Units

E_d	diffuse component of irradiance at the Earth's surface, watts-m^{-2}
E_o	solar irradiance at the top of the atmosphere, watts-m^{-2}
E_{os}	direct solar component of irradiance at the Earth's surface, watts-m^{-2}
E_s	irradiance at the Earth's surface, watts-m^{-2}
FOV	field-of-view, deg
H	sensor altitude, km
IFOV	instantaneous field-of-view, deg
L_B	beam radiance component of L_T, watts-m^{-2}-sr^{-1}
L_P	path radiance component of L_T, watts-m^{-2}-sr^{-1}
L_s	surface radiance, watts-m^{-2}-sr^{-1}
L_T	total radiance measured at the instrument, watts-m^{-2}-sr^{-1}
R	bidirectional reflectance factor
R_r	bidirectional reflectance factor of reference
R_t	bidirectional reflectance factor of target
T	transmittance of atmosphere along target-to-sensor path
TOA	top of atmosphere
V	atmospheric visual range, km
V_r	instrument response when viewing reference
V_t	instrument response when viewing target
θ_i	irradiance zenith angle, deg
θ_r	reflected beam zenith angle, deg
λ	wavelength, μm
ρ	total reflectance; used in the appendix to represent reflectance measurement of the Earth's surface

ρ_A apparent reflectance of a surface feature when viewed from aloft through the atmosphere

ρ_b reflectance of background

ρ_t reflectance of target

τ_A optical depth

ψ relative azimuth angle, deg

ϕ_i irradiance azimuth angle, deg

ϕ_r reflected beam azimuth angle, deg

ω_o single-scattering albedo

Measurement of Reflectance

Reflectance of a target can be measured in three ways: in the laboratory, in the field, or from an elevated platform such as an aircraft. These three approaches provide different results for several reasons. Illumination conditions are more easily controlled in the laboratory, but then the content of the field-of-view changes from laboratory to field to aircraft (or spacecraft). In studying vegetation, for example, a single leaf may be analyzed in the laboratory, whereas in the field the footprint usually becomes larger with altitude. Thus, depending on its altitude, a narrow-field-of-view instrument may "see" anything from several leaves to a field several hundred meters in diameter. As the footprint becomes larger, the target becomes a composite of leaves, stalks, soil, grasses, weeds, etc., and its reflectance properties are influenced by such factors as wind condition, row geometry, solar zenith, target slope, etc. Also, as altitude increases, atmospheric effects become more important, and scattering and absorption effects on radiance are enhanced. Target radiance is also influenced by scattered radiance from outside the instrument field-of-view. (These two effects are discussed in the appendix.)

Although the three measurement techniques yield different results, each has its place in remote sensing research. When modeling a vegetation canopy, the reflectance of the individual leaves is a required input. The laboratory data in this report do not adequately support canopy modeling; however, they do show spectral variations important in remote sensing. When combining various ratios of vegetation and bare soil to obtain an integrated reflectance, field measurements are required. And lastly, when attempting to correlate target reflectance with satellite measurements, a field measurement with a large footprint is desirable. Since target reflectance is influenced by the manner in which the measurement is made, each of the three techniques will be discussed separately.

Laboratory Measurements

Total reflectance ρ is the ratio of the reflected radiant flux to the incident flux (Judd 1967). For a given target this quantity can be determined in several ways, but in the laboratory a small sample of the target is usually analyzed using a spectrophotometer with an integrating sphere attachment. Two methods of measuring reflectance with an integrating sphere are possible. In the *substitution method*, sample and reference (an ideal Lambertian surface) are placed in turn at the sample aperture and the ratio of respective photocell readings is determined. This technique has introduced systematic error of up to 12 percent in the determination of reflectance (Jacquez and Kuppenheim 1955). In the *comparison method*, both sample and reference are placed in separate apertures, the illuminating beam is switched from one to the other, and the ratio of the respective photocell readings is determined (Vlcek 1972). For a perfect sphere, the error is zero; with a flat sample, the error is about 1 percent. Most of the laboratory data included in the appendix were generated with spectrophotometers that use the comparison method.

Because of the transmittance of leaves, any reflectance measurement of a single leaf is influenced by the background on which the sample is supported (Lillesaeter 1982). When leaves are stacked, it has been found that no further change in reflectance at near-infrared wavelengths occurs beyond a depth of eight leaf layers or more (Allen and Richardson 1968). When comparing laboratory with field measurements, Knipling (1970) found that the visible and near-infrared reflectances from a nearly continuous broad leaf canopy were typically about 40 and 70 percent, respectively, of the laboratory reflectance of a single leaf.

Field Measurements

Spectral reflectance of natural surfaces can be measured in the field by using a radiometer fitted with an integrating sphere as the primary radiation receiver. The aperture of the sphere is pointed at zenith to measure irradiance and then rotated 180° to nadir to measure the target radiance. Since the nadir field-of-view is nearly 180°, a correction is usually applied to compensate for shading by the instrument itself (Coulson and Reynolds 1971). When the integrating sphere technique was used for measuring hemispheric reflectance, Coulson and Reynolds found that the time-varying irradiance field, particularly on hazy days, was responsible for appreciable scatter in the reflectance determinations because of the sequential nature of the measurements. Duggin and Cunia (1983) compared simultaneous measurements of irradiance and target radiance with sequential measurements and showed that the simultaneous approach dramatically reduced the variation of the reflectance measurements. Large cumulus clouds near the solar disk and thin cirrus clouds are two major causes of varying irradiance (Robinson and Biehl 1979).

A cosine receptor, which usually employs a diffusing optics element or an immersion lens for improved performance, is often used to measure irradiance over a 2π steradian field-of-view. The target radiance measurement at nadir is frequently restricted to a smaller field-of-view, referred to as an "apertured" reflectance measurement (Graetz and Gentle 1982). The more commonly measured parameter, however, is the bidirectional reflectance factor, which requires a reference standard for the irradiance determination. A bidirectional reflectance factor R is defined as the ratio of the radiant flux reflected by the target to that reflected into the same beam geometry by a perfectly reflecting diffuser (Lambertian) identically irradiated (Judd 1967).

The bidirectional nature of $R(\theta_i, \phi_i; \theta_r, \phi_r)$ is illustrated in figure 1 for incident and reflected beams where (θ_i, ϕ_i) and (θ_r, ϕ_r) are the zenith and azimuth angles of the incident and reflected beams. In the field, R can be approximated by taking the ratio of the instrument response when viewing the target V_t to the instrument response when viewing a level reference surface V_r such that

$$R_t(\theta_i, \phi_i; \theta_r, \phi_r) = \frac{V_t}{V_r} R_r(\theta_i, \phi_i; \theta_r, \phi_r) \qquad (1)$$

where $R_r(\theta_i, \phi_i; \theta_r, \phi_r)$ is the bidirectional reflectance factor of the reference surface; this term corrects for the nonideal reflectance properties of the reference surface. This relation assumes that (1) the instrument response is linear to entrant flux, (2) the diffuse component of irradiance is negligible, (3) the reference surface is irradiated and viewed in the same manner as the target, and (4) the aperture is sufficiently distant from the target.

An attempt to correct for the diffuse skylight component in the irradiance field by subtracting the spectral responses of the shadowed target and shadowed reference introduces an uncertainty in the reflectance determination that is greater than the diffuse skylight effect itself (Bauer et al. 1977). A simulation study on the influence of sky radiance has found the error induced in the estimation of bidirectional reflectance factors to be less than 5 percent for zenith view and Sun zenith angles less than 55° (Kirchner et al. 1982). As long as the field-of-view is no greater than 15° to 20°, the term bidirectional reflectance factor is considered to describe the measurements adequately (Bauer et al. 1979).

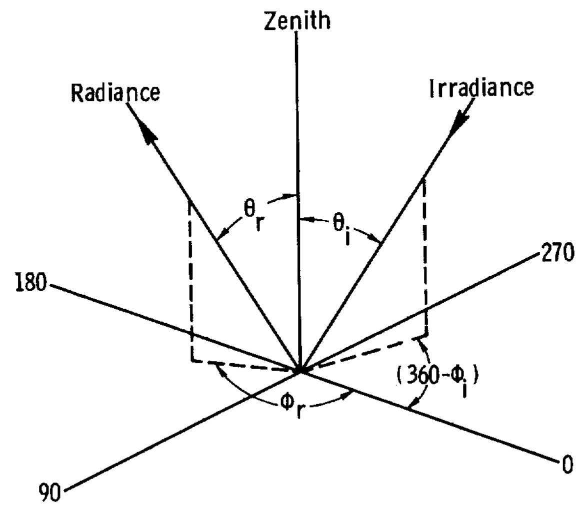

Figure 1. Viewing geometry for bidirectional reflectance factor measurements.

When field illumination conditions are too variable or the sky is frequently overcast, measurements can be made using an artificial light source (De Boer et al. 1974). In this procedure the target is covered to block out natural light. The technique can also be extended to the laboratory, though it is the usual practice to view potted field plants and not individual leaves (McClellan et al. 1963).

Aircraft Measurements

The measurement of reflectance has thus far involved only a ratio of two instrument readings and a calibrated reference surface (when the reflectance factor is measured). With aircraft measurements, there is the additional complication of atmospheric scattering and absorption effects. Atmospheric scattering is apparent to anyone who has viewed the ground from an aircraft on a hazy day; the scattering produces a bluish turbidity superimposed over the background scene. If a suitable reference surface is available or if the spectral reflectance of selected targets has been established as references using field or helicopter (i.e., low altitude) equipment, aircraft data can also be calibrated (Bauer et al. 1979). The wide scan angle of most aircraft instruments is an additional problem, since the atmospheric path is variable across the scan. Either additional calibrations should be made at selected off-nadir scan angles or the targets of interest should be restricted to nadir viewing.

Surface reflectances can be estimated fairly well without ground support, however, provided that absolute radiance measurements are obtained and a suitable radiative transfer program is used to correct for atmospheric effects (Bowker et al. 1983). Because of the interest in airborne and spaceborne remote sensing systems, the influence of the atmosphere on radiance measurements from elevated platforms is discussed in the appendix. Two of the reflectance curves presented in this report have been corrected for atmospheric effects using the technique given in the appendix.

General Features of Reflectance Curves

Many natural targets have common features in their spectral reflectance curves, which make the targets difficult to identify or separate. All vegetation, for instance, has a similar reflectance profile, whether it be agricultural crops, trees, shrubs, or grasses. In addition to the subtle differences in reflectances, the reflectances vary with time, at least for vegetation; this often leads to an identification or separation of targets. Several of the major categories of reflectances will be discussed in some detail in this section to show the commonality of features and the manner in which remote sensing may take advantage of minor differences to separate targets. Vane et al. (1982) have summarized the spectral bands useful for remote sensing applications.

Vegetation

Figure 2 is a typical reflectance curve for photosynthetically active vegetation. The spectrum can be broken into three regions according to the major factor responsible for the curve behavior. Below 0.7 μm, absorption is dominated by carotenoid pigments (centered at 0.48 μm) and chlorophylls (centered at 0.68 μm). The green peak (centered at approximately 0.56 μm) is the region of the visible spectrum corresponding to weak absorption. The sharp rise around 0.7 μm, (called the red edge) marks the change from chlorophyll absorption to cellular reflectance. The near-infrared reflectance from 0.7 to 1.3 μm is dominated by the cell-wall/airspace interface and, to a lesser extent, by refractive index discontinuities of cellular constituents (Gausman 1974). Beyond 1.3 μm, reflectance is primarily controlled by leaf water content. The suggested spectral bands given in figure 2 have been successfully used by the researchers; they mostly represent bands that were available on various sensors and are not necessarily optimum with respect to bandwidth or central wavelength.

During the growth cycle of vegetation the reflectance decreases in the visible wavelength and increases in the near-infrared wavelengths until maximum canopy development is reached. Then, with senescence, the visible reflectance increases while the near-infrared reflectance decreases, although relatively less than the visible increases. Thus, vegetation reflectance usually progresses from a background, such as soil, to full greenness and then returns to the background again.

By analyzing the reflectance spectrum of vegetation in discrete narrow bands, Verhoef and Bunnik (1974) identified about 12 spectral bands relevant for assessing special features of crops. The selection of a few bands and/or wide bands does not give optimum results (Beers 1975). Generally, the selected bands should have low correlation. Using the Landsat MSS bands, Kauth and Thomas (1976) developed a linear transformation (called the "tasseled cap") that defines two orthogonal components called "brightness" and "greenness." The brightness establishes the data space of soils, and the greenness is a measure of green vegetation. The temporal behavior of the greenness can be used to separate some crops (Badhwar et al. 1982). Idso et al. (1980) used a reflectance ratio involving Landsat MSS bands 5 (0.6–0.7μm) and 6 (0.7–0.8 μm) to estimate grain yields by remote sensing of crop senescence rates. Crops that are stressed for water, which have lowest grain yields, had a longer period of senescence.

The broad absorption areas near 1.4 and 1.95 μm are also atmospheric water vapor bands and should be avoided in remote sensing. However, the 1.6 and 2.2 μm regions are useful for distinguishing succulent (average leaf water content of 92 percent) from nonsucculent (average leaf water content of 71 percent) plants (Gausman et al. 1978).

According to Collins (1978) the sharp spectral reflectance rise between the chlorophyll absorption maximum and the cellular reflectance maximum, the red edge, can be very useful in detecting phenologic changes and geochemical stress. In a study of maturation changes of crop plants such as corn, wheat, and sorghum, Collins detected a red-shift (of 0.007 to 0.010 μm) of the red edge to longer wavelengths (0.690 to 0.700 μm) associated with the conversion from vegetative growth to reproductive growth (heading and flowering). The red-shift was useful in separating some crop types, particularly the non-grain from the grain crops (the shift is not as pronounced in the non-grain crops).

When plants become stressed, a decrease in chlorophyll productivity causes a shift of the red edge toward shorter wavelengths. This kind of blue-shift has been detected in the reflectance spectrum from a forest canopy growing over copper-lead-zinc sulfide mineralization (Collins et al. 1977).

Just as the detection of the shift in the red edge requires spectral measurements of 0.010-μm resolution, other regions within the reflectance curve of vegetation may also demand such resolution (Mack et al. 1984). There is an emphasis toward more bands with higher spectral resolution; however, Mack advises using only those bands with an established relevant biophysical and agronomic basis. Knowledge of these spectral characteristics is essential for minimizing data processing costs and time.

Soil

Figure 3 displays five representative spectral reflectance curves for soils. Condit (1970) has classified 160 soil samples from 36 states into three general types according to the shape of their reflectance curves within the 0.4 to 1.0 μm region of the spectrum. Type 1 curves have rather low reflectances with slightly increasing slope, which gives them their characteristic concave form from 0.32 to about 1.0 μm. Type 2 curves are characterized by generally decreasing slope to about 0.6 μm followed by a slight dip from 0.6 to 0.7 μm, with continued decreasing slope beyond 0.75 μm. This results in a typical convex shape from the visible to beyond 1.0 μm. Type 2 soils are better drained and lower in organic matter than type 1 soils. Type 3 curves have a slightly decreasing steep slope to about 0.6 μm followed by a slight dip from 0.62 to 0.74 μm, with slope decreasing to near zero or becoming negative from 0.76 to 0.88 μm. Beyond 0.88 μm (to 1.0 μm) the slope increases with wavelength. Type 3 soils have moderately high iron content. Condit was able to reproduce these curves (160 in all) with a high degree of accuracy from measurements at five narrow bandwidths (0.02 μm) centered at 0.40, 0.54, 0.64, 0.74, and 0.92 μm; these wavelengths may not relate to specific physical phenomena. Stoner and Baumgardner (1980) established two more types of soil reflectance curves, similar to type 3, by extending the data out to 1.3 μm. The type 4 reflectance behavior from 0.88 to 1.3 μm was caused by high iron content and organic material. In type 5, the negative slope from 0.75 to 1.3 μm resulted from very high iron and low organic concentrations. This was the only type that did not show a strong absorption (water) at 1.45 μm.

Although reflectances in all spectral regions are negatively correlated with organics, the region around 0.57 μm (the green peak) is particularly useful for monitoring organic matter in bare soils since it is free of other major disturbances. Stoner and Baumgardner considered measurements at 0.7, 0.9, and 1.0 μm to be essential for thorough classification of background soil reflectance. Absorptions at 0.7 and 0.9 μm are produced by ferric iron compounds, while that at 1.0 μm is caused by ferrous iron compounds.

The 0.4 to 1.0 μm region is not useful for monitoring soil moisture content (Reginato et al. 1977), although the entire reflectance curve is generally suppressed with increased moisture. The region centered at 2.2 μm has the highest correlation with soil moisture; this region was similarly important with vegetation.

The two regions of highest soil reflectance, centered at approximately 1.27 and 1.65 μm, correlate with many soil properties (Stoner and Baumgardner 1980). With sandy textured soils, a decrease in particle size increased reflectance. However, with medium to fine textured soils, a decrease in particle size decreased reflectance.

Rocks and Minerals

Figure 4 shows spectral reflectance curves for shale and andesite. Rocks are similar to soils in reflectance, which is not surprising since soils are derived from weathered rocks. One major difference between the two is the organic matter present in soils, which tends to decrease reflectance.

With transparent rock particles, reflectance increases with a decrease in particle size, but just the opposite is the case with opaque particles (Salisbury and Hunt 1968). This may explain the behavior of the fine grain soils discussed in the previous section.

The iron absorption bands are very prominent in basic rocks (i.e., igneous rocks with minerals rich in metallic bases). These absorption bands are even prominent in red-stained beach sands.

The strong fundamental OH vibration at 2.74 μm characterizes the behavior of hydroxyl-bearing minerals. Clays (hydrous aluminum silicates), in particular, show decreasing spectral reflectance beyond 1.6 μm, and this broadband behavior can be used to identify clay-rich areas associated with hydrothermal alteration zones (Podwysocki et al. 1983). The absorption peaks at 2.17 and 2.20 μm can be used to identify clay minerals (Goetz and Rowan 1981). The reflectance spectrum of unaltered material is not as complex, particularly in the 2.0 to 2.4 μm region, as in altered rocks.

The spectral absorption features at 1.4 and 1.9 μm, as well as at 2.2 μm, indicate hydration, but these two regions are subject to atmospheric interference.

The detection of vegetation cover and the analysis of the spectral properties of plants to identify conditions present in the soil are also an important area in geologic remote sensing. This subject was mentioned in the vegetation section. A discussion of

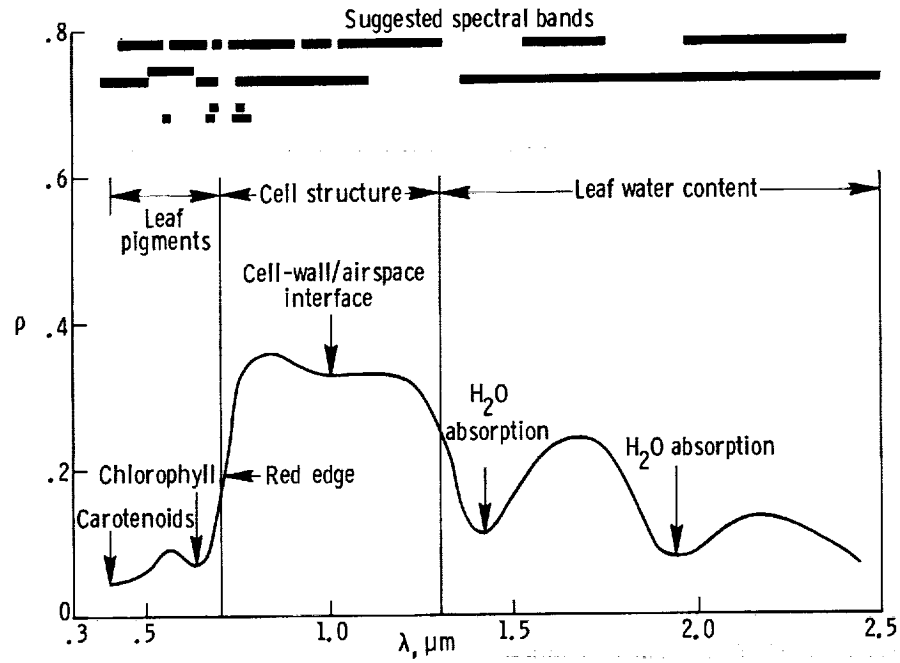

Figure 2. Typical vegetation reflectance curve showing dominant factors controlling leaf reflectance. Vane et al. (1982) attributed the three rows of suggested spectral bands to Wiersma and Landgrebe (top row), Tucker (middle row), and ORI, Inc. (bottom row).

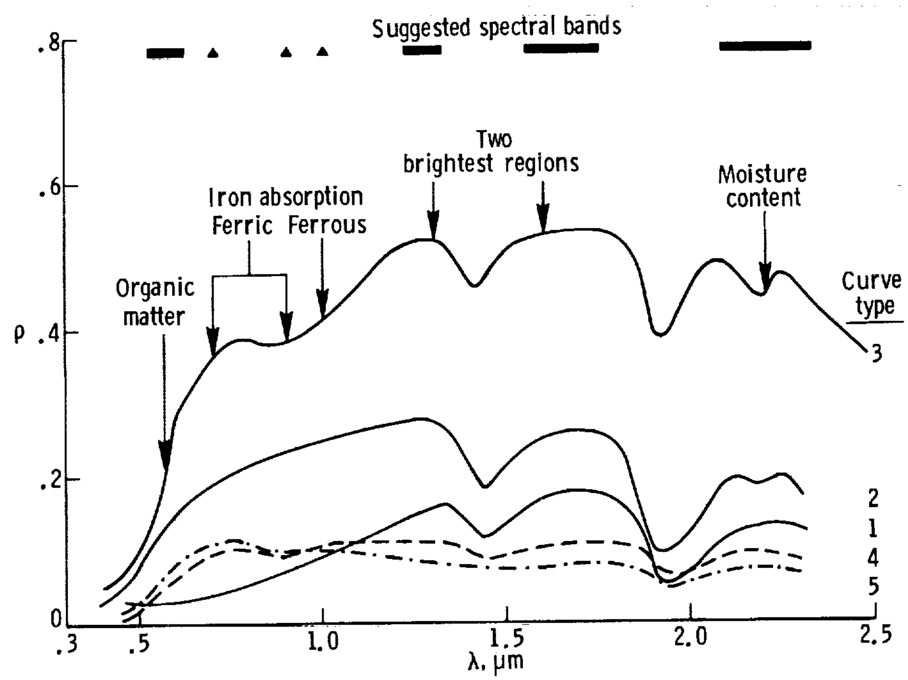

Figure 3. Typical soil reflectance curves for the five major types of curves. Types 1–3 proposed by Condit (1970) and types 4 and 5 by Stoner and Baumgardner (1980). Vane et al. (1982) attributed the suggested spectral bands to Stoner and Baumgardner.

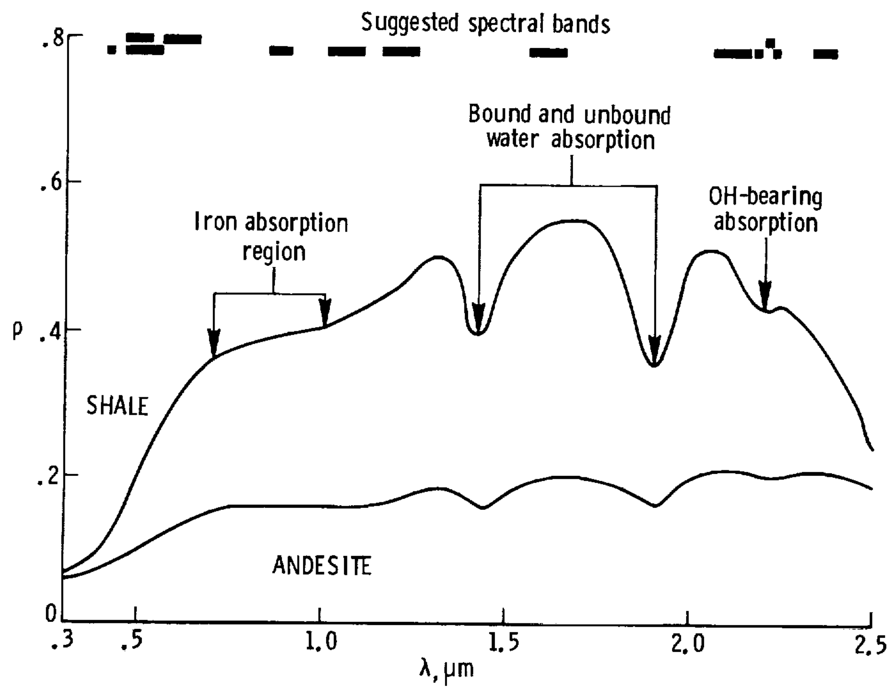

Figure 4. Typical reflectance curves for two rock formations. Vane et al. (1982) attributed the suggested spectral bands to Goetz and Rowan except for the 0.40–0.42 μm and 0.84–0.90 μm bands (ORI, Inc.) and the 0.45–0.52 μm band (Billingsley).

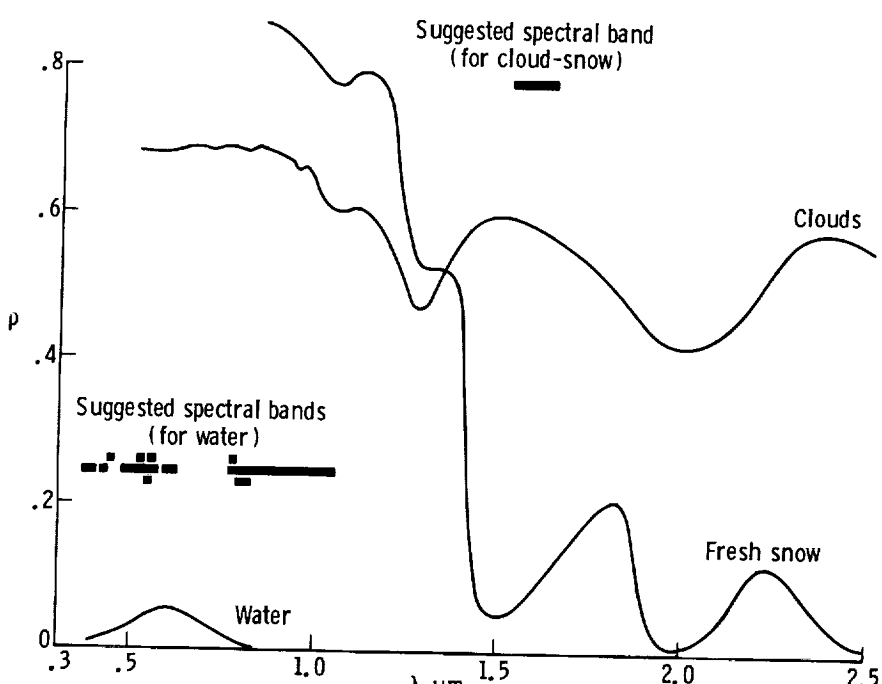

Figure 5. Typical reflectance curves for water, snow, and clouds. Vane et al. (1982) attributed the suggested spectral bands for water to ORI, Inc., except for the 0.47–0.57 μm band (NASA-GSFC). The cloud-snow band is by Crane and Anderson (1984).

the topic has been presented by Goetz et al. (1983). A 10-percent grass cover masks beyond recognition spectral characteristics of such rocks as andesite and limestone that have low reflectances; dry vegetation, on the other hand, has a minimal effect (Siegal and Goetz 1977). Beyond 1.4 μm, the reflectance of rock tends to become more dominant.

Water, Snow, and Clouds

In the absence of glitter effects, water is easily distinguished from other targets by its low reflectance, particularly in the near-infrared portion of the spectrum. However, high concentrations of suspended sediment, which often occur in shallow reservoirs, can increase reflectance. Surface algal blooms can also change the reflectance properties of water; these are distinguished from high sediment loads by the characteristic chlorophyll absorption in the red area of the spectrum. Monitoring chlorophyll in ocean waters, where reflectance is less than 0.02, has been discussed by Gower et al. (1984).

In figure 5, both snow and clouds are seen to have high reflectance in the visible portion of the spectrum. Clouds are still highly reflective in the near-infrared wavelengths, while snow becomes relatively nonreflective beyond 1.4 μm, particularly in the 1.5 to 1.6 μm region (Crane and Anderson 1984).

Selection and Formatting of the Spectral Reflectance Data

A literature search for spectral reflectance data retrieved about 300 spectral curves. From these, 156 were selected based on the following criteria: (1) the importance of the target, (2) the data collection mode, and (3) the quality of the data. Priorities for the remote sensing of agricultural crops have been established by Bowker (1985). For the other areas, however, selection was guided by availability and the desire to present a variety of targets. Field measurements made with a high-resolution scanning spectrophotometer were preferred. This type of data was limited, so that laboratory spectral measurements often had to be selected. It is important to note that laboratory measurements are sometimes required because of vegetation cover of natural targets in the field, for example, soils. Of the 156 data sets, 59 represent laboratory measurements. Most of these occur in either the tree or the rocks and soils category. (As previously mentioned, the laboratory and field data are not compatible since they represent entirely different environments.) Finally, the quality of the reflectance data, which was judged somewhat arbitrarily, was used to eliminate some of the data. The preferred data were well documented with a discussion of error sources.

The targets were grouped into six major categories: agriculture; trees; shrubs and grasses; rocks and soils; water, snow, and clouds; and miscellaneous targets. Each reflectance curve was presented by its author as being representative of a given target; this report has simply standardized all of the data to a common format.

This standardization involved digitizing the curves from the published documents and interpolating to obtain the desired format. The digitization was performed in the following manner. First, a photocopy was made of each spectral reflectance curve chosen for inclusion in the data set. Then, an X-Y digitizer was used to digitize the data from each profile. Each record was archived on magnetic tape. In final processing the data were retrieved, the reflectance curve was machine plotted, and a second-order interpolation was performed to give the uniform spectral intervals and format shown; having a common wavelength interval for each profile helps intercomparison of the data.

Digitizing the data has, of course, introduced some error. All of the data were taken from copies of the original documents. Fortunately, one of the reports (Gausman et al. 1973) contained both graphical and tabular data. This set of data represents the worst case in digitizing since the original figures were only approximately 20 by 45 mm in size. Comparison of reflectance values at 38 coincident wavelengths (taken from two figures in the Gausman report) gave an average error of only 0.0073 units of reflectance. This is an excellent agreement, and the data presented in this report may, therefore, be taken as reliably reporting the original sources.

Spectral reflectances for the 156 selected targets are presented in the common format in the back of this report. The reflectance data for each target are presented in two formats: (1) graphical, with a wavelength interval from 0.3 to 1.2 μm or from 0.3 to 2.5 μm, and (2) tabular, with a spectral resolution of 0.01 μm (0.3 to 1.2 μm) or 0.02 μm (0.3 to 2.5 μm). The ordinate of the reflectance curves is labeled "reflectance" with a range from 0 to 1. Bidirectional reflectance factor would have been a more appropriate term for most of the field data, but it was not always clear that the assumptions required by equation (1) were valid (see Robinson and Biehl 1979). In several instances data have been included where the ordinate was labeled "relative reflectance" or "albedo." The magnitudes of most target reflectances are known to vary over wide limits, even when the target descriptions are identical. What is most important is the variation of reflectance with wavelength.

Concluding Remarks

A collection of spectral reflectances for 156 natural targets has been presented in a uniform format. Each target is described by both graphical and tabular data. The collection was chosen with some consideration of the relative importance of the targets, and the data presented are representative of what is available in the literature. While the data set was developed to support simulation studies in the development of remote sensing instruments, it may find application in other areas of remote sensing, such as algorithm development and radiative transfer studies.

The data are presented here with a uniform 0.01- or 0.02-μm spacing, even though the spectral resolution of the source data varied widely. Therefore these data are intended for the broad class of applications requiring moderate spectral resolution, and not for those requiring high spectral resolution, such as the detection of the vegetative red-shift; for these high-resolution tasks, other data must be used.

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Appendix

Atmospheric Effects on Reflectance Profiles

In the spectral region of interest for this report, 0.3 to 2.5 μm, the sensed energy is almost entirely derived from solar radiation which transits the atmosphere, is reflected by the surface, and is then transmitted to the sensor aloft. In this spectral region, the thermal radiation from the atmosphere itself is negligible in comparison with the solar component, so it will be ignored here. The solar irradiance E_o on top of the atmosphere is shown in figure A1. After passing through the atmosphere, the irradiance impinging on the surface has been attenuated as shown by the lower curve. Both curves here pertain to the Sun at zenith. The atmospheric absorption features shaded on the curve are due to ozone, oxygen, water vapor, and carbon dioxide, as indicated.

The solar irradiance at the surface is composed of both a direct and a diffuse component, as shown in figure A2. For the example shown, the diffuse component amounts to more than 30 percent of the total at the shortest wavelengths. (Slater (1980) states that a diffuse component of 10 to 20 percent is typical for the visual to near-infrared spectral range.) The conditions assumed for figure A2 are an atmospheric visual range of 31.4 km and a surface reflectance of 0.4 at all wavelengths. (For this, and subsequent curves in this appendix, the solar zenith angle θ_i is 20°; all figures here cover the wavelength range from 0.4 to 1.2 μm.) As will be seen later, varying the visibility and surface reflectance affects the magnitude of the diffuse irradiance.

From the foregoing, it can be seen that the spectral content of the solar irradiance has been modified greatly by the atmosphere even before any reflection takes place. The irradiance at the surface E_s is made up of a direct solar component E_{os} and a diffuse component E_d, so

$$E_s = E_{os} + E_d \tag{A1}$$

Upon reflection by the ground, a surface radiance L_s results which is a function of E_s and ρ, the surface reflectance. If Lambertian (isotropic) reflectance can be assumed (this assumption may not always be justified; see Smith et al. 1980), then

$$L_s = \frac{E_s \rho}{\pi} \tag{A2}$$

All quantities have a spectral dependence, which has been omitted here for clarity of notation. The surface radiance L_s is that radiance which would be measured by an observer at the surface. When the target is viewed from aloft, the total radiance measured at the instrument L_T is composed of a beam radiance L_B and a path radiance L_P. Thus,

$$L_T = L_B + L_P \tag{A3}$$

The beam radiance L_B is that component of radiance arising from radiation reflected from the surface and transmitted directly to the sensor without scattering, i.e., $L_B = L_s T$. The path radiance L_P is scattered radiation which enters the path between target and sensor. In terms of the surface radiance L_s,

$$L_T = L_s T + L_P \tag{A4}$$

where T is the transmittance of the atmosphere along the target-to-sensor path. Since the surface reflectance is defined as

$$\rho = \frac{\pi L_s}{E_s} \tag{A5}$$

then the apparent reflectance aloft is

$$\rho_A = \frac{\pi L_T}{E_s} = \frac{\pi}{E_s}(L_s T + L_P) \tag{A6}$$

which differs from the true reflectance ρ according to the magnitudes of T and L_P for the altitude of the sensor. Depending on their magnitudes, ρ_A can be either larger or smaller than the true value ρ.

Figure A3 shows the apparent reflectances of targets with true reflectances of 0.1, 0.4, and 0.7 when the targets are viewed from altitudes of 0.6 km, 3.0 km, and the top of the atmosphere (TOA). In general, viewing through the atmosphere increases the apparent reflectance for low-reflectance objects (e.g., $\rho = 0.1$) and decreases the apparent reflectance for high-reflectance objects (e.g., $\rho = 0.7$). For objects of intermediate reflectance (e.g., $\rho = 0.4$), the effect is minimal and depends on wavelength; ρ_A can be either larger or smaller than the true reflectance ρ.

This distortion in ρ_A is not surprising because only photons in L_s carry information purely concerning the target. Most photons making up L_P have had no interaction with the target. Some of them are derived from multiple-scattered radiation which has never reached the surface. Others are derived from radiation which has been reflected from the surface outside the target area and then, after one or more atmospheric scatterings, has found its way into the field-of-view of the sensor. A small number of photons in L_P have been reflected by the target, but scattered at least once on their way to the sensor (and, thus, are not strictly part of the beam radiance). As the path radiance increases relative to the beam radiance, less information about the target is included in the radiance signal.

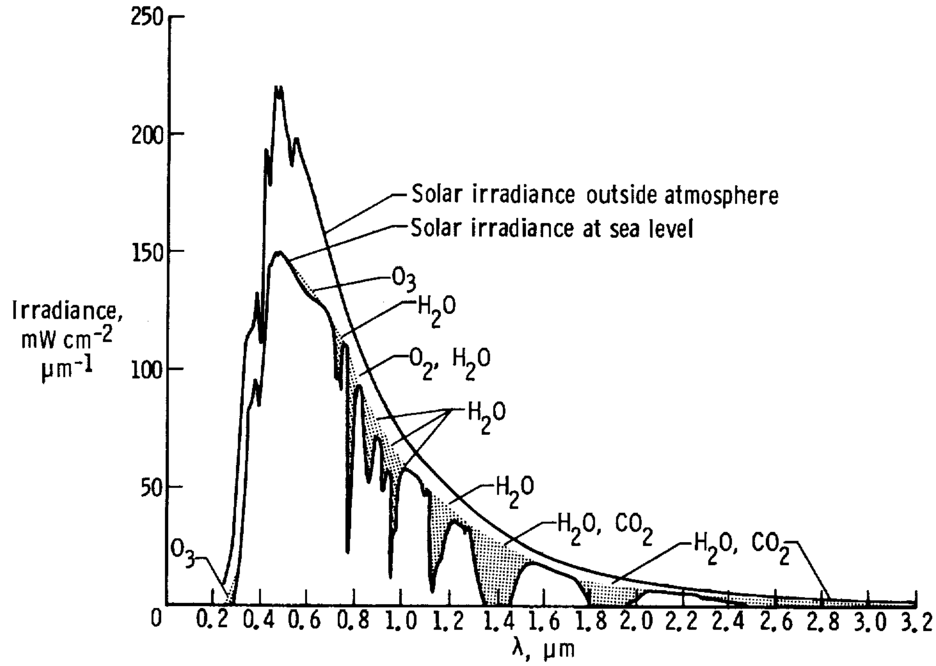


Figure A1. Solar spectral irradiance outside the atmosphere and at the surface, for solar zenith angle of 0°. Features due to principal absorbers are identified.

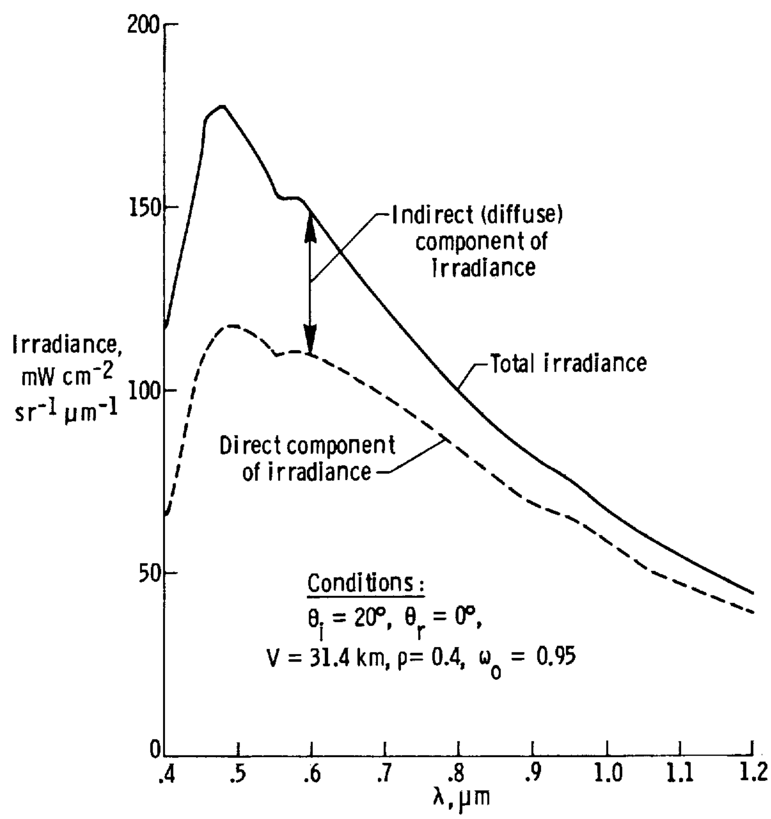


Figure A2. An example of the direct and indirect (diffuse) components of irradiance on a surface with reflectance of 0.4.

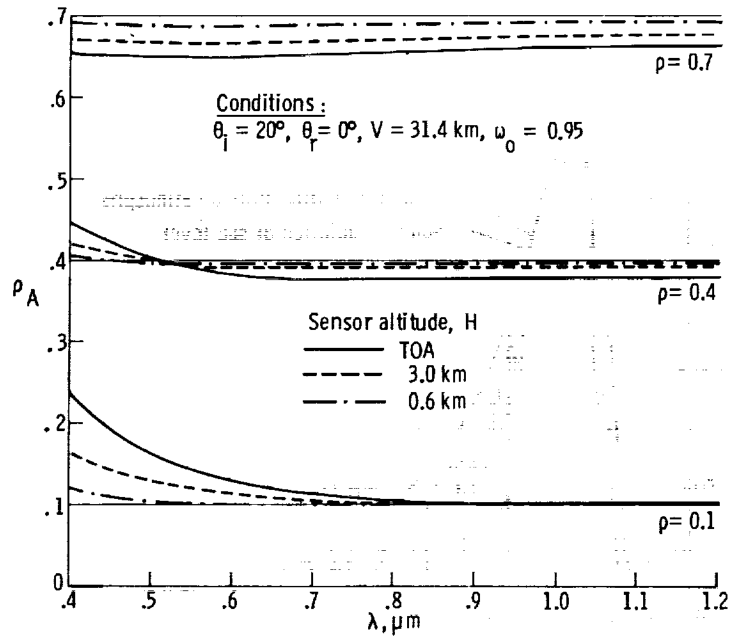


Figure A3. Effect of sensor altitude on apparent surface reflectance.

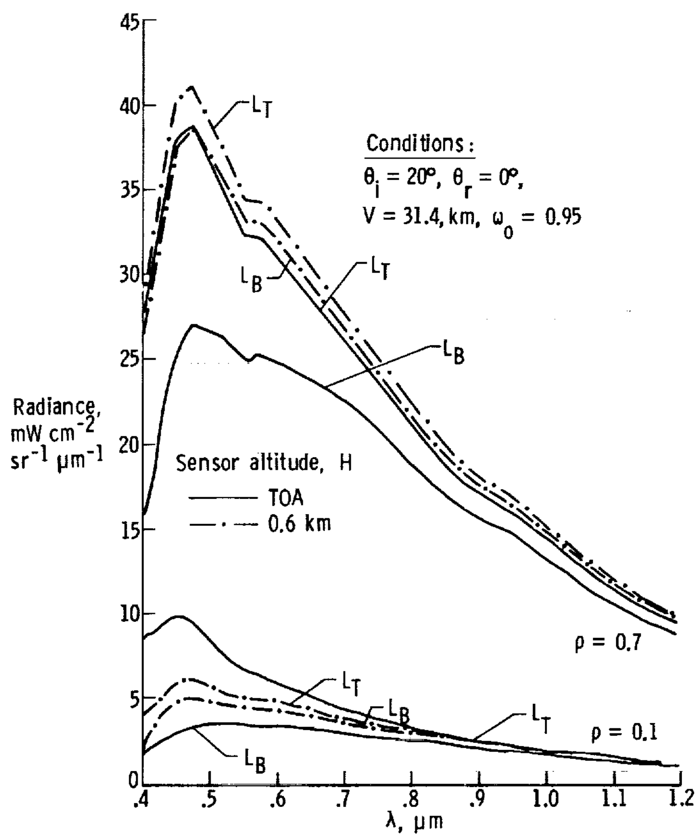


Figure A4. Beam radiance and total radiance at 0.6 km and TOA.

Figure A4 shows the relative strengths of L_T and L_B for reflectances of 0.1 and 0.7, at altitudes of 0.6 km and TOA. Thus, this figure shows the radiance components for the ρ_A plots in figure A3. Note that the absorption features in the radiance curves have been omitted, for clarity. The path radiance is the difference between L_T and L_B. For reflectance of 0.1, the 0.6-km curves lie between the TOA curves. Then, for reflectance of 0.7, the 0.6-km curves lie at or above both TOA curves. This behavior shows that for $\rho = 0.1$, total radiance increases with altitude, but for $\rho = 0.7$, it decreases with altitude. For $\rho = 0.4$ (not shown), the total radiance is nearly constant. Turner (1975) describes in more detail the relative magnitudes of L_T, L_B, and L_P under a variety of conditions.

Factors Affecting Apparent Reflectance Determination

Some introductory examples have just been given of the influence of altitude and surface reflectance on the derived reflectance. In the present section, all the parameters affecting the determination of apparent reflectance will be identified, and their effects described. The parameters are shown on figure A5; they may be grouped as follows:

Viewing geometry:
- Solar zenith angle, θ_i
- Viewing angle, θ_r
- Azimuthal angle, ϕ_i or ϕ_r
- Relative azimuthal angle, ψ, where $\psi = \phi_r - \phi_i + 180$
- Altitude of sensor, H

Meteorological parameters:
- Relative humidity
- Cloud cover
- Surface pressure

Atmospheric optical parameters:
- Optical thickness, τ_A
  or
- Atmospheric visual range, V
- Aerosol type (phase function)
- Single-scattering albedo, ω_o

Target and background parameters:
- Target size
- Target reflectance, ρ_t
- Background reflectance, ρ_b
- Instantaneous field-of-view, IFOV

The effect of variation in each of these parameters is now discussed.

Viewing Geometry. As θ_i increases, less solar irradiance is incident on the surface, and less is reflected

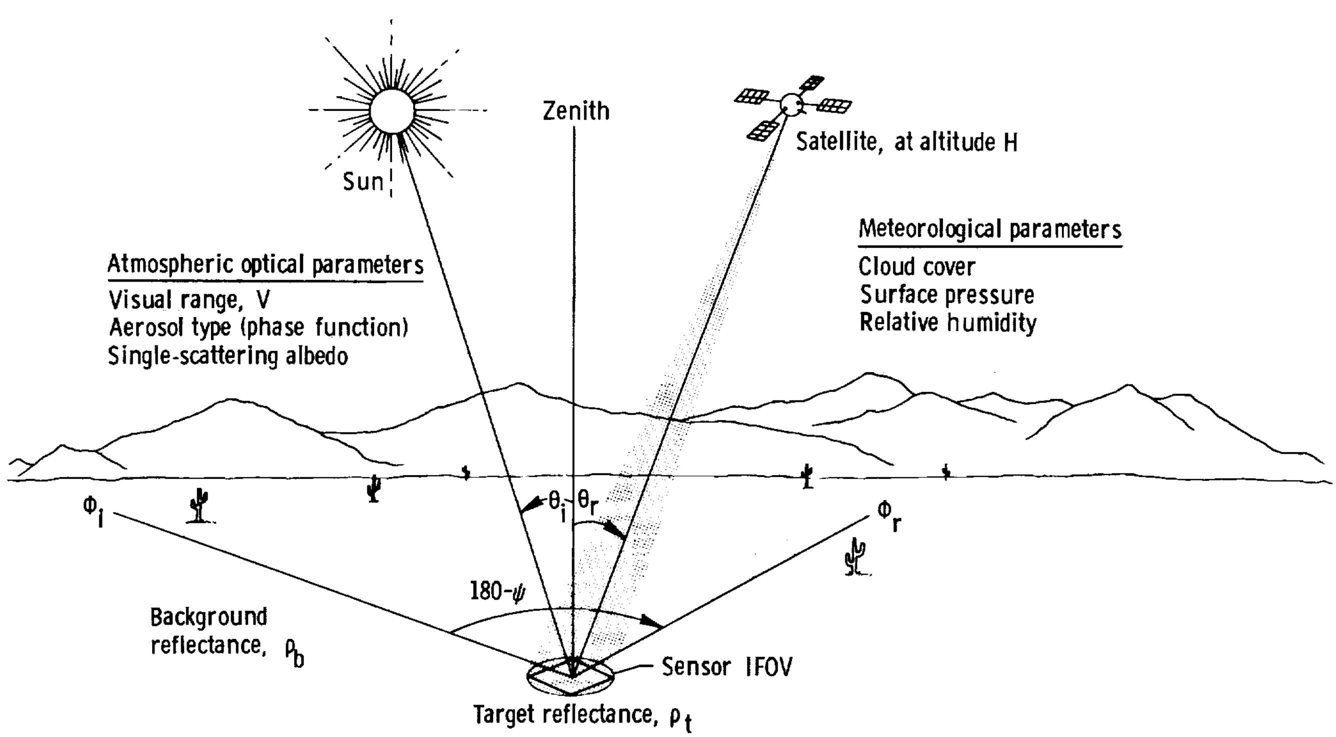


Figure A5. Parameters affecting apparent reflectance.

to the observer. Therefore, failure to account for an increase in θ_i would result in an underestimate of reflectance. (As noted earlier, θ_i should be kept below 55°.) Also, as θ_i increases, there is a higher proportion of multiple scattering in the incident radiation.

Similar effects are noted for θ_r; as θ_r increases, the path component of radiance increases, and the beam component of radiance passes through a longer atmospheric path and suffers more attenuation through absorption and scattering. Therefore, as θ_r increases, the total radiance depends more heavily on atmospheric influences and less on target characteristics. Thus, target contrast and modulation become reduced with increasing θ_r. In addition to the atmospheric effects, most targets have bidirectional reflectance characteristics that are not isotropic (see, e.g., Smith and Ranson 1979 and Kimes 1983). This behavior needs to be considered in addition to the effects of changing θ_i and θ_r (Holben and Fraser 1984 and Barnsley 1984). A feature's reflectance may be considered to be isotropic only for small instantaneous fields-of-view (IFOV) and over ranges of θ_i and θ_r each smaller than a few degrees (Slater 1980). However, isotropic surface reflectance is assumed in all cases here.

Solar radiation is scattered by both the molecular and the aerosol component of the atmosphere. The molecular component (mostly nitrogen) scatters in a Rayleigh-like fashion with equal amounts of forward- and back-scattering, and smaller amounts at right angles to the incident beam. In a very clear atmosphere, the scattering of radiation approaches this condition. In an aerosol atmosphere, however, scattering is much more anisotropic, with the preponderance of radiation scattered in the forward direction. In most conditions, the scattering phase function shape is a blend of the Rayleigh and aerosol phase function shapes, with considerable departure from anisotropy. For this reason, the magnitude of the radiance reaching the detector depends highly on ψ except when θ_r is zero (i.e., the nadir is being viewed). For molecular scattering, the radiation is scattered approximately as the inverse fourth power of the wavelength. (This accounts for the predominantly blue color of the sky.) For aerosol scattering, the result is less marked, the exponent being on the order of −1.3 (Kiang 1982). Thus, aerosol scattering results in a blue-white "milkiness," rather than a blue coloration. For both of these reasons, the effect of a change in ψ is, again, always most marked at the shortest wavelengths. Figure A6 shows the effect of changing ψ with $\theta_i = 20°$ when a surface with reflectance of 0.1 is viewed from satellite altitude for $\theta_r = 5°$. For example, at $\lambda = 0.4$ μm, ρ_A increases by 0.030 for observations in the direction of the Sun (relative azimuth angle $\psi = 0°$) and decreases by 0.014 for observations in the direction opposite the Sun ($\psi = 180°$), compared with the nadir-looking case, which is denoted by X's on the graph. At $\lambda = 0.7$ μm, the increase and decrease are both approximately equal to 0.002.

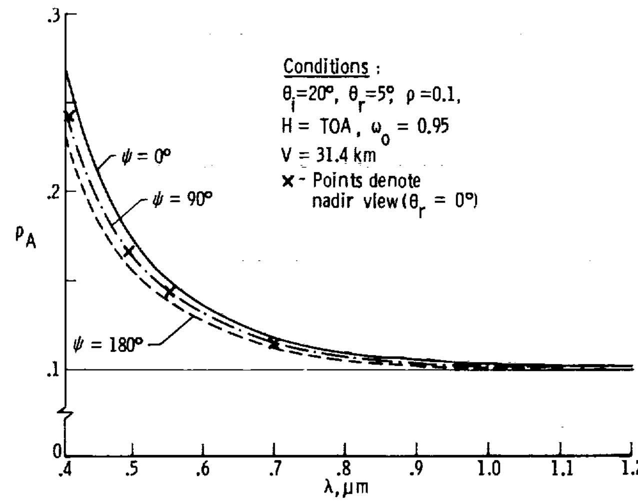


Figure A6. Effect on apparent reflectance of changing relative azimuthal angle when viewing a surface with reflectance of 0.1 at 5° from nadir, from satellite altitude.

Meteorological parameters. Implicit in the foregoing discussion was the assumption of a cloud-free atmosphere and a nominal water vapor profile. Clouds can drastically modulate the amount of energy reaching the surface; they are not modeled here. (For a good discussion of cloud effects, see Duggin et al. 1984.) Changes in the humidity profile change the depth of the water vapor absorption features. A higher level of relative humidity also affects the type of aerosol present, by favoring larger aerosol particles (Shettle and Fenn 1979).

Surface pressure and terrain altitude variability have similar effects on the radiance level. The three-sigma surface pressure variability worldwide is estimated to be equivalent to a surface elevation range from −0.73 to +0.78 km (Bowker et al. 1983). Either a pressure or a surface elevation change modifies the amount of molecular scattering. For most cases, this effect is small.

Atmospheric optical parameters. The amount of aerosol in the atmosphere is usually parameterized by the aerosol optical thickness τ_A where

$$T_A = \exp(-\tau_A) \qquad \text{(A7)}$$

is the aerosol transmissivity in a vertical path. The value of τ_A can be determined for a locality by viewing the Sun with a photometer over a range of solar elevation angles (Flowers et al. 1969 and Peterson et al. 1981). The total attenuation is measured and, then, because the molecular scattering and ozone optical thicknesses are known and can be subtracted, the aerosol optical thickness can be determined. The aerosol optical thickness is sometimes expressed as a turbidity, often taken at or near 0.55 μm wavelength. The optical thickness (or turbidity) at one wavelength can be related to the optical thickness at other wavelengths statistically (Fraser 1975 and Kaufman and Fraser 1983) or analytically (Nicholls 1984).

Another way of quantifying aerosol amount is through visual range in the horizontal at the surface (Elterman 1970). The lower the visual range, the more turbid the atmosphere. This approach has appeal because visibility (which is proportional to visual range (Kneizys et al. 1980)) is a parameter measured at all weather stations, whereas optical thickness is measured at comparatively few sites. The correspondence between optical thickness and visual range is only a rough proportionality, however, because it is possible to have thick layers of aerosol existing aloft with a very clear atmosphere at the surface, as indicated by a surface visibility measurement. For this reason, particularly in remote sensing measurements, for which a target is viewed downward through the atmosphere rather than along a near-surface path, turbidity is a more reliable measure.

In summary, a decrease in visual range, or an increase in optical thickness, increases the amount of aerosol scattering. Figure A7 shows the effect on apparent reflectance of changing the atmospheric visual range from a very hazy condition ($V = 10.5$ km) through an average condition ($V = 31.4$ km) to a rather clear condition ($V = 62.8$ km). The solar zenith angle is 20°, and the nadir is viewed. Three different surface reflectances are simulated. For the low reflectance ($\rho = 0.1$), the effect is an increase in apparent reflectance at all wavelengths, particularly at short wavelengths. Even for the very clear atmosphere ($V = 62.8$ km), the apparent reflectance at $\lambda = 0.4$ μm for $\rho = 0.1$ is around 0.24. At $\lambda = 0.7$ μm, the increase in reflectance is only approximately 0.02, even for a very hazy atmosphere. For $\rho = 0.4$, the effect of the atmosphere can be either to decrease or to increase the apparent reflectance, depending on the wavelength and visual range. There is an increase only at wavelengths smaller than 0.6 μm; at longer wavelengths, the apparent reflectance decreases, by up to 0.04 for a hazy atmosphere. For $\rho = 0.7$, the effect is a decrease in apparent reflectance for all wavelengths and visual ranges. A more detailed discussion of the effects of

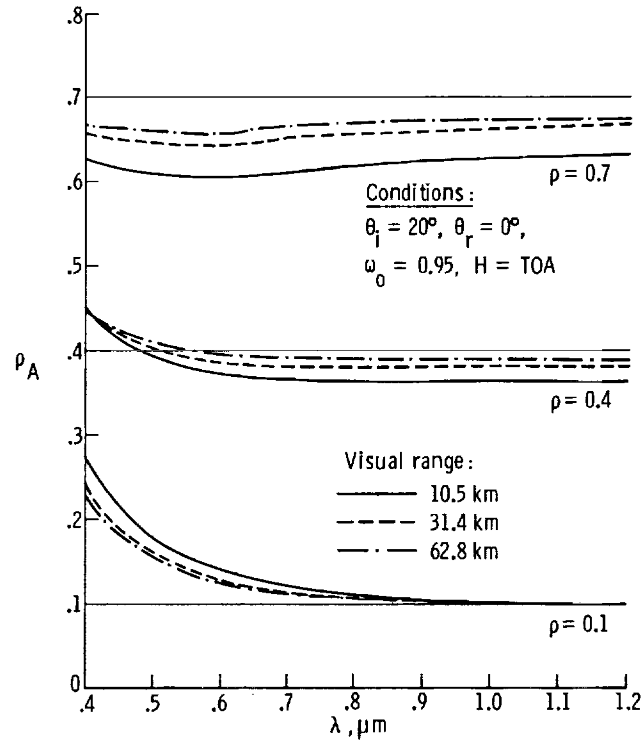


Figure A7. Effect of atmospheric visual range on apparent reflectance, for three surface reflectances.

visual range at solar zenith angles other than 20° may be found in Bowker et al. (1983).

The type of aerosol affects the shape of the single-scattering phase function. Also, the more absorptive the aerosol, the more isotropic the scattering. The single-scattering albedo ω_o determines the amount of radiation scattered, rather than absorbed, at each scattering. A higher ω_o means a higher total radiance level. Remember that the shape of the actual phase function varies with wavelength and is a blend of the Rayleigh and aerosol phase function shapes. Figure A8 shows the effect on ρ_A of changes in the aerosol single-scattering albedo ω_o assumed in the calculations; the effect is shown for three surface reflectances. The apparent reflectance is always highest for the highest value of ω_o and lowest for the lowest value. The effect of a change in ω_o is roughly proportional to the surface reflectance. For darkest scenes, the effect is minimal; for the brightest scene simulated ($\rho = 0.7$), the effect on ρ_A is as much as 0.04 at $\lambda = 0.4$ μm.

Target and background parameters. If the reflectance of the adjacent surface area differs from that of the target, then light scattered from this surrounding background has a different spectral content from that of the target, and the perceived target re-

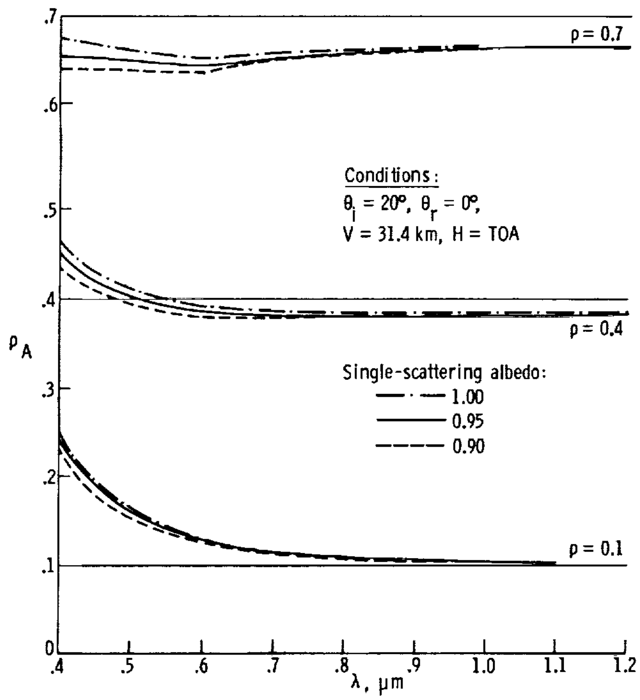


Figure A8. Effect of aerosol single-scattering albedo on apparent reflectance, for three surface reflectances.

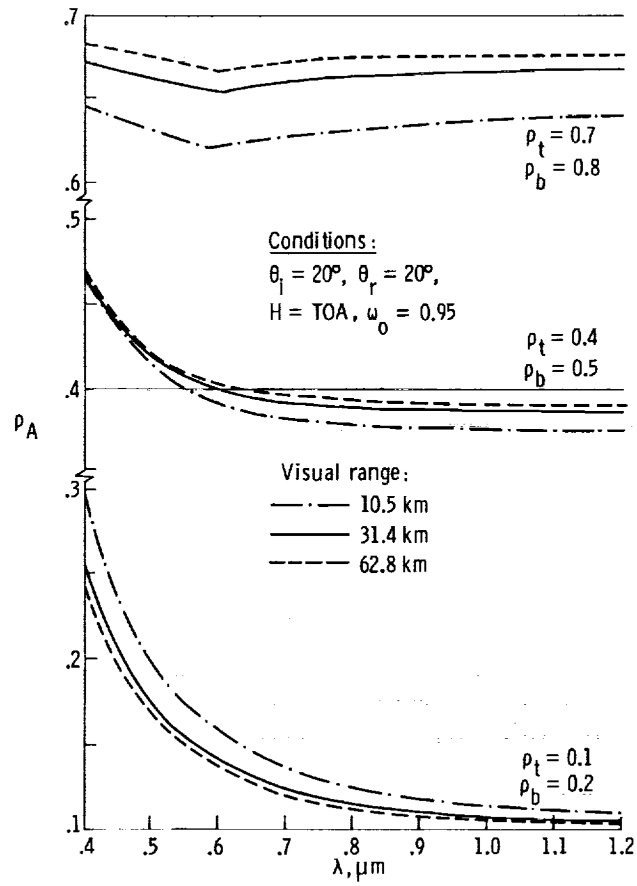


Figure A9. Effect of background radiance on apparent reflectance, when background reflectance is 0.1 higher than target reflectance, for three target reflectances and atmospheric visual ranges.

flectance will be in error. Figure A9 shows the effect of viewing a target surrounded by a uniform, slightly more reflective background. The figure shows cases with target/background reflectance combinations of 0.1/0.2, 0.4/0.5, and 0.7/0.8. A comparison of these results with those for the uniform-scene reflectances of 0.1, 0.4, and 0.7 in figure A7 shows that in each case the apparent reflectance is higher than that of the target alone, because of additional photons scattered into the path from the background. Even for the slight reflectance differences (0.1) simulated here, the effect is appreciable. Thus, background effects need to be taken carefully into account.

The research area of modeling such "adjacency effects" continues to be an active one. Some recent references are those of Dave (1980), Kaufman and Joseph (1982), Dana (1982), and Kaufman (1984). A good introductory discussion may be found in Slater (1980).

Correction for Atmospheric Effects

Because the factors named above all affect the perceived reflectances of substances, it is of interest to ask whether such influences can be estimated well enough to remove their effects and allow the true reflectance profiles to be estimated. Bowker et al. (1983) directly attacked this problem. In that report, the effects of imprecision in the knowledge of each of the quantities noted earlier on derived reflectance are discussed, and the results plotted. Also, a method was developed for estimating spectral reflectance from total radiance values. Figure A10 (from Bowker et al. 1983) shows an example of an alfalfa radiance profile converted to obtain a reflectance profile. When the sky is free of clouds and relatively stable atmospheric conditions prevail, it should be possible to determine reflectance to an accuracy of 10 percent or better, by using local meteorological data. It should be noted, however, that only 2 of the 156 reflectance curves presented in this report have been corrected for atmospheric effects in this manner.

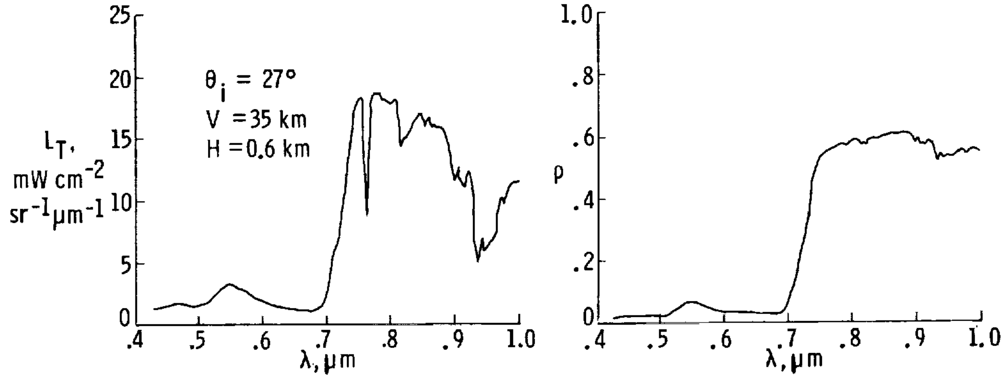


Figure A10. Example of alfalfa field radiance profile that has been converted to spectral reflectance.

References

Allen, William A.; and Richardson, Arthur J. 1968: Interaction of Light With a Plant Canopy. *J. Opt. Soc. America,* vol. 58, no. 8, Aug., pp. 1023–1028.

Badhwar, G. D.; Carnes, J. G.; and Austin, W. W. 1982: Use of Landsat-Derived Temporal Profiles for Corn-Soybean Feature Extraction and Classification. *Remote Sensing Environ.*, vol. 12, no. 1, Mar., pp. 57–79.

Barnsley, M. J. 1984: Effects of Off-Nadir View Angles on the Detected Spectral Response of Vegetation Canopies. *Int. J. Remote Sensing,* vol. 5, no. 4, July-Aug., pp. 715–728.

Bauer, M. E.; McEwen, M. C.; Malila, W. A.; and Harlan, J. C. 1979: *Design, Implementation, and Results of LACIE Field Research.* LARS Tech. Rep. 102579 (Contract NAS9-15466), Purdue Univ., Oct., pp. 1037–1066. (Available as NASA TM-80811.)

Bauer, Marvin E.; Silva, LeRoy; Hoffer, Roger M.; and Baumgardner, Marion F. 1977: *Agricultural Scene Understanding.* LARS Contract Rep. 112677, (Contract NAS9-14970), Purdue Univ., Nov. (Available as NASA CR-155343.)

Beers, J. N. P. 1975: *Analysis of Significance Within Crop-Spectra—A Comparison Study of Different Multispectral Scanners.* NIWARS Publ. No. 30, Netherlands Interdepartmental Working Community for the Application of Remote Sensing Techniques (Kanaalweg 3, Delft, The Netherlands), May.

Begni, Gerard 1982: Selection of the Optimum Spectral Bands for the SPOT Satellite. *Photogramm. Eng. & Remote Sensing,* vol. 48, no. 10, Oct., pp. 1613–1620.

Biehl, L. L.; Bauer, M. E.; Robinson, B. F.; Daughtry, C. S. T.; Silva, L. F.; and Pitts, D. E. 1982: A Crops and Soils Data Base for Scene Radiation Research. *Machine Processing of Remotely Sensed Data—Crop Inventory and Monitoring,* D. C. McDonald and D. B. Morrison, eds., Laboratory for Applications of Remote Sensing, Purdue Univ., pp. 169–177.

Bowker, D. E.; Davis, R. E.; Von Ofenheim, W. H. C.; and Myrick, D. L. 1983: Estimation of Spectral Reflectance Signatures From Spectral Radiance Profiles. *Proceedings of the Seventeenth International Symposium on Remote Sensing of Environment, Volume II,* Environmental Research Inst. of Michigan, pp. 795–814.

Bowker, D. E. 1985: Priorities for Remote Sensing Based on Worldwide Distribution of Crops. *Photogramm. Eng. & Remote Sensing,* vol. 51, no. 8, Aug. (Scheduled for publication.)

Collins, William 1978: Remote Sensing of Crop Type and Maturity. *Photogramm. Eng. & Remote Sensing,* vol. 44, no. 1, Jan., pp. 43–55.

Collins, W. E.; Raines, G. L.; and Canney, F. C. 1977: Airborne Spectroradiometer Discrimination of Vegetation Anomalies Over Sulfide Mineralization: A Remote Sensing Technique. *Geology Society of America 90th Annual Meeting Program and Abstracts,* vol. 9, no. 7, pp. 932–933.

Condit, H. R. 1970: The Spectral Reflectance of American Soils. *Photogramm. Eng.,* vol. 36, no. 8, Aug., pp. 955–966.

Coulson, K. L.; and Reynolds, David W. 1971: The Spectral Reflectance of Natural Surfaces. *J. Appl. Meteorol.,* vol. 10, no. 6., Dec., pp. 1285–1295.

Crane, R. G.; and Anderson, M. R. 1984: Satellite Discrimination of Snow/Cloud Surfaces. *Int. J. Remote Sensing,* vol. 5, no. 1, Jan.-Feb., pp. 213–223.

Dana, Robert W. 1982: Background Reflectance Effects in Landsat Data. *Appl. Opt.,* vol. 21, no. 22, Nov. 15, pp. 4106–4111.

Dave, J. V. 1980: Effect of Atmospheric Conditions on Remote Sensing of a Surface Nonhomogeneity. *Photogramm. Eng. & Remote Sensing,* vol. 46, no. 9, Sept., pp. 1173–1180.

De Boer, Th. A.; Bunnik, N. J. J.; Van Kasteren, H. W. J.; Uenk, D.; Verhoef, W.; and De Loor, G. P. 1974: Investigation Into the Spectral Signature of Agricultural Crops During Their State of Growth. *Proceedings of the Ninth International Symposium on Remote Sensing of Environment, Volume II,* Environmental Research Inst. of Michigan, pp. 1441–1455.

Duggin, M. J.; and Cunia, T. 1983: Ground Reflectance Measurement Techniques: A Comparison. *Appl. Opt.,* vol. 22, no. 23, Dec. 1, pp. 3771–3777.

Duggin, M. J.; Schoch, L.; Cunia, T.; and Piwinski, D. 1984: Effects of Random and Systematic Variations in Unresolved Cloud on Recorded Radiance and on Target Discriminability. *Appl. Opt.,* vol. 23, no. 3, Feb. 1, pp. 387–395.

Elterman, L. 1970: *Vertical-Attenuation Model With Eight Surface Meteorological Ranges 2 to 13 Kilometers.* AFCRL-70-0200, U.S. Air Force, Mar. (Available from DTIC as AD 707 488.)

Flowers, E. C.; McCormick, R. A.; and Kurfis, K. R. 1969: Atmospheric Turbidity Over the United States, 1961-66. *J. Appl. Meteorol.,* vol. 8, no. 6, Dec., pp. 955–962.

Fraser, Robert S. 1975: Degree of Interdependence Among Atmospheric Optical Thicknesses in Spectral Bands Between 0.36-2.4 μm. *J. Appl. Meteorol.,* vol. 14, no. 6, Sept., pp. 1187–1196.

Gausman, H. W.; Allen, W. A.; Wiegand, C. L.; Escobar, D. E.; Rodriquez, R. R.; and Richardson, A. J. 1973: *The Leaf Mesophylls of Twenty Crops, Their Light Spectra, and Optical and Geometrical Parameters.* Tech. Bull. No. 1465 (NASA Contract No. R-09-038-002), U.S. Dep. Agriculture, Mar.

Gausman, Harold W. 1974: Leaf Reflectance of Near-Infrared. *Photogramm. Eng.,* vol. XL, no. 2, Feb., pp. 183–191.

Gausman, H. W.; Escobar, D. E.; Everitt, J. H.; Richardson, A. J.; and Rodriguez, R. R. 1978: Distinguishing Succulent Plants From Crop and Woody Plants. *Photogramm. Eng. & Remote Sensing,* vol. 44, no. 4, Apr., pp. 487–491.

Goetz, Alexander F. H.; Rock, Barrett N.; and Rowan, Lawrence C. 1983: Remote Sensing for Exploration: An Overview. *Econ. Geol. & Bull. Soc. Econ. Geol.,* vol. 78, no. 4, June-July, pp. 573–590.

Goetz, Alexander F. H.; and Rowan, Lawrence C. 1981: Geologic Remote Sensing. *Science*, vol. 211, no. 4484, Feb. 20, pp. 781–791.

Gower, J. R. F.; Lin, S.; Borstad, G. A. 1984: The Information Content of Different Optical Spectral Ranges for Remote Chlorophyll Estimation in Coastal Waters. *Int. J. Remote Sensing,* vol. 5, no. 2, Mar./Apr., pp. 349–364.

Graetz, R. D.; and Gentle, M. R. 1982: The Relationships Between Reflectance in the Landsat Wavebands and the Composition of an Australian Semi-Arid Shrub Rangeland. *Photogramm. Eng. & Remote Sensing,* vol. 48, no. 11, Nov., pp. 1721–1730.

Holben, Brent; and Fraser, Robert S. 1984: Red and Near-Infrared Sensor Response to Off-Nadir Viewing. *Int. J. Remote Sensing,* vol. 5, no. 1, Jan.-Feb., pp. 145–160.

Huck, F. O.; Davis, R. E.; Fales, C. L.; Aherron, R. M.; Arduini, R. F.; and Samms, R. W. 1984: Study of Remote Sensor Spectral Responses and Data Processing Algorithms for Feature Classification. *Opt. Eng.*, vol. 23, no. 5, Sept./Oct., pp. 650–666.

Idso, S. B.; Pinter, P. J., Jr.; Jackson, R. D.; and Reginato, R. J. 1980: Estimation of Grain Yields by Remote Sensing of Crop Senescence Rates. *Remote Sensing Environ.*, vol. 9, no. 1, Feb., pp. 87–91.

Jacquez, John A.; and Kuppenheim, Hans F. 1955: Theory of the Integrating Sphere. *J. Opt. Soc. America,* vol. 45, no. 6, June, pp. 460–470.

Judd, Deane B. 1967: Terms, Definitions, and Symbols in Reflectometry. *J. Opt. Soc. America,* vol. 57, no. 4, Apr., pp. 445–452.

Kahle, Anne B.; Goetz, Alexander F. H.; Paley, Helen N.; Alley, Ronald E.; and Abbott, Elsa A. 1981: A Data Base of Geologic Field Spectra. *Proceedings of the Fifteenth International Symposium on Remote Sensing of Environment, Volume 1,* Environmental Research Inst. of Michigan, pp. 329-337.

Kaufman, Yoram J. 1984: Atmospheric Effect on Spatial Resolution of Surface Imagery. *Appl. Opt.,* vol. 23, no. 19, Oct. 1, pp. 3400–3408.

Kaufman, Yoram J.; and Joseph, Joachim H. 1982: Determination of Surface Albedos and Aerosol Extinction Characteristics From Satellite Imagery. *J. Geophys. Res.*, vol. 87, no. C2, Feb. 20, pp. 1287–1299.

Kaufman, Yoram J.; and Fraser, Robert S. 1983: Light Extinction by Aerosols During Summer Air Pollution. *J. Clim. & Appl. Meteorol.,* vol. 22, no. 10, Oct., pp. 1694–1706.

Kauth, R. J.; and Thomas, G. S. 1976: The Tasselled Cap—A Graphic Description of the Spectral-Temporal Development of Agricultural Crops as Seen by LANDSAT. *Symposium on Machine Processing of Remotely Sensed Data*, 76CH1103-1 MPRSD, Inst. Electr. & Electron. Eng., Inc., pp. 4B-41–4B-51.

Kiang, Richard K. 1982: Atmospheric Effects on TM Measurements: Characterization and Comparison With the Effects on MSS. *IEEE Trans. Geophys. & Remote Sensing,* vol. GE-20, no. 3, July, pp. 365–370.

Kimes, D. S. 1983: Dynamics of Directional Reflectance Factor Distributions for Vegetation Canopies. *Appl. Opt.*, vol. 22, no. 9, May 1, pp. 1364–1372.

Kirchner, J. A.; Youkhana, S.; and Smith, J. A. 1982: Influence of Sky Radiance Distribution on the Ratio Technique for Estimating Bidirectional Reflectance. *Photogramm. Eng. & Remote Sensing,* vol. 48, no. 6, June, pp. 955–959.

Kneizys, F. X.; Shettle, E. P.; Gallery, W. O.; Chetwynd, J. H., Jr.; Abreu, L. W.; Selby, J. E. A.; Fenn, R. W.; and McClatchey, R. A. 1980: *Atmospheric Transmittance/Radiance: Computer Code LOWTRAN 5.* AFGL-TR-80-0067, U.S. Air Force, Feb. (Available from DTIC as AD A088 215.)

Knipling, Edward B. 1970: Physical and Physiological Basis for the Reflectance of Visible and Near-Infrared Radiation From Vegetation. *Remote Sensing Environ.*, vol. 1, no. 3, Summer, pp. 155–159.

Lillesaeter, O. 1982: Spectral Reflectance of Partly Transmitting Leaves: Laboratory Measurements and Mathematical Modeling. *Remote Sensing Environ.*, vol. 12, no. 3, July, pp. 247–254.

Mack, A. R.; Brach, E. J.; and Rao, C. R. 1984: Appraisal of Multispectral Scanner Systems From Analysis of High-Resolution Plant Spectra. *Int. J. Remote Sensing,* vol. 5, no. 2, Mar.-Apr., pp. 279–288.

McClellan, W. D.; Meiners, J. P.; and Orr, Don G. 1963: Spectral Reflectance Studies on Plants. *Proceedings of the Second Symposium on Remote Sensing of Environment,* Univ. of Michigan, pp. 403–413.

Nicholls, R. W. 1984: Wavelength-Dependent Spectral Extinction of Atmospheric Aerosols. *Appl. Opt.*, vol. 23, no. 8, Apr. 15, pp. 1142–1143.

Peterson, James T.; Flowers, Edwin C.; Berri, Guillermo J.; Reynolds, Cheryl L.; and Rudisill, John H. 1981: Atmospheric Turbidity Over Central North Carolina. *J. Appl. Meteorol.*, vol. 20, no. 3, Mar., pp. 229–241.

Podwysocki, M. H.; Segal, D. B.; and Abrams, M. J. 1983: Use of Multispectral Scanner Images for Assessment of Hydrothermal Alteration in the Marysvale, Utah, Mining Area. *Econ. Geol.*, vol. 78, no. 4, June-July, pp. 675–687.

Reginato, R. J.; Vedder, J. F.; Idso, S. B.; Jackson, R. D.; Blanchard, M. B.; and Goettelman, R. 1977: An Evaluation of Total Solar Reflectance and Spectral Band Ratioing Techniques for Estimating Soil Water Content. *J. Geophy. Res.*, vol. 82, no. 15, May, pp. 2101–2104.

Robinson, B. F.; and Biehl, L. L. 1979: Calibration Procedures for Measurement of Reflectance Factor in Remote Sensing Field Research. *Measurements of Optical Radiations, Volume 196 of Proceedings of the Society of Photo-Optical Instrumentation Engineers,* Harold P. Field, Edward F. Zalewski, and Frederic Zweibaum, eds., pp. 16–26.

Salisbury, John W.; and Hunt, Graham R. 1968: Martian Surface Materials: Effect of Particle Size on Spectral Behavior. *Science*, vol. 161, no. 3839, July 26, pp. 365–366.

Schappell, Roger T.; Tietz, John C.; Hulstrom, Roland L.; Cunningham, Robert A.; and Reel, Gwynn M. 1976: *Preliminary Experiment Definition for Video Landmark Acquisition and Tracking.* NASA CR-145122.

Shettle, Eric P.; and Fenn, Robert W. 1979: *Models for the Aerosols of the Lower Atmosphere and the Effects of Humidity Variations on Their Optical Properties.* AFGL–TR–79–0214, U.S. Air Force, Sept. (Available from DTIC as AD A085 951.)

Siegal, Barry S.; and Goetz, Alexander F. H. 1977: Effect of Vegetation on Rock and Soil Type Discrimination. *Photogramm. Eng. & Remote Sensing,* vol. 43, no. 2, Feb., pp. 191–196.

Slater, Philip N. 1980: *Remote Sensing—Optics and Optical Systems.* Addison-Wesley Pub. Co., Inc.

Smith, J. A.; Lin, Tzeu Lie; and Ranson, K. J. 1980: The Lambertian Assumption and Landsat Data. *Photogramm. Eng. & Remote Sensing,* vol. 46, no. 9, Sept., pp. 1183–1189.

Smith, J. A.: and Ranson, K. J. 1979. *Multispectral Resource Sampler (MRS) Proof of Concept Literature Survey of Bidirectional Reflectance.* NASA CR-170599.

Stoner, Eric R.; and Baumgardner, Marion F. 1980: *Physiochemical, Site and Bidirectional Reflectance Factor Characteristics of Uniformly Moist Soils.* SR-PO-00431 (Contract NAS9-15466), Purdue Univ., Feb. (Available as NASA CR-160571.)

Turner, Robert E. 1975: *Atmospheric Effects in Multispectral Remote Sensor Data.* ERIM 109600-15-F (Contract NAS9-14123), Environmental Research Inst. of Michigan, May. (Available as NASA CR-141863.)

Vane, Gregg; Billingsley, Fred C.; and Dunne, James A. 1982: Observational Parameters for Remote Sensing in the Next Decade. *Advanced Multispectral Remote Sensing Technology and Applications, Volume 345 of Proceedings of SPIE—The International Society for Optical Engineering,* Ken J. Ando, ed., pp. 52–65.

Verhoef, W.; and Bunnik, N. J. J. 1974: *Spectral Reflectance Measurements on Agricultural Field Crops During the Growing Season.* NIWARS Publ. 31, Netherlands Interdepartmental Working Community for the Application of Remote Sensing Techniques (Kanaalweg 3, Delft, The Netherlands), Dec.

Vlcek, J. 1972: *Considerations in Determination, Evaluation and Computer Banking of Spectral Signatures of Natural Objects.* FMR-22, Forest Management Inst., (Ottawa, Ontario), Mar.

Spectral Reflectance Data

Spectral reflectance data are presented for 156 targets. The targets are grouped into six major categories: agriculture; trees; shrubs and grasses; rocks and soils; water, snow, and clouds; and miscellaneous. Within each category the targets are arranged alphabetically with appropriate adjectives that help to describe the state of the target. Of the 156 data sets, 59 represent laboratory measurements. Most of these occur in either the tree or the rocks and soils category. The laboratory data are identified by the words sample, leaf, or needles. As previously mentioned, laboratory and field data are not compatible, since they represent entirely different environments.

The reflectance data for each target are presented in both a graphical and a tabular format. On each graph the source reference number is given along with the date of measurement and target location, where available, and any other pertinent information concerning the target condition or viewing geometry. The supporting information provided here has been limited to the more commonly measured items, and the reader may refer to the original source when more specific data are needed. Each reflectance curve was presented by its author as being representative of a given target; this report has simply standardized all of the data to a common format.

An index of targets and a numbered list of reference sources precede the spectral reflectance data.

Index of Spectral Reflectance Targets

Agriculture

No.	Target	Ref.
1	Alfalfa	9
2	Mature Alfalfa	6
3	Dry Alfalfa Hay	37
4	Barley	38
5	Barley	50
6	Stem Extension Barley	3
7	Ripe Barley	6
8	Ripe Barley	3
9	Bean Leaf	26
10	Dehydrated Bean Leaf	26
11	Beans	50
12	Beets	46
13	Cabbage	46
14	Cantaloupe Leaf	20
15	Tall Green Corn	27
16	Silage Corn	27
17	Yellow Corn	27
18	Cotton Leaf	15
19	Dehydrated Cotton Leaf	15
20	Fallow Field	40
21	Flax	33
22	Oats	33
23	Oats	50
24	Oats	38
25	Peanuts	33
26	Potatoes	46
27	Potatoes	50
28	Rapeseed	38
29	Sorghum	7
30	Soybeans	29
31	Soybeans	38
32	Sugar Beets	50
33	Sugar Beets	33
34	Sugarcane Leaf	14
35	Sugarcane Leaf	19
36	Sugarcane	19
37	Sunflower	23
38	Tobacco	26
39	Tomatoes	46
40	Tomatoes	33
41	Watermelon Leaf	14
42	Wheat	50
43	Seedling Wheat	3
44	Young Wheat	11
45	Booted Wheat	6
46	Mature Wheat	11
47	Mature Wheat	3
48	Wheat Stubble	40

Trees

No.	Target	Ref.
49	Trembling Aspen	51
50	Birch Leaves	30
51	Redblush Citrus	17
52	American Elm Leaf	24
53	Balsam Fir	57
54	Silver Maple Leaf	24
55	Sugar Maple Leaf	52
56	Burr Oak Leaf	36
57	Live Oak	39
58	Orange Leaf	56
59	Peach Leaf	56
60	Dead Ponderosa Pine Needles	22
61	Ponderosa Pine Needles	22
62	Ponderosa Pine Needles	55
63	Red Pine Needles	36
64	White Pine	51
65	Red Spruce	57
66	Sycamore Leaf	49
67	Dehydrated Sycamore Leaf	49
68	Tulip Tree Leaf	24

Shrubs and Grasses

No.	Target	Ref.
69	Cenizo	39
70	Average Desert Leaves	4
71	Grass	40
72	Grass	44
73	Kentucky Blue Grass	50
74	Red Fescue Grass	50
75	Blue Grama Grass	48
76	Perennial Rye Grass	50
77	Dry Lichen Sample	13
78	Lichen Mat	12
79	Manzanita	44
80	Mesquite	39
81	Honey Mesquite	16
82	Prickly Pear	19
83	Dry Sage	44
84	Average Subalpine Slope Leaves	4
85	Silverleaf Sunflower	39
86	Burned Forest Surface	12

Rocks and Soils

No.	Target	Ref.
87	Arkose	21
88	Basalt Sample	41
89	Red Cinder Basalt Sample	1
90	Gray Basalt Sample	1
91	Breccia	32
92	Dry Red Clay Sample	47
93	Wet Red Clay Sample	47
94	Quartz Diorite	5
95	Granite	54
96	Granite	5
97	Biotite Granite Sample	41
98	Gravel	40
99	Glaciofluvial Sand and Gravel	45
100	Limestone	21
101	Limestone Sample	47
102	Monzonite	5
103	Quartz Monzonite	5
104	Obsidian Sample	1
105	Unaltered Rocks	42
106	Altered Rocks	42
107	Rhyolite Sample	41
108	Beach Sand Sample	25
109	Carbonate Beach Sand Sample	10
110	Quartz Beach Sand Sample	10
111	Quartz Beach Sand Sample	10
112	Dry Sand	8
113	Gypsum Sand Sample	25
114	Silica Sand Sample	25
115	Shale	21
116	Dry Silt Sample	47
117	Wet Silt Sample	47
118	Dry Silt	8
119	Dry Lacustrine Silt and Clay	45
120	Soil Sample	43
121	Soil Sample	43
122	Soil Sample	25
123	Disked Bare Soil	18
124	Dry Pedocal-Type Soil	8
125	Dry Chernozem-Type Soil	8
126	Dry Laterite-Type Soil	8
127	Dry Clay Soil Sample	24
128	Wet Clay Soil Sample	24
129	Dry Lake Soil Sample	25
130	Chilean Nitrate Soil Sample	25
131	Salt Pool Soil Sample	25
132	Dry Sandy Soil Sample	24
133	Wet Sandy Soil Sample	24
134	Syenite	5
135	Dry Glacial Till	45
136	Rhyolite Tuff Sample	1

Water, Snow, and Clouds

No.	Target	Ref.
137	Altocumulus Clouds	28
138	Stratus Clouds	28
139	Cirrostratus Clouds	28
140	Middle Layer Clouds	34
141	Dense Ice Cloud Sample	58
142	Hoarfrost Sample	58
143	Snow Sample	53
144	Typical Snow Sample	35
145	Fresh Snow Sample	35
146	Two Day Old Snow Sample	35
147	Dry Fresh Snow	23
148	Wet Snow	23
149	Water	40
150	Clear Lake Water	2
151	Turbid River Water	2

Miscellaneous

No.	Target	Ref.
152	Asphalt	40
153	Blacktop	9
154	Concrete	40
155	Shingles	40
156	Artificial Turf	31

Reference Sources for Spectral Reflectance Data

1. Adams, John B.; and Filice, Alan L.: Spectral Reflectance 0.4 to 2.0 Microns of Silicate Rock Powders. *J. Geophys. Res.*, vol. 72, no. 22, Nov. 15, 1967, pp. 5705–5715.
2. Bartolucci, Luis A.; Robinson, Barrett F.; and Silva, LeRoy F.: Field Measurements of the Spectral Response of Natural Waters. *Photogramm. Eng. & Remote Sensing*, vol. 43, no. 5, May 1977, pp. 595–598.
3. Bauer, M. E.; McEwen, M. C.; Malila, W. A.; and Harlan, J. C.: Design, Implementation, and Results of LACIE Field Research. LARS Tech. Rep. 102579 (Contract NAS9-15466), Purdue Univ., Oct. 1979, pp. 1037–1066. (Available as NASA TM-80811.)
4. Billings, W. D.; and Morris, Robert J.: Reflection of Visible and Infrared Radiation From Leaves of Different Ecological Groups. *American J. Bot.*, vol. 38, May 1951, pp. 327–331.
5. Blom, Ronald G.; Abrams, Michael J.; and Adams, Herbert G.: Spectral Reflectance and Discrimination of Plutonic Rocks in the 0.45 to 2.45 μm Region. *J. Geophys. Res.*, vol. 85, no. B5, May 10, 1980, pp. 2638–2648.
6. Bowker, D. E.; Davis, R. E.; Von Ofenheim, W. H. C.; and Myrick, D. L.: Estimation of Spectral Reflectance Signatures From Spectral Radiance Profiles. *Proceedings of the Seventeenth International Symposium on Remote Sensing of Environment, Volume II*, Environmental Research Inst. of Michigan, 1983, pp. 795–814.
7. Castruccio, P. A.: End-to-End Design Concept. *Remote Sensing of Earth From Space*, Roger A. Breckenridge, ed., American Inst. Aeronaut. & Astronaut., c.1979, pp. 221–230. (Available as AIAA Paper 78-1738.)
8. Condit, H. R.: The Spectral Reflectance of American Soils. *Photogramm. Eng.*, vol. 36, no. 8, Aug. 1970, pp. 955–966.
9. Coulson, K. L.; and Reynolds, David W.: The Spectral Reflectance of Natural Surfaces. *J. Appl. Meteorol.*, vol. 10, no. 6, Dec. 1971, pp. 1285–1295.
10. Davis, C. F.; Schuchman, R. A.; and Suits, G. H.: The Use of Remote Sensing in the Determination of Beach Sand Parameters. *Proceedings of the Thirteenth International Symposium on Remote Sensing of Environment, Volume II*, Environmental Research Inst. of Michigan, 1979, pp. 775–788.
11. De Boer, Th. A.; Bunnik, N. J. J.; Van Kasteren, H. W. J.; Uenk, D.; Verhoef, W.; and De Loor, G. P.: Investigation Into the Spectral Signature of Agricultural Crops During Their State of Growth. *Proceedings of the Ninth International Symposium on Remote Sensing of Environment, Volume II*, Environmental Research Inst. of Michigan, 1974, pp. 1441-1455.
12. Fuller, Stephan P.; and Rouse, Wayne R.: Spectral Reflectance Changes Accompanying a Post-Fire Recovery Sequence in a Subarctic Spruce Lichen Woodland. *Remote Sensing Environ.*, vol. 8, no. 1, Feb. 1979, pp. 11–23.
13. Gates, David M.; Keegan, Harry J.; Schleter, John C.; and Weidner, Victor R.: Spectral Properties of Plants. *Appl. Opt.*, vol. 4, no. 1, Jan. 1965, pp. 11–20.
14. Gausman, H. W.; Allen, W. A.; Wiegand, C. L.; Escobar, D. E.; Rodriguez, R. R.; and Richardson, A. J.: *The Leaf Mesophylls of Twenty Crops, Their Light Spectra, and Optical and Geometrical Parameters*. Tech. Bull. No. 1465 (NASA Contract No. R-09-038-002), U.S. Dep. Agriculture, Mar. 1973.
15. Gausman, Harold W.: Leaf Reflectance of Near-Infrared. *Photogramm. Eng.*, vol. XL, no. 2, Feb. 1974, pp. 183–191.
16. Gausman, H. W.; Everitt, J. H.; Gerbermann, A. H.; and Escobar, D. E.: Leaf Spectral Characteristics of Nine Woody Plant Species From Texas Rangelands. *Remote Sensing of Earth Resources, Volume V*, F. Shahrokhi, ed., Univ. of Tennessee Space Inst., 1976, pp. 333–347.
17. Gausman, H. W.; Escobar, D. E.; and Wiegand, C. L.: Reflectance and Photographic Characteristics of Three Citrus Varieties for Discrimination Purposes. *Remote Sensing of Earth Resources, Volume VI*, F. Shahrokhi, ed., Univ. of Tennessee Space Inst., 1977, pp. 341–355.
18. Gausman, H. W.; Leamer, R. W.; Noreiga, J. R.; Rodriguez, R. R.; and Wiegand, C. L.: Field–Measured Spectroradiometric Reflectances of Disked and Nondisked Soil With and Without Wheat Straw. *Soil Sci. Soc. America J.*, vol. 41, 1977, pp. 793–796.
19. Gausman, H. W.; Escobar, D. E.; Everitt, J. H.; Richardson, A. J.; and Rodriguez, R. R.: Distinguishing Succulent Plants From Crop and Woody Plants. *Photogramm. Eng. & Remote Sensing*, vol. 44, no. 4, Apr. 1978, pp. 487–491.
20. Gausman, H. W.; Escobar, D. E.; Rodriguez, R. R.; Thomas, C. E.; and Bowen, R. L.: Ozone Damage Detection in Cantaloupe Plants. *Photogramm. Eng. & Remote Sensing*, vol. 44, no. 4, Apr. 1978, pp. 481–485.
21. Goetz, Alexander F. H.: Remote Sensing Geology: Landsat and Beyond. *Proceedings, Caltech/JPL Conference on Image Processing Technology, Data Sources and Software for Commercial and Scientific Applications*, Gunther H. Redmann, ed., JPL SP-43-30 (Contract NAS7-100), California Inst. Technol., Nov. 1976, pp. 8-1–8-8.
22. Heller, R. C.: Previsual Detection of Ponderosa Pine Trees Dying From Bark Beetle Attack. *Proceedings of the Fifth Symposium on Remote Sensing of Environment*, Univ. of Michigan, 1968, pp. 387–434.
23. Hodarev, Yu. K.; Dunaev, B. S.; Rodionov, B. N.; Serebryakyan, A. L.; Tchesnokov, Yu. M.; and Etkin, V. S.: Some Possible Uses of Optical and Radio-Physical Remote Measurements for Earth Investigations. *Proceedings of the Seventh International Symposium on Remote Sensing of Environment, Volume I*, Univ. of Michigan, 1971, pp. 99–118.
24. Hoffer, R. M.; and Johannsen, C. J.: Ecological Potentials in Spectral Signature Analysis. *Remote Sensing in*

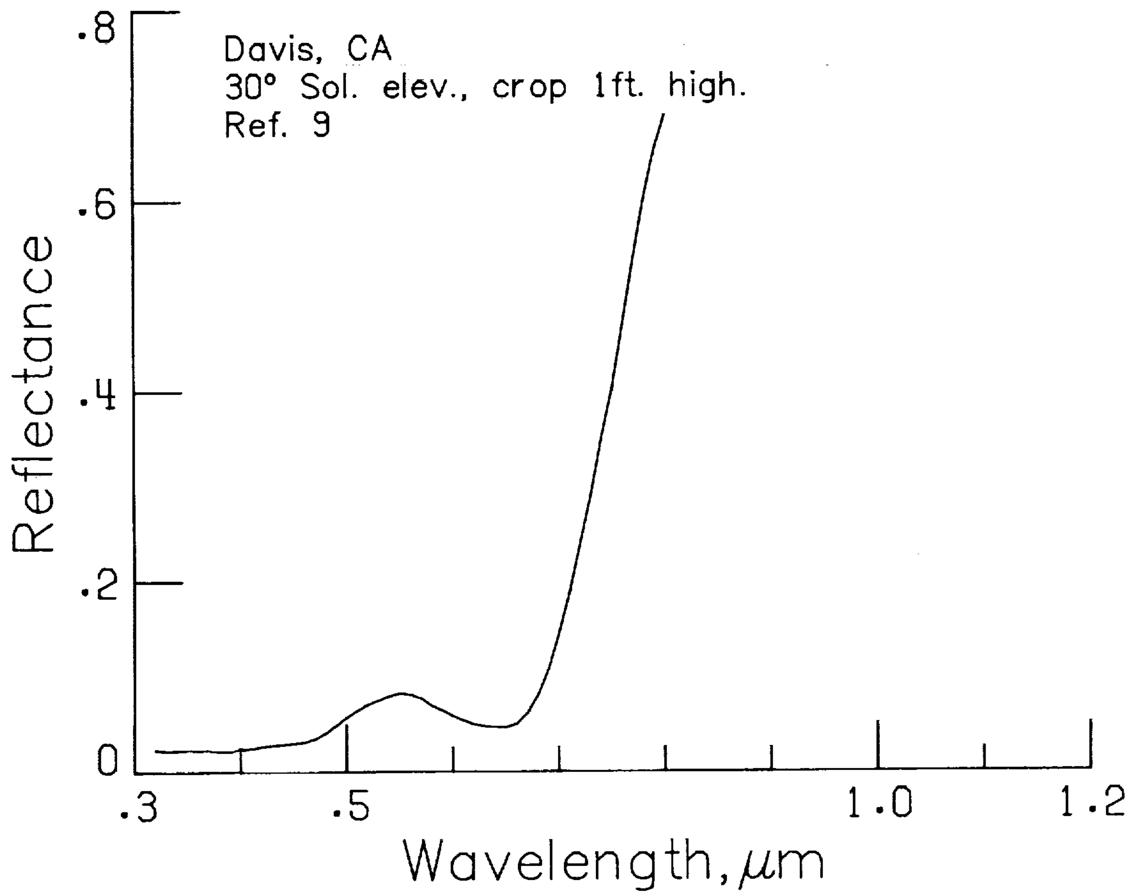
Ecology, Philip L. Johnson, ed., Univ. of Georgia Press, c.1969, pp. 1-16.

25. Hovis, W. A., Jr.: Infrared Spectral Reflectance of Some Common Minerals. *Appl. Opt.,* vol. 5, no. 2, Feb. 1966, pp. 245–248.
26. Knipling, Edward B.: Physical and Physiological Basis for the Reflectance of Visible and Near-Infrared Radiation From Vegetation. *Remote Sensing Environ.,* vol. 1, no. 3, Summer 1970, pp. 155–159.
27. Kondrat'ev, K. Ya., ed.: *Radiation Characteristics of the Atmosphere and the Earth's Surface.* NASA TT F-678, 1973.
28. Kondratyev, K. Ya.; Binenko, V. I.; Vasilyev, O. V.; and Grishechkin, V. S.: Spectral Optical Properties of Stratus Clouds From Aircraft Observations. *Remote Sensing of Earth Resources, Volume IV,* F. Shahrokhi, ed., Univ. of Tennessee Space Inst., 1975, pp. 177–201.
29. Lemeur, Raoul; and Rosenberg, Norman J.: Reflectant Induced Modification of the Radiation Balance for Increased Crop Water Use Efficiency. *Heat and Mass Transfer in the Biosphere: Part 1—Transfer Processes in the Plant Environment,* D. A. deVries and N. H. Afgan, eds., Scripta Book Co., 1975, pp. 479–488.
30. Lillesaeter, O.: Spectral Reflectance of Partly Transmitting Leaves: Laboratory Measurements and Mathematical Modeling. *Remote Sensing Environ.,* vol. 12, no. 3, July 1982, pp. 247–254.
31. Lillesand, Thomas M.; and Kiefer, Ralph W.: *Remote Sensing and Image Interpretation.* John Wiley & Sons, Inc., 1979.
32. Marrs, Ronald W.: *Application of Remote-Sensing Techniques to the Geology of the Bonanza Volcanic Center.* Remote Sensing Rep. 73-1 (Grant NGL 06-001-015), Dep. of Geology, Colorado School of Mines, Mar. 1973. (Available as NASA CR-133499.)
33. McClellan, W. D.; Meiners, J. P.; and Orr, Don G.: Spectral Reflectance Studies on Plants. *Proceedings of the Second Symposium on Remote Sensing of Environment,* Univ. of Michigan, 1963, pp. 403–413.
34. Novosel'tsev, Ye. P.: *Spectral Reflectivity of Clouds.* NASA TT F-328, 1965.
35. O'Brien, Harold W.; and Munis, Richard H.: *Red and Near-Infrared Spectral Reflectance of Snow.* Res. Rep. 332, U.S. Army Cold Regions Research & Engineering Lab., Mar. 1975. (Available from DTIC as AD A007 732.)
36. Olson, C. E., Jr.: The Energy Flow Profile in Remote Sensing. *Proceedings of the Second Symposium on Remote Sensing of Environment,* Univ. of Michigan, 1963, pp. 187–199.
37. Pease, Robert W.: *Plant Tissue and the Color Infrared Record.* Interagency Rep. NASA-147 (Contract No. R-09-020-024(A/1), Task No. 160-75-01-32-10), Dep. of Geography, Univ. of California, Feb. 1969. (Available as NASA CR-125657.)
38. Rao, V. R.; Brach, E. J.; and Mack, A. R.: Crop Discriminability in the Visible and Near Infrared Regions. *Photogramm. Eng. & Remote Sensing,* vol. 44, no. 9, Sept. 1978, pp. 1179–1184.
39. Richardson, Arthur J.; Escobar, David E.; Gausman, Harold W.; and Everitt, James H.: Comparison of LANDSAT-2 and Field Spectrometer Reflectance Signatures of South Texas Rangeland Plant Communities. *Machine Processing of Remotely Sensed Data and Soil Information Systems and Remote Sensing and Soil Survey,* P. G. Burroff and D. B. Morrison, eds., Purdue Univ., 1980, pp. 88–97.
40. Root, R. R.; and Miller, L. D.: *Identification of Urban Watershed Units Using Remote Multispectral Sensing.* Completion Rep. No. 29, Environmental Resources Center, Colorado State Univ., Jan. 31, 1972. (Available from NTIS as PB 209 639.)
41. Ross, Howard P.; Adler, Joel E. M.; and Hunt, Graham R.: A Statistical Analysis of the Reflectance of Igneous Rocks From 0.2 to 2.65 Microns. *Icarus,* vol. 11, no. 1, July 1969, pp. 46–54.
42. Sabins, Floyd F., Jr.: *Remote Sensing—Principles and Interpretation.* W. H. Freeman & Co., Inc., c.1978.
43. Seubert, C. E.; Baumgardner, M. F.; Weismiller, R. A.; and Kirschner, F. R.: Mapping and Estimating Areal Extent of Severely Eroded Soils of Selected Sites in Northern Indiana. *Machine Processing of Remotely Sensed Data—Proceedings,* I. M. Tendam and D. B. Morrison, eds., 79 CH 1430-8 MPRSD, Inst. Electr. & Electron. Eng., Inc., 1979, pp. 234–239.
44. Siegal, Barry S.; and Goetz, Alexander F. H.: Effect of Vegetation on Rock and Soil Type Discrimination. *Photogramm. Eng. & Remote Sensing,* vol. 43, no. 2, Feb. 1977, pp. 191–196.
45. Singhroy, V.; and Duggin, M.: Measurements of the Characteristic Reflectance Spectra of Surficial Deposits. *Proceedings of the Seventh Canadian Symposium on Remote Sensing,* William G. Best and Sue-Ann Weselake, eds., Manitoba Remote Sensing Centre, 1981, pp. 341–348.
46. *DEMETER—An Earth Resources Satellite System.* Stanford Univ., June 1968.
47. Tanguay, Marc G.; Hoffer, Roger M.; and Miles, Robert D.: Multispectral Imagery and Automatic Classification of Spectral Response for Detailed Engineering Soils Mapping. *Proceedings of the Sixth International Symposium on Remote Sensing of Environment, Volume I,* Univ. of Michigan, 1969, pp. 33–63.
48. Tucker, Compton J.: *Use of Near Infrared/Red Radiance Ratios for Estimating Vegetation Biomass and Physiological Status.* NASA TM X-71388, 1977.
49. Tucker, Compton J.: Post Senescent Grass Canopy Remote Sensing. *Remote Sensing Environ.,* vol. 7, no. 3, Aug. 1978, pp. 203–210.
50. Vane, Gregg; Billingsley, Fred C.; and Dunne, James A.: Observational Parameters for Remote Sensing in the Next Decade. *Advanced Multispectral Remote Sensing Technology and Applications, Volume 345 of Proceedings of SPIE—The International Society for Optical Engineering,* Ken J. Ando, ed., c.1982, pp. 52–65.
51. Vlcek, J.: Difficulties in Determining Meaningful Spectral Signatures of Forest Tree Canopies. *Proceedings*

of Symposium on Remote Sensing and Photo Interpretation, Volume II, Canadian Inst. of Surveying, Oct. 1974, pp. 805–810.

52. Ward, Jennifer M.: The Significance of Changes in Infrared Reflectance in Sugar Maple (ACER Saccharum Marsh), Induced by Soil Conditions of Drought and Salinity. *Proceedings of the Sixth International Symposium on Remote Sensing of Environment, Volume II,* Univ. of Michigan, 1969, pp. 1205–1226.
53. Warren, Stephen G.: Optical Properties of Snow. *Rev. Geophys. & Space Phys.,* vol. 20, no. 1, Feb. 1982, pp. 67–89.
54. Watson, Robert D.: Spectral Reflectance and Photometric Properties of Selected Rocks. *Remote Sensing Environ.,* vol. 2, no. 2, Feb. 1972, pp. 95–100.
55. Wert, S. L.: A System for Using Remote Sensing Techniques To Detect and Evaluate Air Pollution Effects on Forest Stands. *Proceedings of the Sixth International Symposium on Remote Sensing of Environment, Volume II,* Univ. of Michigan, 1969, pp. 1169–1178.
56. Wiegand, C. L.; Gausman, H. W.; and Allen, W. A.: Physiological Factors and Optical Parameters as Bases of Vegetation Discrimination and Stress Analysis. *Operational Remote Sensing: An Interactive Seminar To Evaluate Current Capabilities,* American Soc. Photogrammetry, 1972, pp. 82–100.
57. Yost, Edward; and Wenderoth, Sondra: The Reflectance Spectra of Mineralized Trees. *Proceedings of the Seventh International Symposium on Remote Sensing of Environment, Volume I,* Univ. of Michigan, 1971, pp. 269–284.
58. Zander, R.: Spectral Scattering Properties of Ice Clouds and Hoarfrost. *J. Geophys. Res.,* vol. 71, no. 2, Jan. 15, 1966, pp. 375–378.

NO. 1 - ALFALFA



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.33	.022	.51	.065	.69	.108	.87		1.05	
.34	.022	.52	.071	.70	.146	.88		1.06	
.35	.023	.53	.076	.71	.188	.89		1.07	
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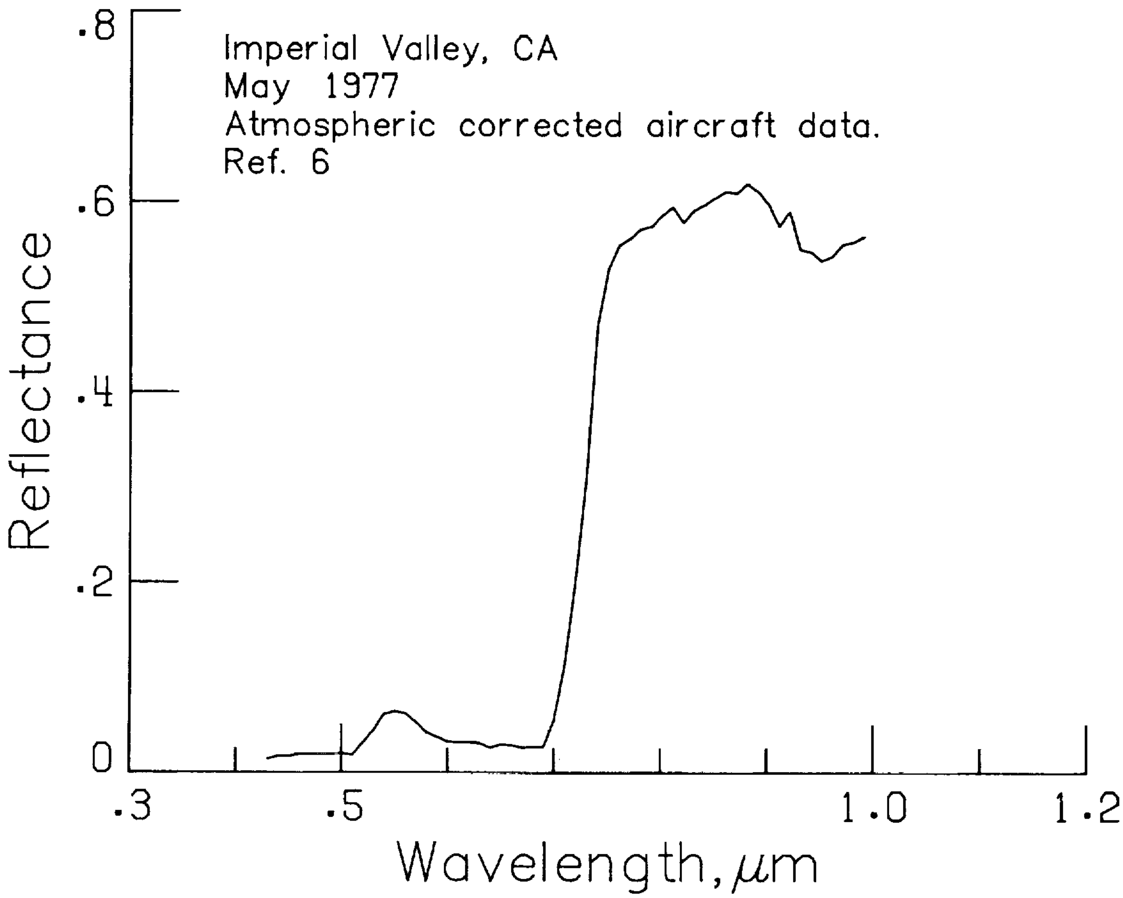
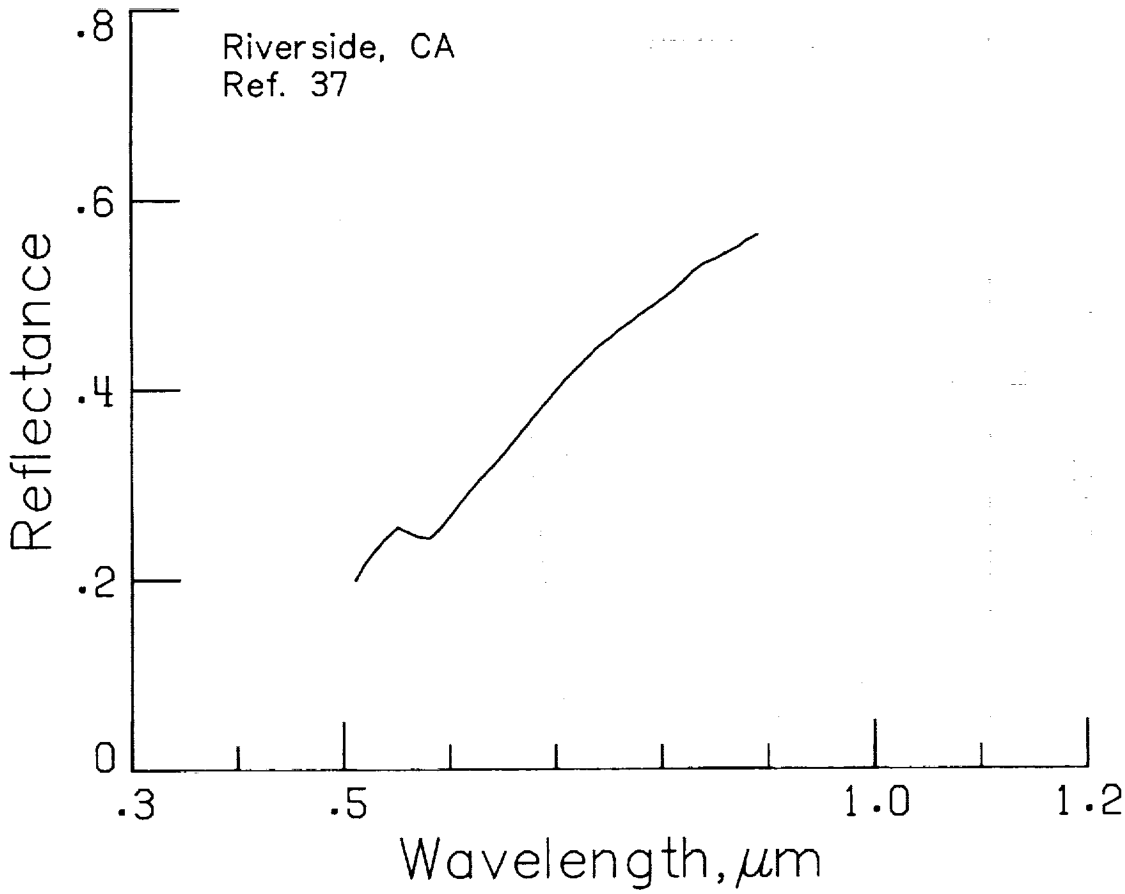
.37	.023	.55	.083	.73	.291	.91		1.09	
.38	.022	.56	.081	.74	.351	.92		1.10	
.39	.022	.57	.077	.75	.403	.93		1.11	
.40	.024	.58	.069	.76	.472	.94		1.12	
.41	.025	.59	.064	.77	.539	.95		1.13	
.42	.027	.60	.058	.78	.602	.96		1.14	
.43	.028	.61	.053	.79	.653	.97		1.15	
.44	.029	.62	.049	.80	.690	.98		1.16	
.45	.030	.63	.047	.81		.99		1.17	
.46	.032	.64	.047	.82		1.00		1.18	
.47	.035	.65	.047	.83		1.01		1.19	

NO.2 - MATURE ALFALFA



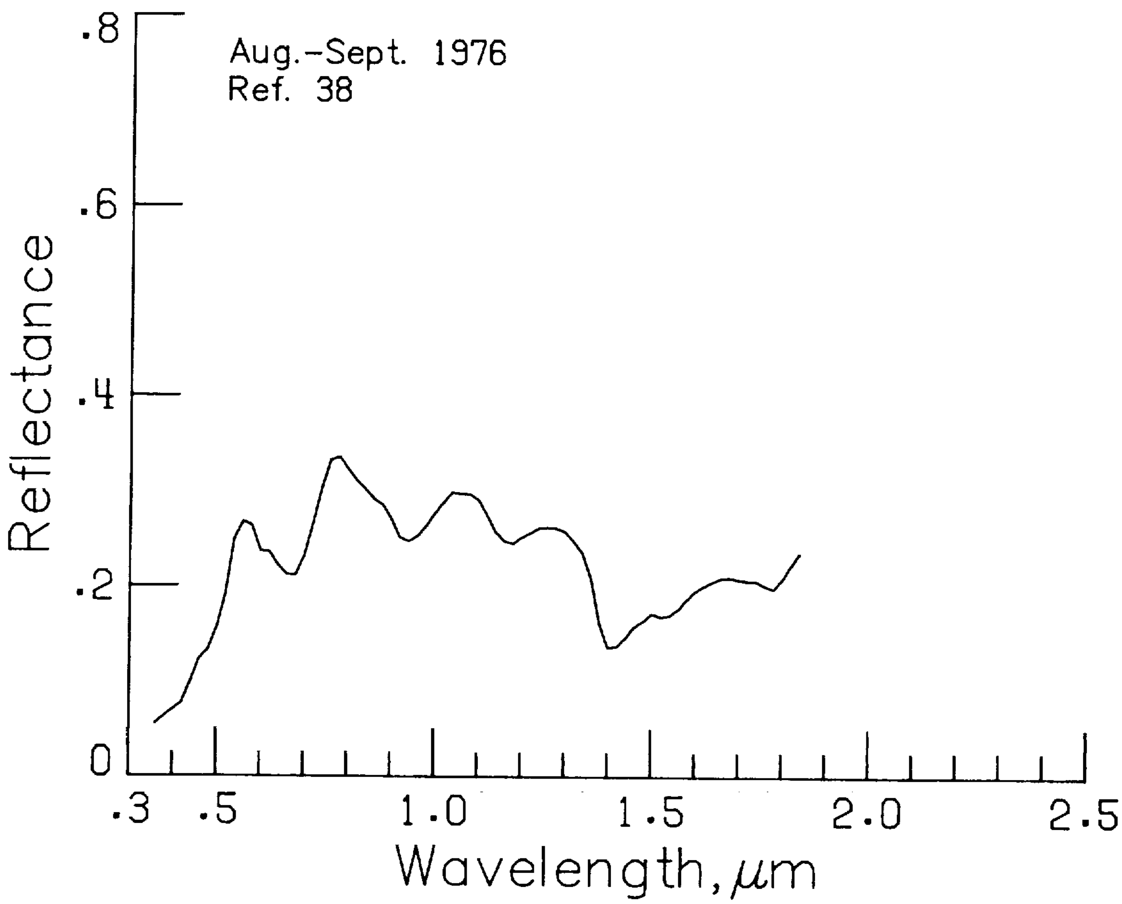
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.020	.66	.029	.84	.597	1.02	
.31		.49	.020	.67	.026	.85	.605	1.03	
.32		.50	.020	.68	.027	.86	.611	1.04	
.33		.51	.018	.69	.027	.87	.609	1.05	
.34		.52	.032	.70	.055	.88	.619	1.06	
.35		.53	.045	.71	.113	.89	.611	1.07	
.36		.54	.062	.72	.202	.90	.598	1.08	
.37		.55	.064	.73	.311	.91	.575	1.09	
.38		.56	.062	.74	.471	.92	.590	1.10	
.39		.57	.053	.75	.530	.93	.550	1.11	
.40		.58	.042	.76	.555	.94	.548	1.12	
.41		.59	.037	.77	.562	.95	.538	1.13	
.42		.60	.032	.78	.572	.96	.543	1.14	
.43	.015	.61	.032	.79	.574	.97	.555	1.15	
.44	.017	.62	.032	.80	.586	.98	.558	1.16	
.45	.017	.63	.031	.81	.594	.99	.564	1.17	
.46	.019	.64	.026	.82	.579	1.00		1.18	
.47	.020	.65	.030	.83	.591	1.01		1.19	

NO.3 - DRY ALFALFA HAY



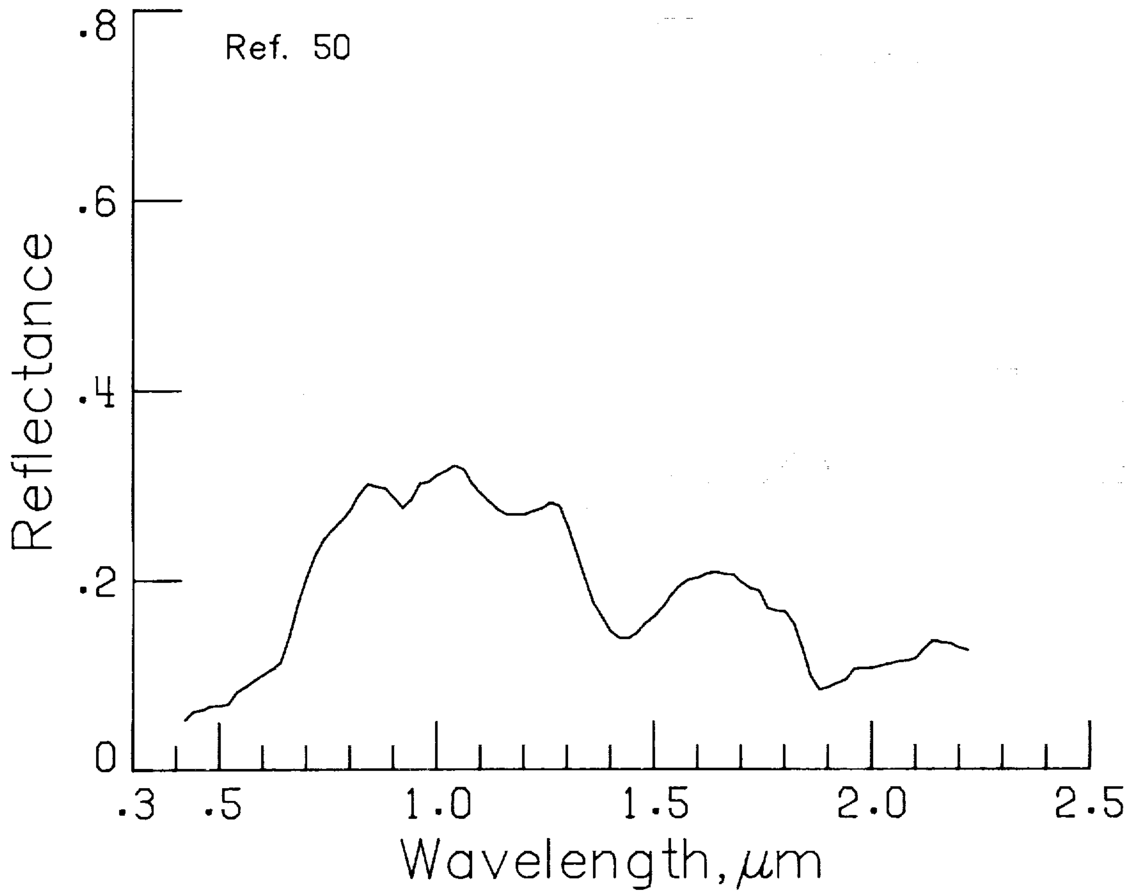
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48		.66	.346	.84	.532	1.02	
.31		.49		.67	.359	.85	.537	1.03	
.32		.50		.68	.373	.86	.542	1.04	
.33		.51	.199	.69	.386	.87	.548	1.05	
.34		.52	.218	.70	.399	.88	.556	1.06	
.35		.53	.232	.71	.412	.89	.562	1.07	
.36		.54	.245	.72	.423	.90		1.08	
.37		.55	.255	.73	.434	.91		1.09	
.38		.56	.249	.74	.446	.92		1.10	
.39		.57	.244	.75	.454	.93		1.11	
.40		.58	.243	.76	.463	.94		1.12	
.41		.59	.253	.77	.471	.95		1.13	
.42		.60	.267	.78	.480	.96		1.14	
.43		.61	.282	.79	.487	.97		1.15	
.44		.62	.296	.80	.495	.98		1.16	
.45		.63	.308	.81	.503	.99		1.17	
.46		.64	.320	.82	.513	1.00		1.18	
.47		.65	.332	.83	.524	1.01		1.19	

NO.4 - BARLEY



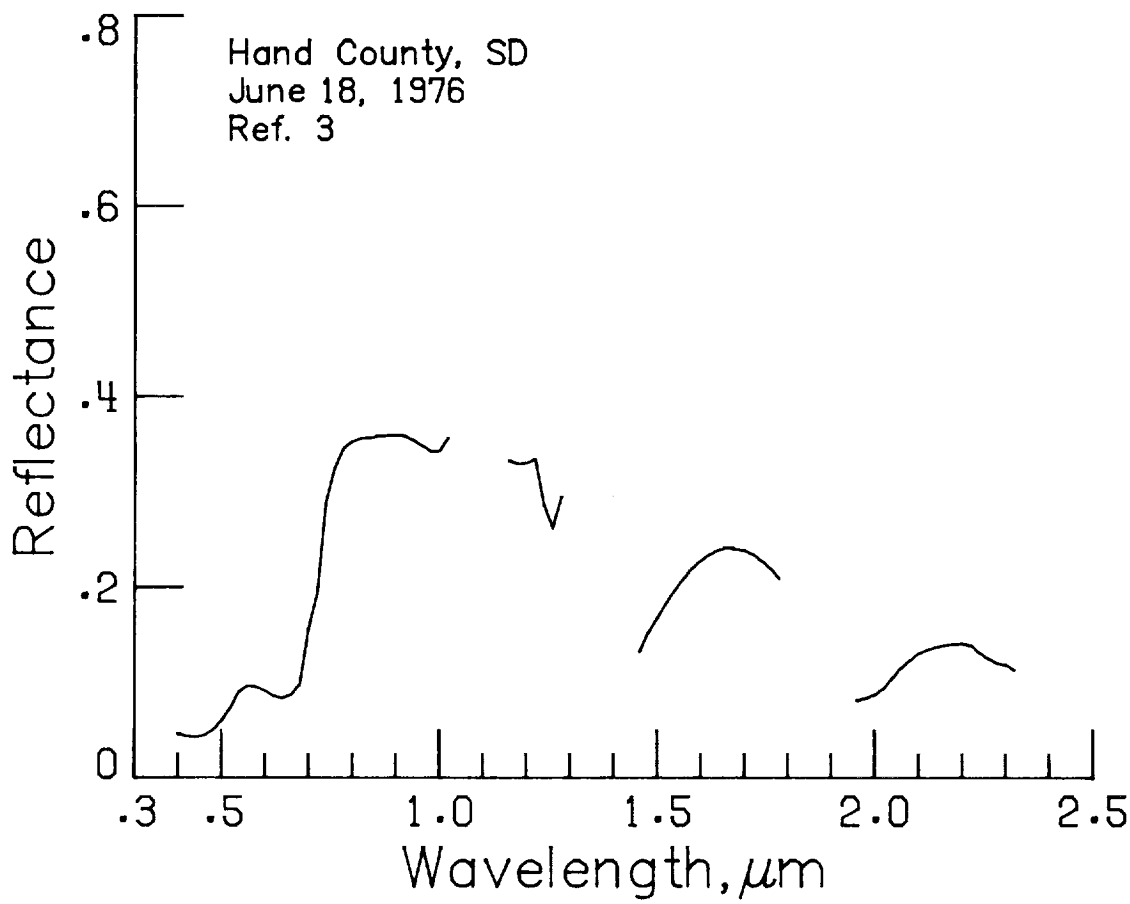
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.304	1.18	.245	1.62	.201	2.06	
.32		.76	.333	1.20	.252	1.64	.206	2.08	
.34		.78	.336	1.22	.257	1.66	.210	2.10	
.36	.055	.80	.323	1.24	.262	1.68	.210	2.12	
.38	.063	.82	.311	1.26	.263	1.70	.208	2.14	
.40	.070	.84	.302	1.28	.262	1.72	.207	2.16	
.42	.077	.86	.292	1.30	.258	1.74	.206	2.18	
.44	.099	.88	.286	1.32	.248	1.76	.201	2.20	
.46	.124	.90	.271	1.34	.235	1.78	.198	2.22	
.48	.133	.92	.251	1.36	.209	1.80	.209	2.24	
.50	.156	.94	.247	1.38	.161	1.82	.223	2.26	
.52	.191	.96	.253	1.40	.136	1.84	.236	2.28	
.54	.250	.98	.263	1.42	.138	1.86		2.30	
.56	.268	1.00	.277	1.44	.147	1.88		2.32	
.58	.264	1.02	.289	1.46	.158	1.90		2.34	
.60	.237	1.04	.299	1.48	.164	1.92		2.36	
.62	.236	1.06	.297	1.50	.172	1.94		2.38	
.64	.222	1.08	.297	1.52	.169	1.96		2.40	
.66	.212	1.10	.291	1.54	.170	1.98		2.42	
.68	.212	1.12	.275	1.56	.177	2.00		2.44	
.70	.232	1.14	.257	1.58	.187	2.02		2.46	
.72	.266	1.16	.248	1.60	.196	2.04		2.48	

NO.5 - BARLEY



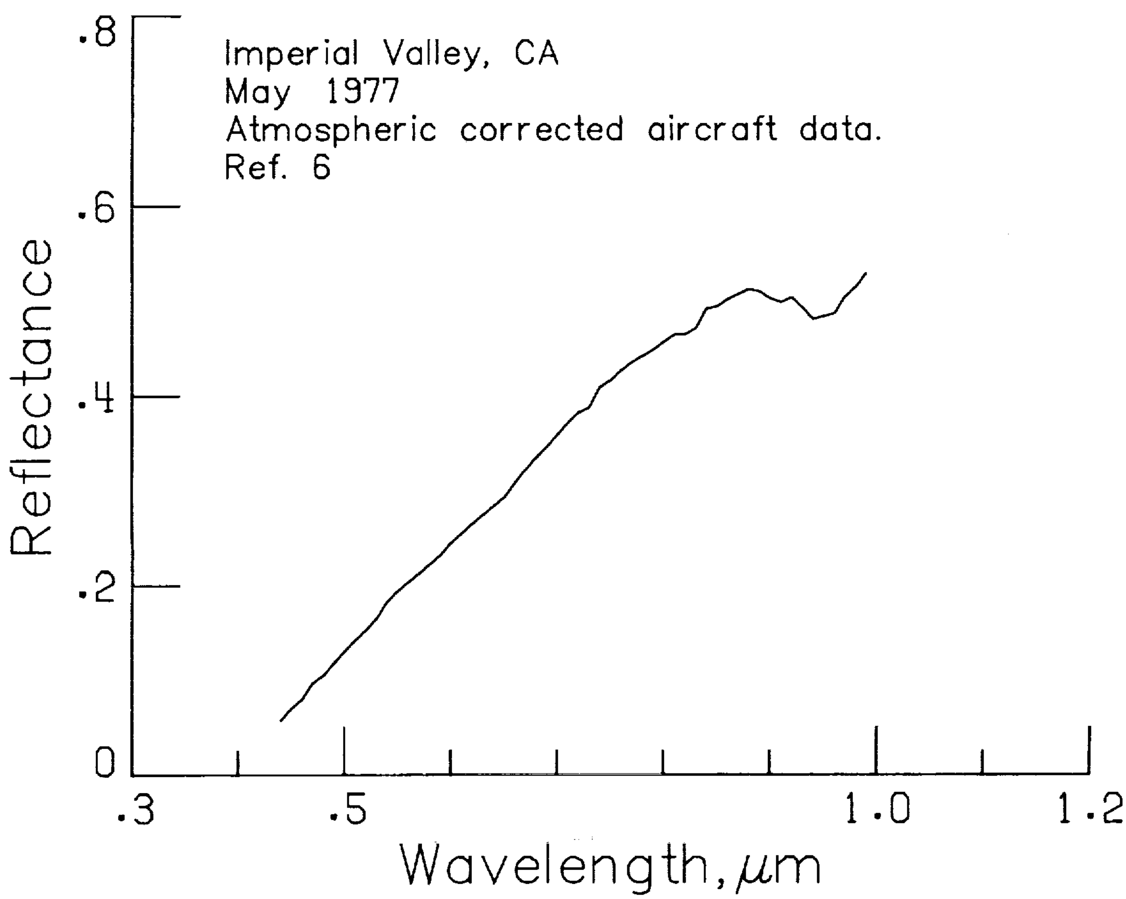
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.244	1.18	.269	1.62	.207	2.06	.114
.32		.76	.254	1.20	.269	1.64	.209	2.08	.115
.34		.78	.263	1.22	.273	1.66	.206	2.10	.117
.36		.80	.274	1.24	.276	1.68	.206	2.12	.127
.38		.82	.290	1.26	.281	1.70	.197	2.14	.136
.40		.84	.301	1.28	.278	1.72	.191	2.16	.134
.42	.053	.86	.298	1.30	.256	1.74	.189	2.18	.133
.44	.062	.88	.296	1.32	.229	1.76	.170	2.20	.128
.46	.064	.90	.286	1.34	.201	1.78	.167	2.22	.126
.48	.068	.92	.276	1.36	.175	1.80	.166	2.24	
.50	.068	.94	.285	1.38	.160	1.82	.154	2.26	
.52	.070	.96	.302	1.40	.145	1.84	.128	2.28	
.54	.083	.98	.303	1.42	.139	1.86	.098	2.30	
.56	.088	1.00	.310	1.44	.138	1.88	.084	2.32	
.58	.095	1.02	.315	1.46	.144	1.90	.087	2.34	
.60	.100	1.04	.321	1.48	.155	1.92	.091	2.36	
.62	.106	1.06	.317	1.50	.162	1.94	.095	2.38	
.64	.114	1.08	.301	1.52	.172	1.96	.106	2.40	
.66	.141	1.10	.291	1.54	.185	1.98	.107	2.42	
.68	.177	1.12	.282	1.56	.195	2.00	.107	2.44	
.70	.205	1.14	.274	1.58	.201	2.02	.109	2.46	
.72	.229	1.16	.269	1.60	.203	2.04	.111	2.48	

NO.6 - STEM EXTENSION BARLEY



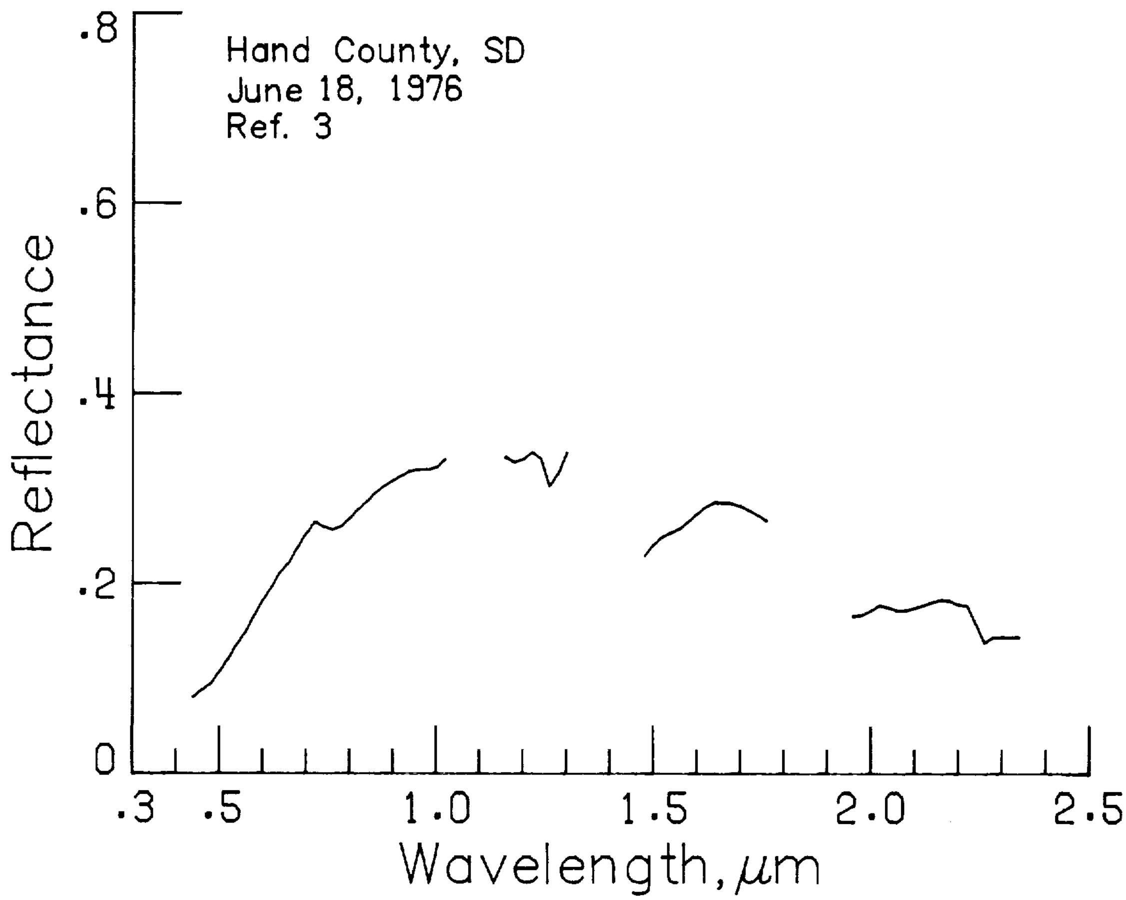
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.291	1.18	.330	1.62	.235	2.06	.116
.32		.76	.327	1.20	.331	1.64	.239	2.08	.124
.34		.78	.347	1.22	.335	1.66	.242	2.10	.131
.36		.80	.354	1.24	.286	1.68	.240	2.12	.135
.38		.82	.357	1.26	.263	1.70	.239	2.14	.138
.40	.046	.84	.357	1.28	.295	1.72	.234	2.16	.140
.42	.044	.86	.359	1.30		1.74	.227	2.18	.141
.44	.043	.88	.360	1.32		1.76	.219	2.20	.141
.46	.045	.90	.360	1.34		1.78	.209	2.22	.139
.48	.050	.92	.359	1.36		1.80		2.24	.131
.50	.060	.94	.355	1.38		1.82		2.26	.125
.52	.073	.96	.349	1.40		1.84		2.28	.120
.54	.090	.98	.343	1.42		1.86		2.30	.118
.56	.097	1.00	.343	1.44		1.88		2.32	.113
.58	.095	1.02	.357	1.46	.133	1.90		2.34	
.60	.091	1.04		1.48	.153	1.92		2.36	
.62	.085	1.06		1.50	.168	1.94		2.38	
.64	.084	1.08		1.52	.183	1.96	.081	2.40	
.66	.087	1.10		1.54	.197	1.98	.084	2.42	
.68	.098	1.12		1.56	.209	2.00	.087	2.44	
.70	.157	1.14		1.58	.220	2.02	.094	2.46	
.72	.194	1.16	.333	1.60	.229	2.04	.105	2.48	

NO.7 - RIPE BARLEY



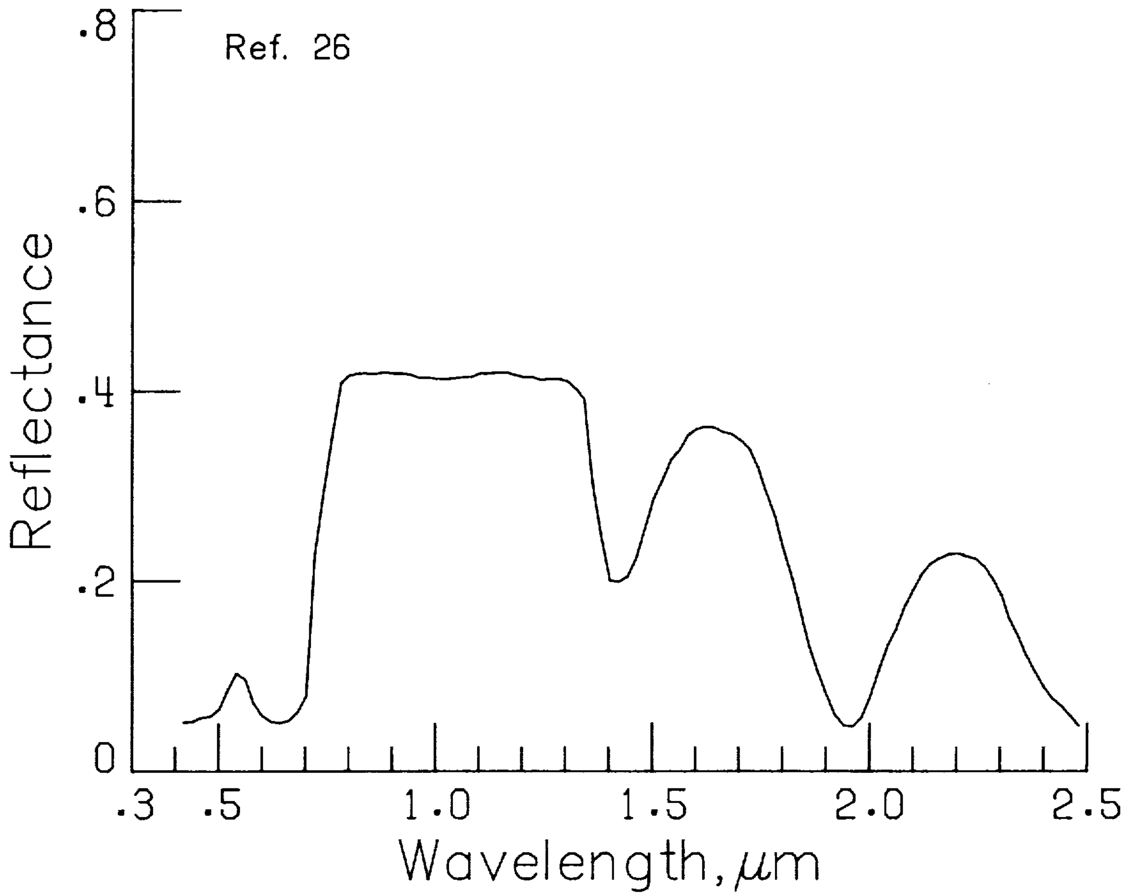
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.105	.66	.308	.84	.492	1.02	
.31		.49	.118	.67	.322	.85	.494	1.03	
.32		.50	.131	.68	.335	.86	.502	1.04	
.33		.51	.142	.69	.346	.87	.507	1.05	
.34		.52	.153	.70	.359	.88	.512	1.06	
.35		.53	.165	.71	.372	.89	.510	1.07	
.36		.54	.182	.72	.383	.90	.502	1.08	
.37		.55	.194	.73	.388	.91	.498	1.09	
.38		.56	.203	.74	.409	.92	.504	1.10	
.39		.57	.213	.75	.416	.93	.493	1.11	
.40		.58	.222	.76	.427	.94	.481	1.12	
.41		.59	.232	.77	.435	.95	.484	1.13	
.42		.60	.245	.78	.442	.96	.487	1.14	
.43		.61	.255	.79	.449	.97	.504	1.15	
.44	.058	.62	.265	.80	.457	.98	.515	1.16	
.45	.070	.63	.275	.81	.464	.99	.529	1.17	
.46	.080	.64	.284	.82	.465	1.00		1.18	
.47	.097	.65	.293	.83	.471	1.01		1.19	

NO.8 - RIPE BARLEY



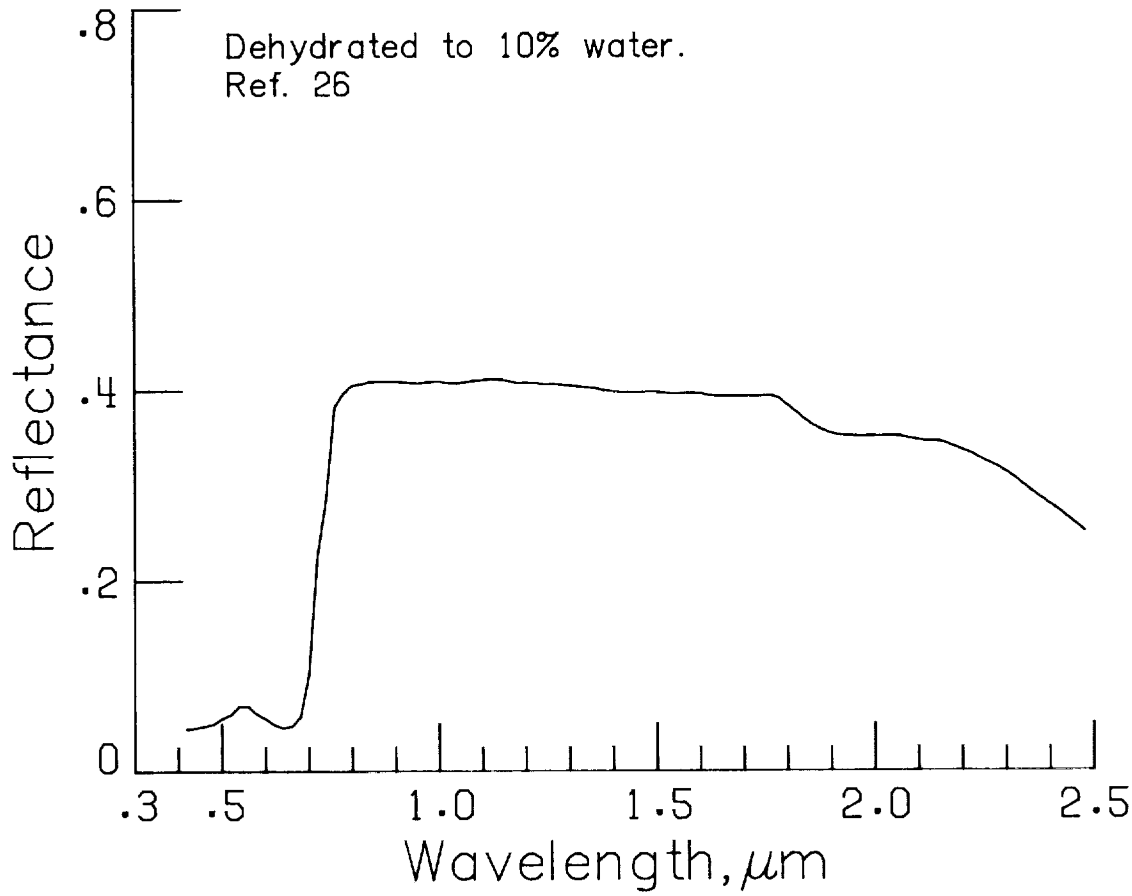
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.260	1.18	.328	1.62	.282	2.06	.172
.32		.76	.257	1.20	.332	1.64	.286	2.08	.173
.34		.78	.261	1.22	.339	1.66	.285	2.10	.175
.36		.80	.269	1.24	.332	1.68	.285	2.12	.178
.38		.82	.279	1.26	.303	1.70	.282	2.14	.181
.40		.84	.287	1.28	.316	1.72	.277	2.16	.183
.42		.86	.296	1.30	.338	1.74	.272	2.18	.182
.44	.081	.88	.303	1.32		1.76	.267	2.20	.178
.46	.089	.90	.309	1.34		1.78		2.22	.177
.48	.095	.92	.314	1.36		1.80		2.24	.158
.50	.108	.94	.319	1.38		1.82		2.26	.138
.52	.121	.96	.320	1.40		1.84		2.28	.144
.54	.136	.98	.320	1.42		1.86		2.30	.144
.56	.149	1.00	.323	1.44		1.88		2.32	.144
.58	.166	1.02	.331	1.46		1.90		2.34	.144
.60	.182	1.04		1.48	.230	1.92		2.36	
.62	.196	1.06		1.50	.242	1.94		2.38	
.64	.212	1.08		1.52	.250	1.96	.166	2.40	
.66	.222	1.10		1.54	.255	1.98	.168	2.42	
.68	.238	1.12		1.56	.259	2.00	.172	2.44	
.70	.253	1.14		1.58	.266	2.02	.178	2.46	
.72	.265	1.16	.333	1.60	.274	2.04	.175	2.48	

NO.9 - BEAN LEAF



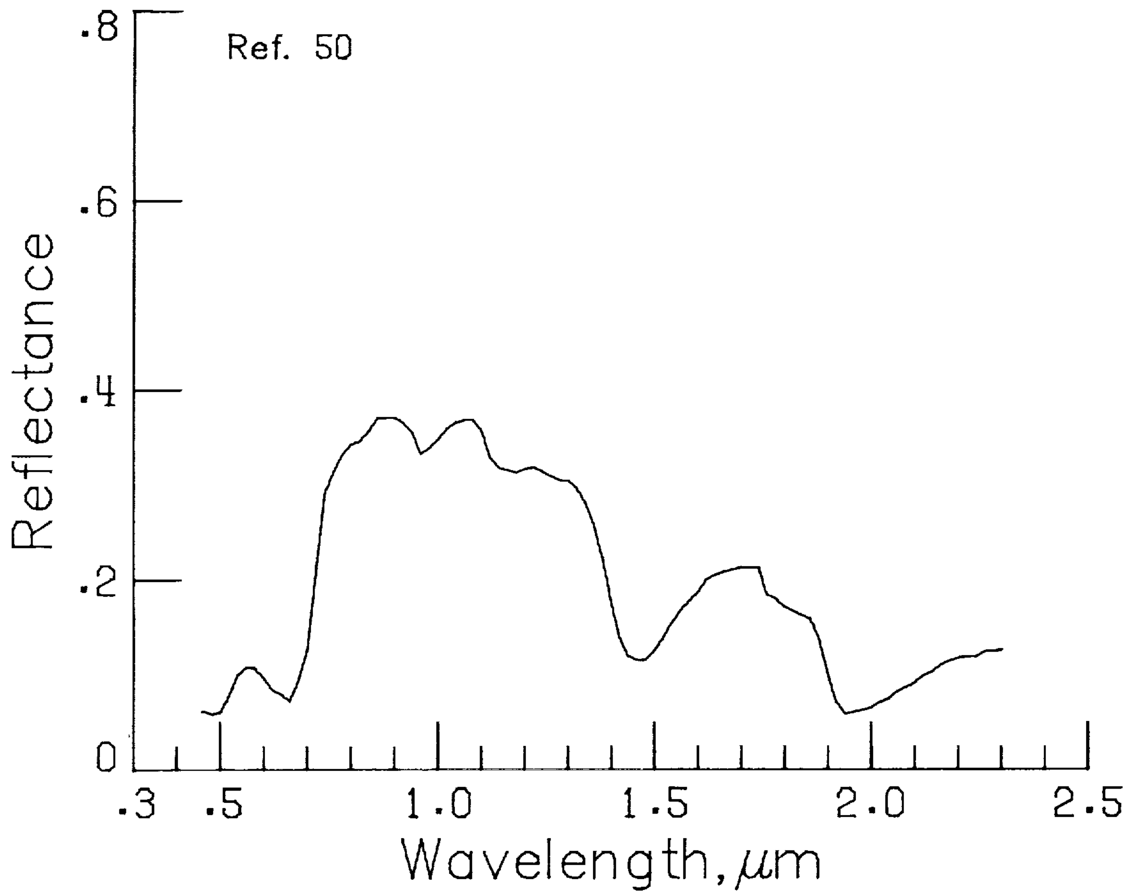
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.293	1.18	.417	1.62	.363	2.06	.149
.32		.76	.353	1.20	.415	1.64	.362	2.08	.174
.34		.78	.409	1.22	.415	1.66	.357	2.10	.192
.36		.80	.417	1.24	.412	1.68	.355	2.12	.208
.38		.82	.419	1.26	.413	1.70	.348	2.14	.219
.40		.84	.419	1.28	.413	1.72	.340	2.16	.224
.42	.051	.86	.418	1.30	.411	1.74	.321	2.18	.228
.44	.052	.88	.420	1.32	.403	1.76	.292	2.20	.229
.46	.056	.90	.419	1.34	.392	1.78	.268	2.22	.226
.48	.058	.92	.418	1.36	.301	1.80	.232	2.24	.223
.50	.065	.94	.417	1.38	.246	1.82	.202	2.26	.216
.52	.085	.96	.414	1.40	.200	1.84	.168	2.28	.203
.54	.103	.98	.414	1.42	.199	1.86	.132	2.30	.186
.56	.097	1.00	.413	1.44	.204	1.88	.104	2.32	.160
.58	.070	1.02	.413	1.46	.223	1.90	.080	2.34	.144
.60	.058	1.04	.414	1.48	.255	1.92	.058	2.36	.121
.62	.052	1.06	.414	1.50	.287	1.94	.048	2.38	.104
.64	.051	1.08	.415	1.52	.306	1.96	.047	2.40	.088
.66	.053	1.10	.419	1.54	.328	1.98	.056	2.42	.076
.68	.062	1.12	.419	1.56	.338	2.00	.078	2.44	.068
.70	.078	1.14	.420	1.58	.354	2.02	.106	2.46	.058
.72	.227	1.16	.420	1.60	.360	2.04	.131	2.48	.048

NO.10 - DEHYDRATED BEAN LEAF



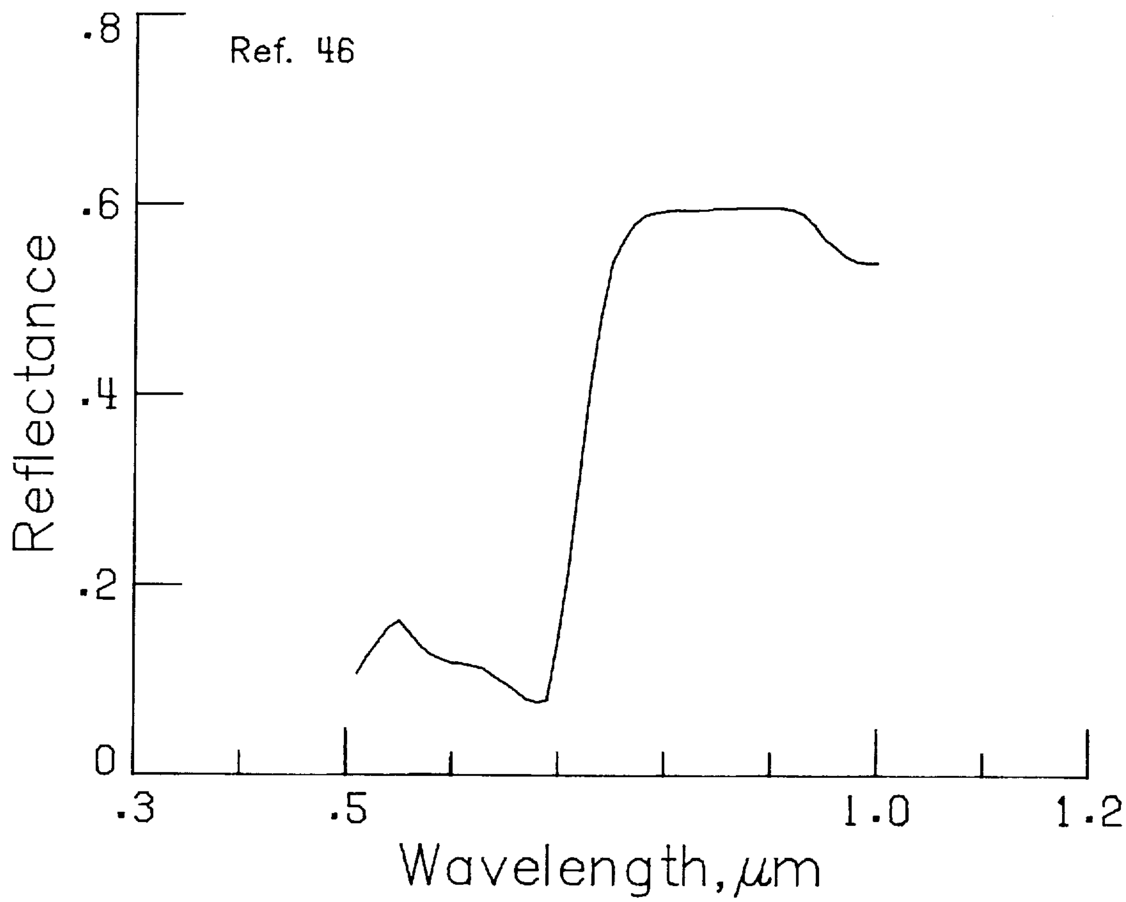
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.285	1.18	.408	1.62	.394	2.06	.351
.32		.76	.382	1.20	.408	1.64	.393	2.08	.349
.34		.78	.397	1.22	.407	1.66	.394	2.10	.347
.36		.80	.405	1.24	.406	1.68	.394	2.12	.346
.38		.82	.407	1.26	.406	1.70	.394	2.14	.346
.40		.84	.409	1.28	.406	1.72	.394	2.16	.344
.42	.044	.86	.409	1.30	.405	1.74	.394	2.18	.341
.44	.046	.88	.409	1.32	.404	1.76	.394	2.20	.337
.46	.048	.90	.409	1.34	.403	1.78	.392	2.22	.333
.48	.050	.92	.408	1.36	.402	1.80	.384	2.24	.328
.50	.056	.94	.408	1.38	.400	1.82	.376	2.26	.324
.52	.060	.96	.408	1.40	.398	1.84	.369	2.28	.319
.54	.069	.98	.409	1.42	.398	1.86	.362	2.30	.314
.56	.068	1.00	.409	1.44	.398	1.88	.358	2.32	.308
.58	.060	1.02	.408	1.46	.398	1.90	.354	2.34	.300
.60	.055	1.04	.408	1.48	.398	1.92	.352	2.36	.293
.62	.049	1.06	.409	1.50	.398	1.94	.351	2.38	.287
.64	.046	1.08	.410	1.52	.397	1.96	.351	2.40	.280
.66	.048	1.10	.411	1.54	.396	1.98	.351	2.42	.274
.68	.057	1.12	.412	1.56	.397	2.00	.351	2.44	.266
.70	.102	1.14	.411	1.58	.397	2.02	.351	2.46	.259
.72	.226	1.16	.410	1.60	.396	2.04	.351	2.48	.252

NO.11 - BEANS



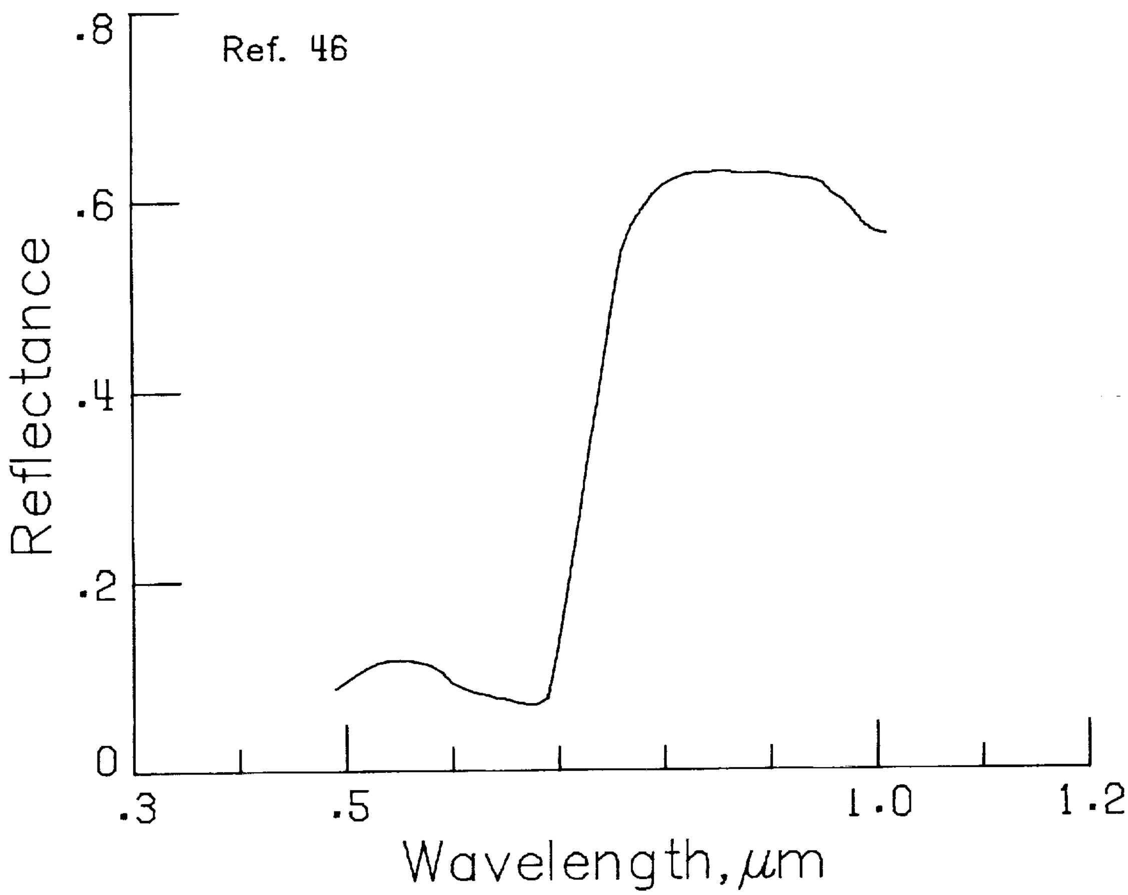
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.292	1.18	.314	1.62	.201	2.06	.083
.32		.76	.315	1.20	.318	1.64	.206	2.08	.087
.34		.78	.333	1.22	.319	1.66	.209	2.10	.092
.36		.80	.343	1.24	.315	1.68	.212	2.12	.099
.38		.82	.347	1.26	.310	1.70	.214	2.14	.103
.40		.84	.357	1.28	.306	1.72	.214	2.16	.111
.42		.86	.370	1.30	.305	1.74	.213	2.18	.115
.44		.88	.371	1.32	.297	1.76	.185	2.20	.118
.46	.062	.90	.371	1.34	.281	1.78	.181	2.22	.119
.48	.059	.92	.365	1.36	.257	1.80	.171	2.24	.119
.50	.061	.94	.355	1.38	.222	1.82	.167	2.26	.125
.52	.078	.96	.333	1.40	.179	1.84	.162	2.28	.125
.54	.100	.98	.340	1.42	.139	1.86	.158	2.30	.126
.56	.108	1.00	.349	1.44	.119	1.88	.138	2.32	
.58	.107	1.02	.359	1.46	.115	1.90	.102	2.34	
.60	.096	1.04	.366	1.48	.116	1.92	.072	2.36	
.62	.084	1.06	.369	1.50	.125	1.94	.059	2.38	
.64	.079	1.08	.368	1.52	.139	1.96	.061	2.40	
.66	.073	1.10	.357	1.54	.154	1.98	.063	2.42	
.68	.094	1.12	.329	1.56	.168	2.00	.066	2.44	
.70	.127	1.14	.319	1.58	.178	2.02	.072	2.46	
.72	.211	1.16	.316	1.60	.187	2.04	.076	2.48	

NO.12 - BEETS



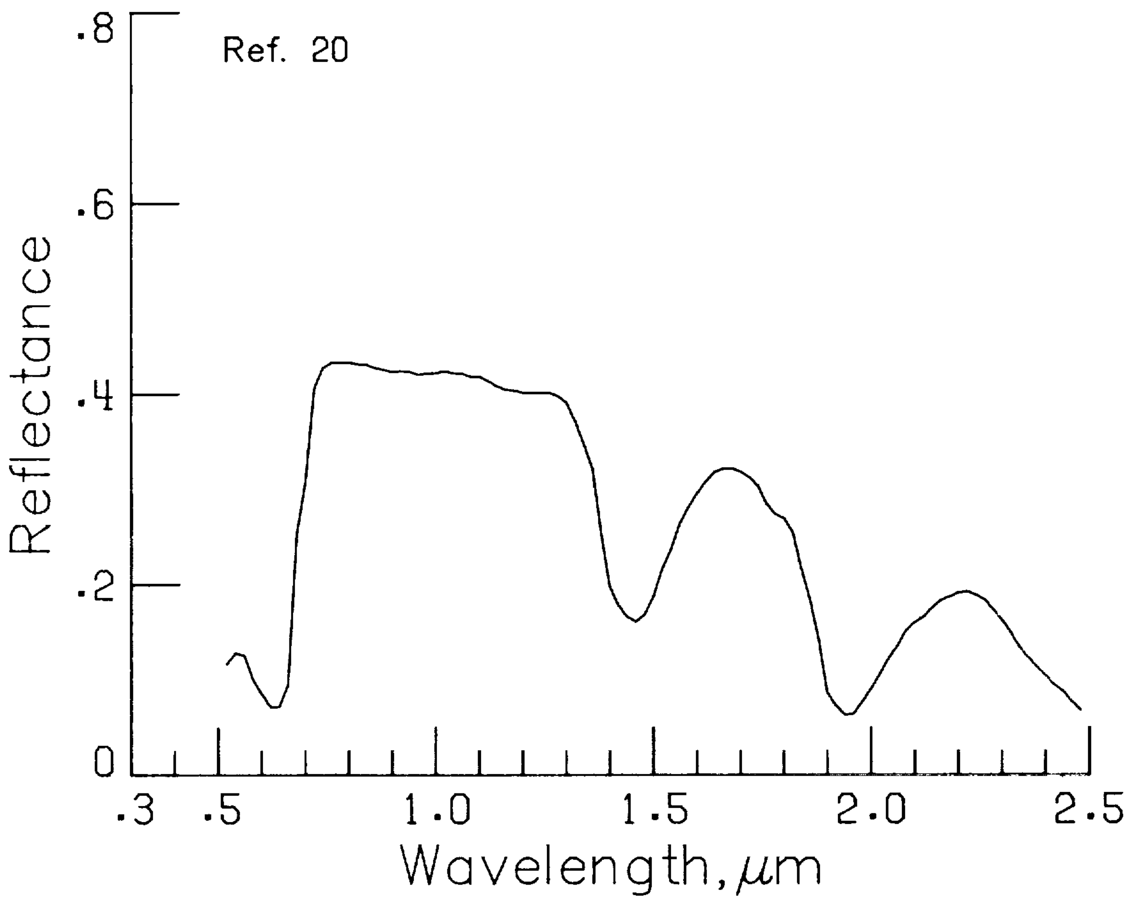
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48		.66	.090	.84	.596	1.02	
.31		.49		.67	.081	.85	.597	1.03	
.32		.50		.68	.078	.86	.597	1.04	
.33		.51	.106	.69	.080	.87	.598	1.05	
.34		.52	.125	.70	.140	.88	.598	1.06	
.35		.53	.140	.71	.217	.89	.598	1.07	
.36		.54	.156	.72	.315	.90	.598	1.08	
.37		.55	.163	.73	.413	.91	.597	1.09	
.38		.56	.151	.74	.484	.92	.595	1.10	
.39		.57	.137	.75	.539	.93	.591	1.11	
.40		.58	.127	.76	.563	.94	.579	1.12	
.41		.59	.123	.77	.580	.95	.564	1.13	
.42		.60	.119	.78	.590	.96	.556	1.14	
.43		.61	.118	.79	.593	.97	.546	1.15	
.44		.62	.115	.80	.594	.98	.541	1.16	
.45		.63	.112	.81	.595	.99	.539	1.17	
.46		.64	.104	.82	.595	1.00	.540	1.18	
.47		.65	.098	.83	.595	1.01		1.19	

NO.13 - CABBAGE



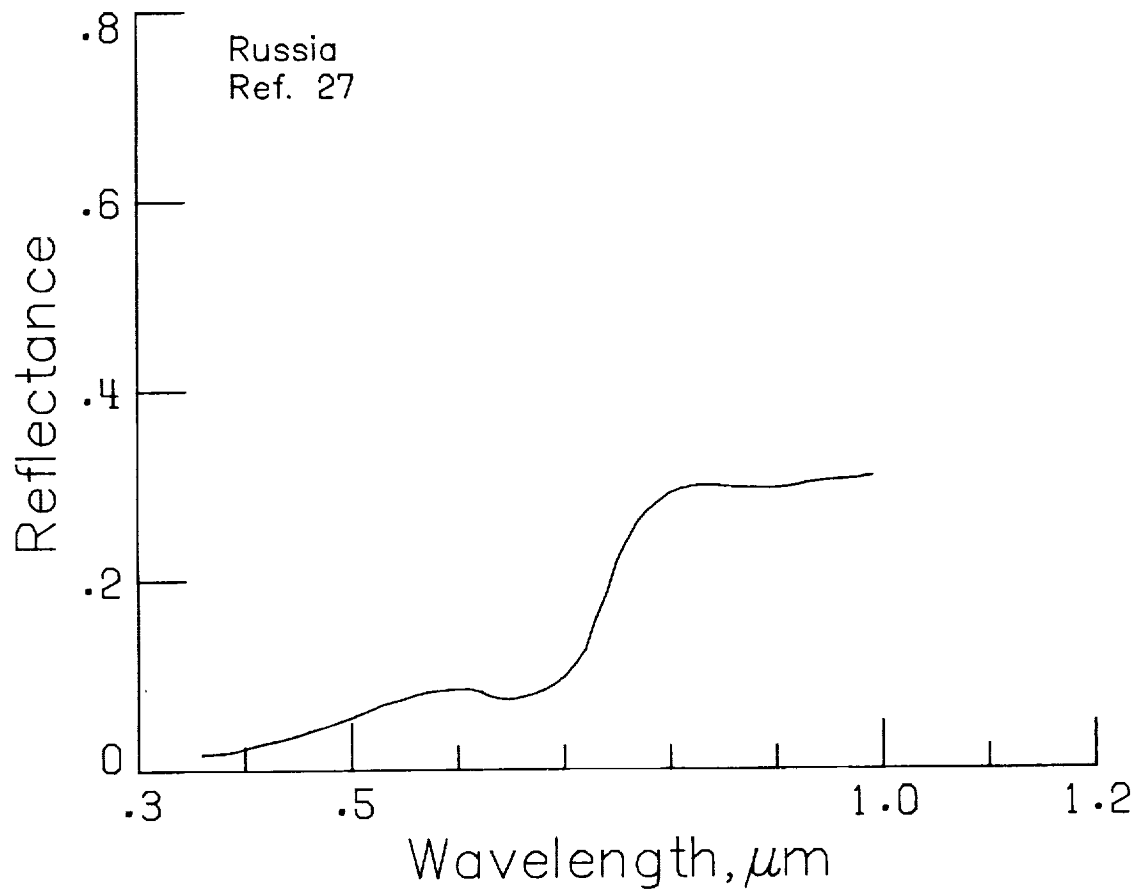
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48		.66	.073	.84	.628	1.02	
.31		.49	.088	.67	.070	.85	.630	1.03	
.32		.50	.095	.68	.071	.86	.630	1.04	
.33		.51	.103	.69	.077	.87	.627	1.05	
.34		.52	.109	.70	.130	.88	.628	1.06	
.35		.53	.115	.71	.198	.89	.628	1.07	
.36		.54	.117	.72	.267	.90	.628	1.08	
.37		.55	.118	.73	.339	.91	.626	1.09	
.38		.56	.116	.74	.405	.92	.623	1.10	
.39		.57	.115	.75	.479	.93	.622	1.11	
.40		.58	.111	.76	.545	.94	.621	1.12	
.41		.59	.104	.77	.574	.95	.617	1.13	
.42		.60	.093	.78	.590	.96	.606	1.14	
.43		.61	.088	.79	.606	.97	.599	1.15	
.44		.62	.083	.80	.616	.98	.587	1.16	
.45		.63	.081	.81	.622	.99	.573	1.17	
.46		.64	.078	.82	.626	1.00	.566	1.18	
.47		.65	.076	.83	.629	1.01	.563	1.19	

NO.14 - CANTALOUPE LEAF



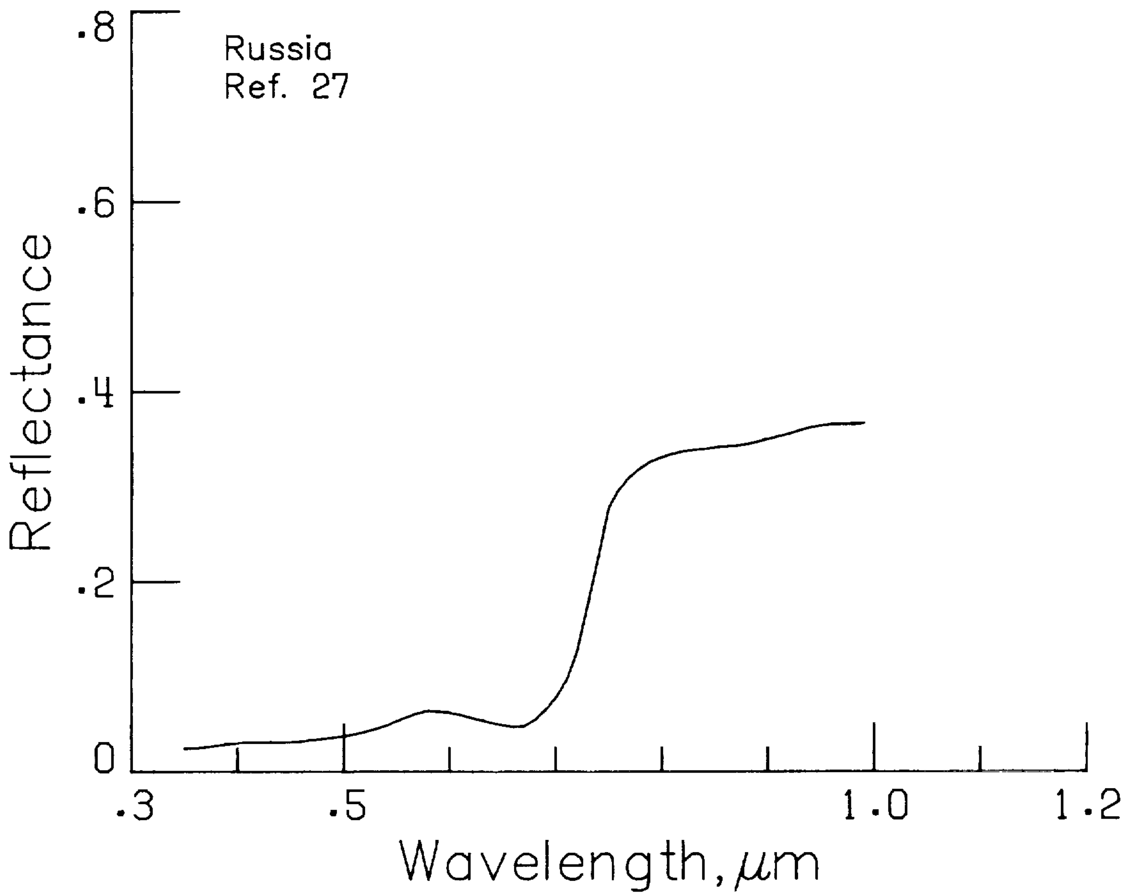
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.428	1.18	.404	1.62	.309	2.06	.135
.32		.76	.433	1.20	.402	1.64	.318	2.08	.152
.34		.78	.433	1.22	.402	1.66	.321	2.10	.160
.36		.80	.433	1.24	.402	1.68	.322	2.12	.166
.38		.82	.431	1.26	.402	1.70	.318	2.14	.176
.40		.84	.431	1.28	.398	1.72	.312	2.16	.184
.42		.86	.428	1.30	.391	1.74	.303	2.18	.187
.44		.88	.426	1.32	.372	1.76	.284	2.20	.191
.46		.90	.423	1.34	.347	1.78	.274	2.22	.193
.48		.92	.424	1.36	.322	1.80	.270	2.24	.189
.50		.94	.423	1.38	.255	1.82	.255	2.26	.184
.52	.117	.96	.421	1.40	.198	1.84	.217	2.28	.174
.54	.128	.98	.422	1.42	.178	1.86	.184	2.30	.163
.56	.126	1.00	.422	1.44	.166	1.88	.142	2.32	.150
.58	.100	1.02	.424	1.46	.161	1.90	.086	2.34	.135
.60	.085	1.04	.422	1.48	.169	1.92	.073	2.36	.124
.62	.072	1.06	.422	1.50	.187	1.94	.063	2.38	.114
.64	.072	1.08	.418	1.52	.217	1.96	.064	2.40	.105
.66	.095	1.10	.418	1.54	.237	1.98	.077	2.42	.095
.68	.254	1.12	.414	1.56	.264	2.00	.091	2.44	.088
.70	.309	1.14	.408	1.58	.282	2.02	.106	2.46	.077
.72	.407	1.16	.405	1.60	.296	2.04	.123	2.48	.068

NO.15 - TALL GREEN CORN



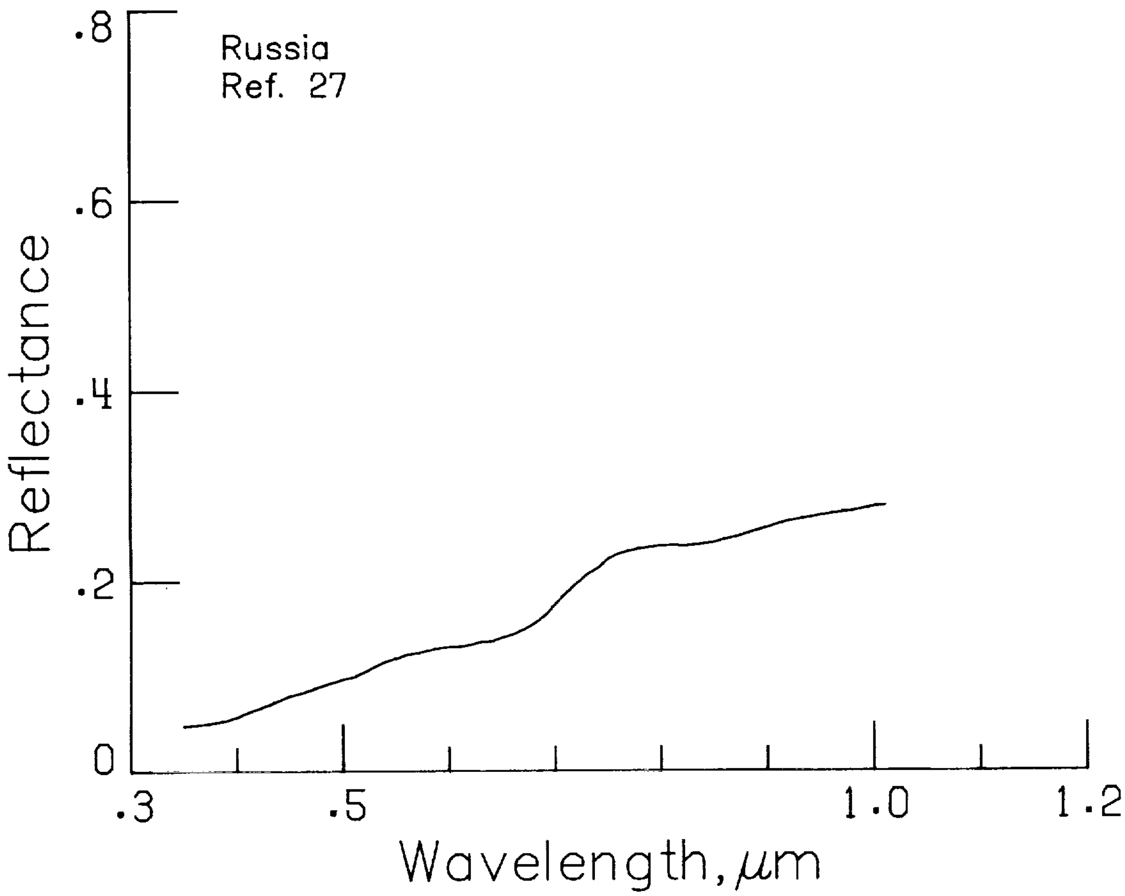
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.048	.66	.076	.84	.299	1.02	
.31		.49	.051	.67	.079	.85	.297	1.03	
.32		.50	.055	.68	.083	.86	.296	1.04	
.33		.51	.060	.69	.089	.87	.296	1.05	
.34		.52	.064	.70	.097	.88	.296	1.06	
.35		.53	.069	.71	.110	.89	.296	1.07	
.36	.017	.54	.072	.72	.126	.90	.296	1.08	
.37	.018	.55	.075	.73	.159	.91	.297	1.09	
.38	.019	.56	.079	.74	.185	.92	.299	1.10	
.39	.020	.57	.082	.75	.220	.93	.302	1.11	
.40	.023	.58	.083	.76	.242	.94	.303	1.12	
.41	.026	.59	.084	.77	.262	.95	.305	1.13	
.42	.029	.60	.085	.78	.274	.96	.305	1.14	
.43	.031	.61	.085	.79	.283	.97	.306	1.15	
.44	.034	.62	.082	.80	.291	.98	.307	1.16	
.45	.037	.63	.077	.81	.295	.99	.309	1.17	
.46	.041	.64	.074	.82	.298	1.00		1.18	
.47	.044	.65	.074	.83	.299	1.01		1.19	

NO.16 - SILAGE CORN



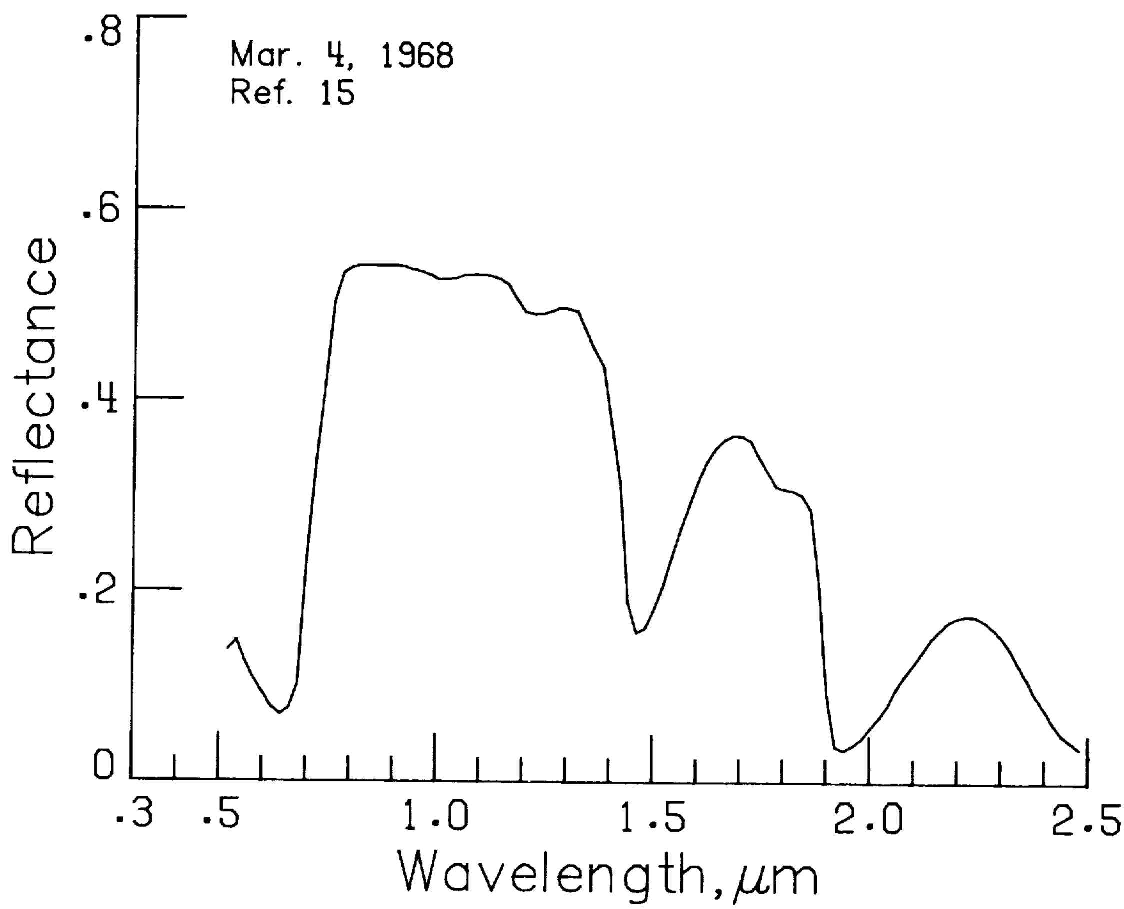
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.034	.66	.047	.84	.339	1.02	
.31		.49	.036	.67	.048	.85	.341	1.03	
.32		.50	.037	.68	.054	.86	.342	1.04	
.33		.51	.039	.69	.064	.87	.343	1.05	
.34		.52	.042	.70	.078	.88	.344	1.06	
.35	.024	.53	.045	.71	.096	.89	.347	1.07	
.36	.025	.54	.048	.72	.127	.90	.350	1.08	
.37	.026	.55	.053	.73	.176	.91	.353	1.09	
.38	.027	.56	.057	.74	.226	.92	.355	1.10	
.39	.029	.57	.061	.75	.279	.93	.359	1.11	
.40	.030	.58	.064	.76	.298	.94	.362	1.12	
.41	.031	.59	.062	.77	.311	.95	.364	1.13	
.42	.031	.60	.061	.78	.320	.96	.365	1.14	
.43	.031	.61	.059	.79	.327	.97	.365	1.15	
.44	.031	.62	.056	.80	.331	.98	.365	1.16	
.45	.031	.63	.053	.81	.334	.99	.366	1.17	
.46	.032	.64	.050	.82	.337	1.00		1.18	
.47	.033	.65	.048	.83	.339	1.01		1.19	

NO.17 - YELLOW CORN



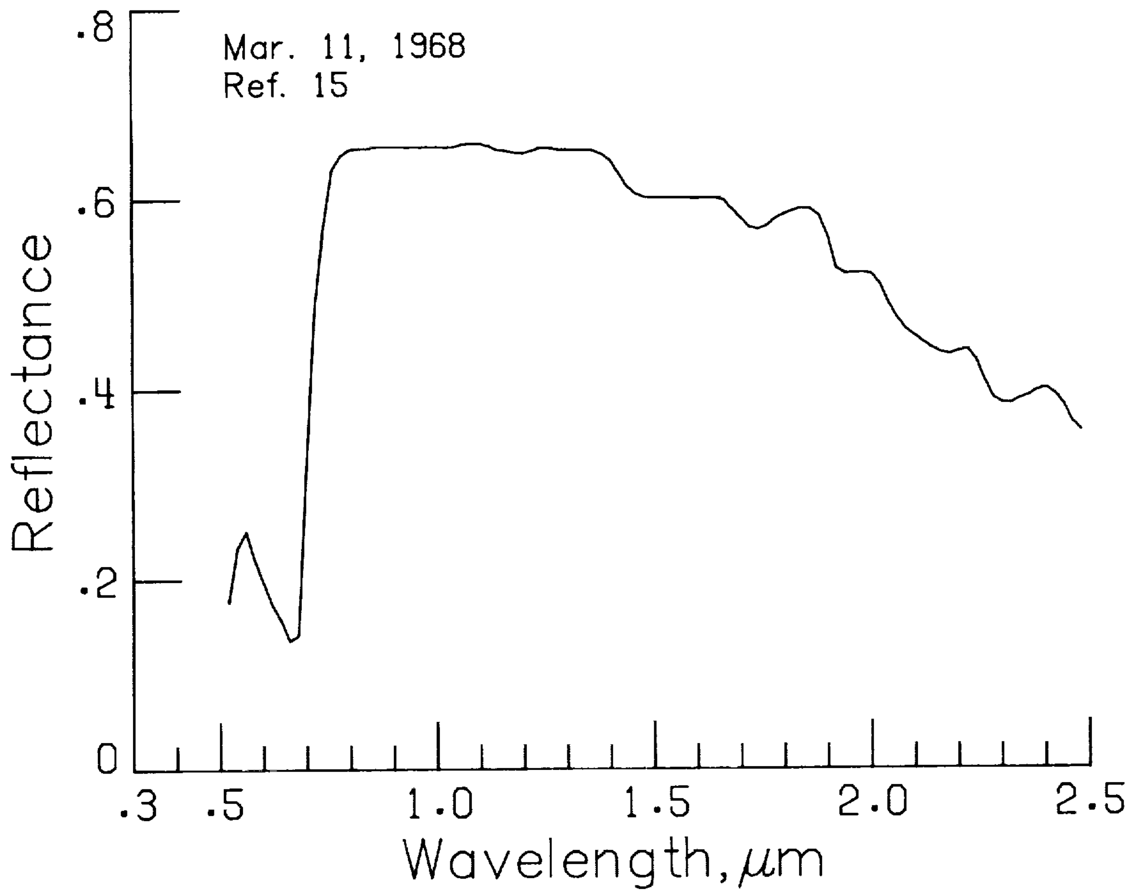
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.090	.66	.144	.84	.239	1.02	
.31		.49	.094	.67	.149	.85	.240	1.03	
.32		.50	.097	.68	.155	.86	.244	1.04	
.33		.51	.100	.69	.164	.87	.246	1.05	
.34		.52	.105	.70	.176	.88	.250	1.06	
.35	.048	.53	.111	.71	.188	.89	.253	1.07	
.36	.050	.54	.116	.72	.198	.90	.256	1.08	
.37	.050	.55	.119	.73	.208	.91	.260	1.09	
.38	.052	.56	.123	.74	.214	.92	.263	1.10	
.39	.054	.57	.124	.75	.224	.93	.265	1.11	
.40	.058	.58	.127	.76	.229	.94	.267	1.12	
.41	.063	.59	.130	.77	.232	.95	.269	1.13	
.42	.067	.60	.131	.78	.234	.96	.270	1.14	
.43	.071	.61	.131	.79	.236	.97	.271	1.15	
.44	.075	.62	.133	.80	.237	.98	.273	1.16	
.45	.080	.63	.136	.81	.237	.99	.275	1.17	
.46	.083	.64	.136	.82	.236	1.00	.277	1.18	
.47	.086	.65	.141	.83	.238	1.01	.278	1.19	

NO.18 - COTTON LEAF



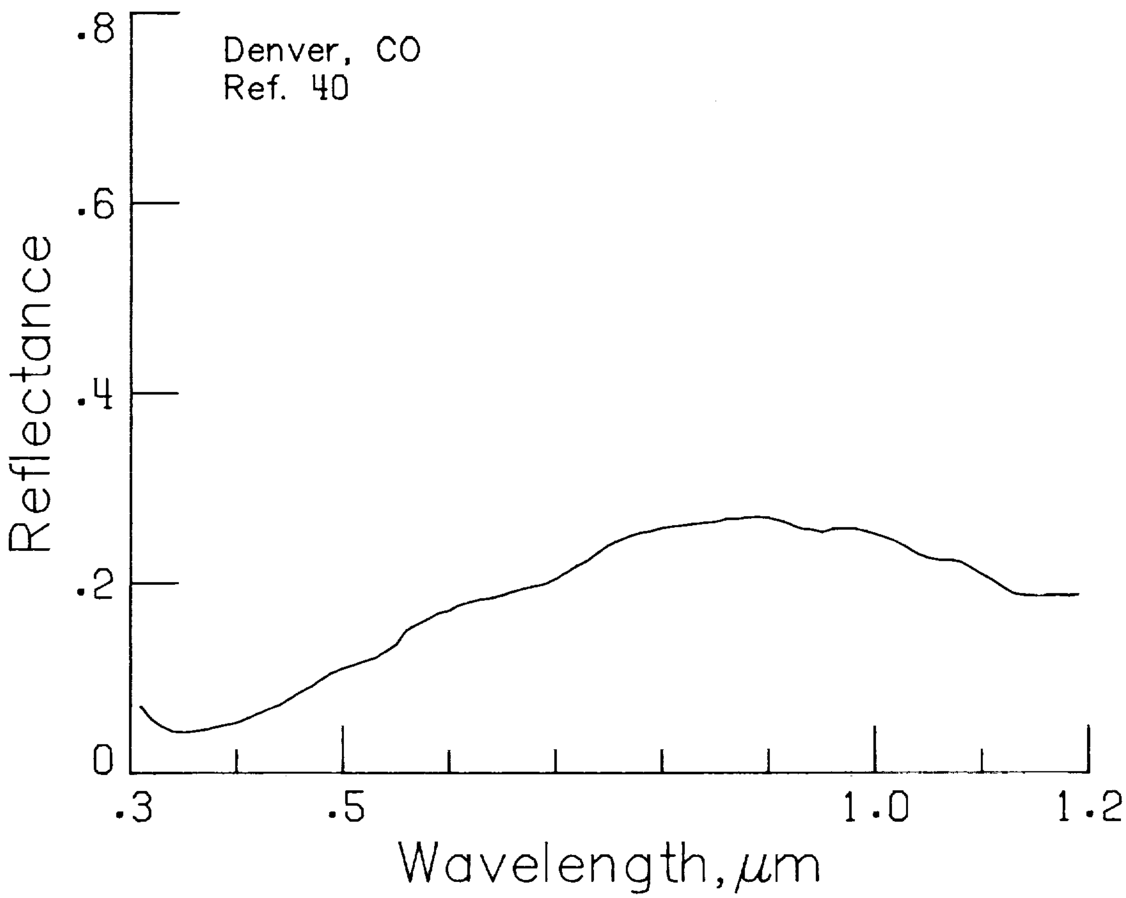
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.416	1.18	.507	1.62	.338	2.06	.100
.32		.76	.505	1.20	.494	1.64	.352	2.08	.114
.34		.78	.534	1.22	.492	1.66	.361	2.10	.126
.36		.80	.540	1.24	.492	1.68	.365	2.12	.139
.38		.82	.542	1.26	.495	1.70	.364	2.14	.152
.40		.84	.541	1.28	.499	1.72	.359	2.16	.162
.42		.86	.541	1.30	.497	1.74	.342	2.18	.171
.44		.88	.541	1.32	.494	1.76	.326	2.20	.174
.46		.90	.541	1.34	.473	1.78	.311	2.22	.176
.48		.92	.540	1.36	.453	1.80	.308	2.24	.175
.50		.94	.537	1.38	.437	1.82	.307	2.26	.171
.52	.139	.96	.535	1.40	.376	1.84	.302	2.28	.163
.54	.148	.98	.532	1.42	.317	1.86	.287	2.30	.154
.56	.124	1.00	.527	1.44	.189	1.88	.209	2.32	.142
.58	.107	1.02	.528	1.46	.158	1.90	.094	2.34	.124
.60	.092	1.04	.529	1.48	.163	1.92	.038	2.36	.109
.62	.078	1.06	.532	1.50	.182	1.94	.035	2.38	.091
.64	.071	1.08	.532	1.52	.206	1.96	.040	2.40	.078
.66	.077	1.10	.532	1.54	.238	1.98	.047	2.42	.063
.68	.103	1.12	.531	1.56	.266	2.00	.058	2.44	.051
.70	.237	1.14	.528	1.58	.292	2.02	.069	2.46	.044
.72	.336	1.16	.522	1.60	.318	2.04	.082	2.48	.037

NO.19 - DEHYDRATED COTTON LEAF



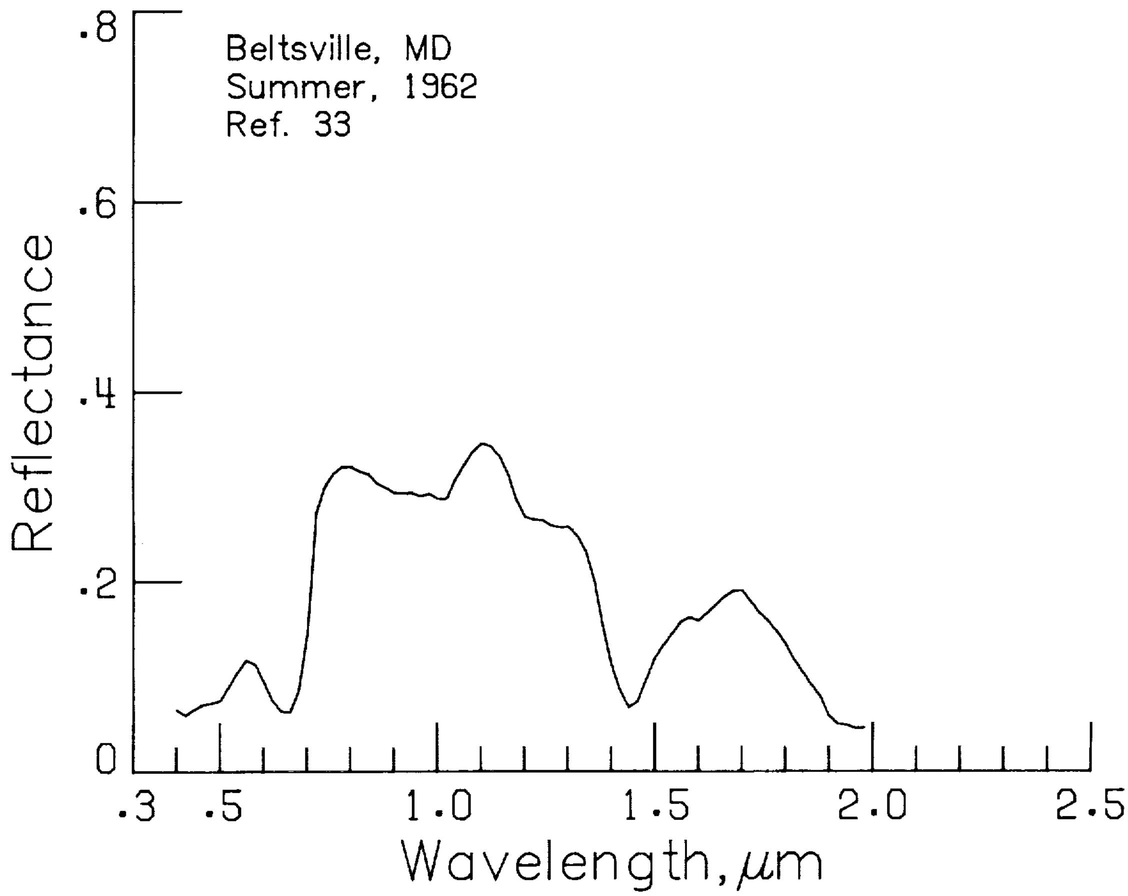
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.570	1.18	.649	1.62	.600	2.06	.473
.32		.76	.632	1.20	.648	1.64	.600	2.08	.461
.34		.78	.646	1.22	.651	1.66	.598	2.10	.455
.36		.80	.653	1.24	.654	1.68	.588	2.12	.448
.38		.82	.654	1.26	.654	1.70	.579	2.14	.442
.40		.84	.654	1.28	.652	1.72	.569	2.16	.437
.42		.86	.655	1.30	.652	1.74	.567	2.18	.436
.44		.88	.655	1.32	.652	1.76	.571	2.20	.439
.46		.90	.655	1.34	.652	1.78	.579	2.22	.441
.48		.92	.655	1.36	.651	1.80	.583	2.24	.429
.50		.94	.655	1.38	.647	1.82	.587	2.26	.407
.52	.176	.96	.655	1.40	.641	1.84	.589	2.28	.389
.54	.234	.98	.655	1.42	.627	1.86	.588	2.30	.385
.56	.251	1.00	.655	1.44	.612	1.88	.582	2.32	.384
.58	.221	1.02	.655	1.46	.605	1.90	.560	2.34	.389
.60	.197	1.04	.655	1.48	.601	1.92	.526	2.36	.392
.62	.173	1.06	.658	1.50	.600	1.94	.521	2.38	.398
.64	.157	1.08	.659	1.52	.600	1.96	.521	2.40	.400
.66	.136	1.10	.659	1.54	.600	1.98	.522	2.42	.394
.68	.141	1.12	.656	1.56	.600	2.00	.520	2.44	.383
.70	.325	1.14	.652	1.58	.600	2.02	.510	2.46	.365
.72	.489	1.16	.651	1.60	.600	2.04	.488	2.48	.355

NO.20 - FALLOW FIELD



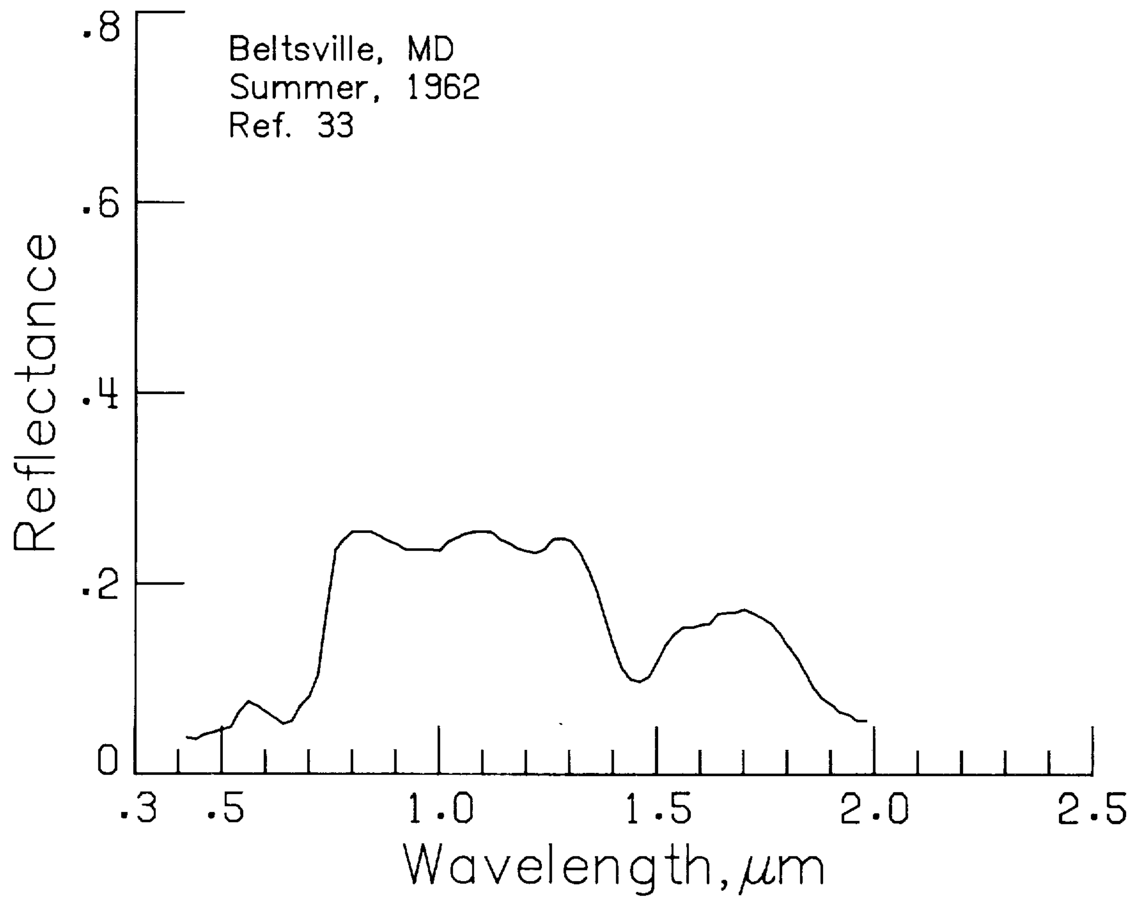
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.099	.66	.191	.84	.264	1.02	.244
.31	.070	.49	.106	.67	.194	.85	.265	1.03	.237
.32	.057	.50	.110	.68	.197	.86	.268	1.04	.231
.33	.049	.51	.114	.69	.199	.87	.268	1.05	.226
.34	.044	.52	.118	.70	.205	.88	.269	1.06	.224
.35	.043	.53	.121	.71	.211	.89	.270	1.07	.224
.36	.044	.54	.128	.72	.218	.90	.269	1.08	.222
.37	.046	.55	.135	.73	.224	.91	.266	1.09	.216
.38	.049	.56	.150	.74	.233	.92	.262	1.10	.209
.39	.051	.57	.156	.75	.240	.93	.257	1.11	.203
.40	.053	.58	.162	.76	.245	.94	.256	1.12	.195
.41	.058	.59	.168	.77	.250	.95	.254	1.13	.188
.42	.063	.60	.171	.78	.253	.96	.257	1.14	.187
.43	.068	.61	.177	.79	.255	.97	.258	1.15	.186
.44	.072	.62	.180	.80	.258	.98	.257	1.16	.186
.45	.079	.63	.183	.81	.260	.99	.255	1.17	.187
.46	.086	.64	.184	.82	.261	1.00	.251	1.18	.186
.47	.091	.65	.187	.83	.262	1.01	.248	1.19	.187

NO.21 - FLAX



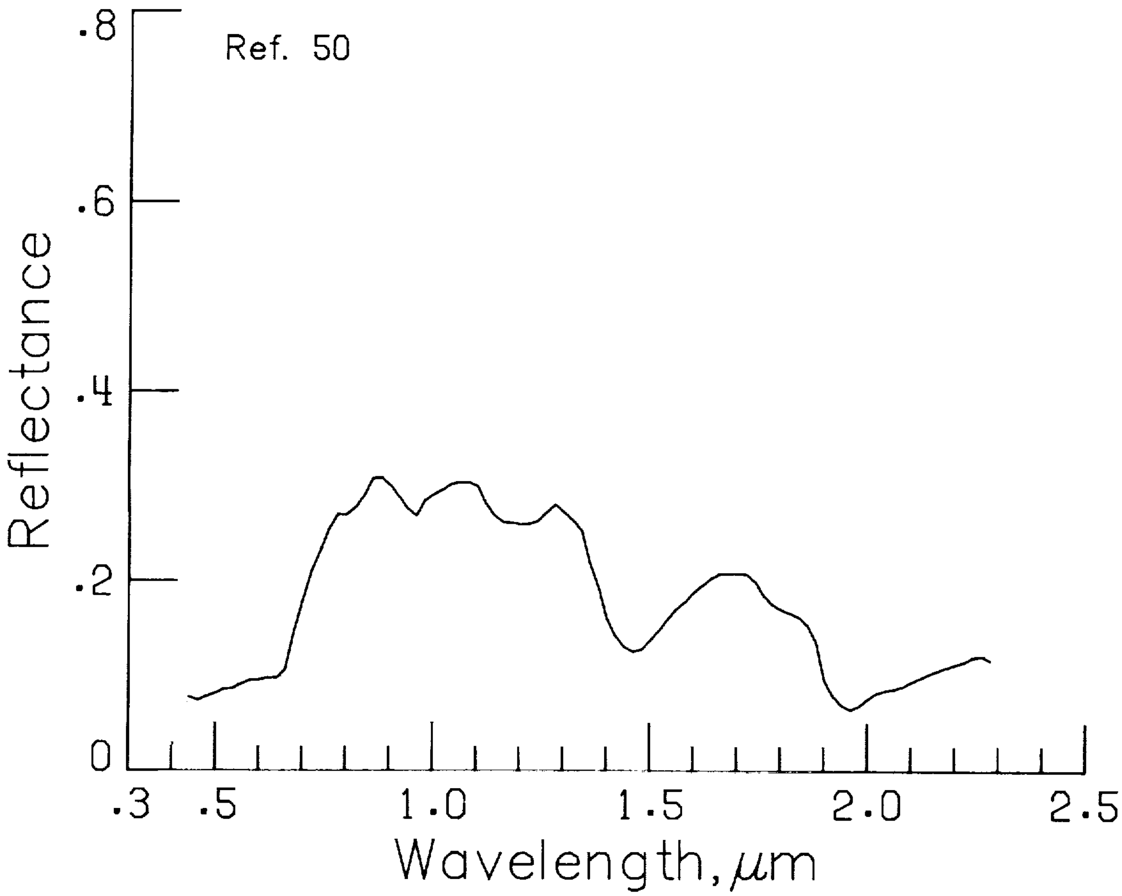
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.300	1.18	.286	1.62	.166	2.06	
.32		.76	.314	1.20	.268	1.64	.175	2.08	
.34		.78	.321	1.22	.265	1.66	.184	2.10	
.36		.80	.321	1.24	.265	1.68	.189	2.12	
.38		.82	.316	1.26	.259	1.70	.190	2.14	
.40	.065	.84	.313	1.28	.257	1.72	.178	2.16	
.42	.059	.86	.303	1.30	.258	1.74	.167	2.18	
.44	.065	.88	.299	1.32	.248	1.76	.158	2.20	
.46	.070	.90	.294	1.34	.232	1.78	.147	2.22	
.48	.072	.92	.293	1.36	.201	1.80	.135	2.24	
.50	.074	.94	.293	1.38	.153	1.82	.117	2.26	
.52	.089	.96	.290	1.40	.112	1.84	.104	2.28	
.54	.105	.98	.293	1.42	.084	1.86	.090	2.30	
.56	.117	1.00	.288	1.44	.067	1.88	.078	2.32	
.58	.113	1.02	.288	1.46	.073	1.90	.057	2.34	
.60	.094	1.04	.308	1.48	.096	1.92	.050	2.36	
.62	.074	1.06	.323	1.50	.119	1.94	.048	2.38	
.64	.063	1.08	.337	1.52	.133	1.96	.045	2.40	
.66	.062	1.10	.345	1.54	.145	1.98	.045	2.42	
.68	.085	1.12	.343	1.56	.157	2.00		2.44	
.70	.145	1.14	.332	1.58	.161	2.02		2.46	
.72	.273	1.16	.313	1.60	.158	2.04		2.48	

NO.22 - OATS



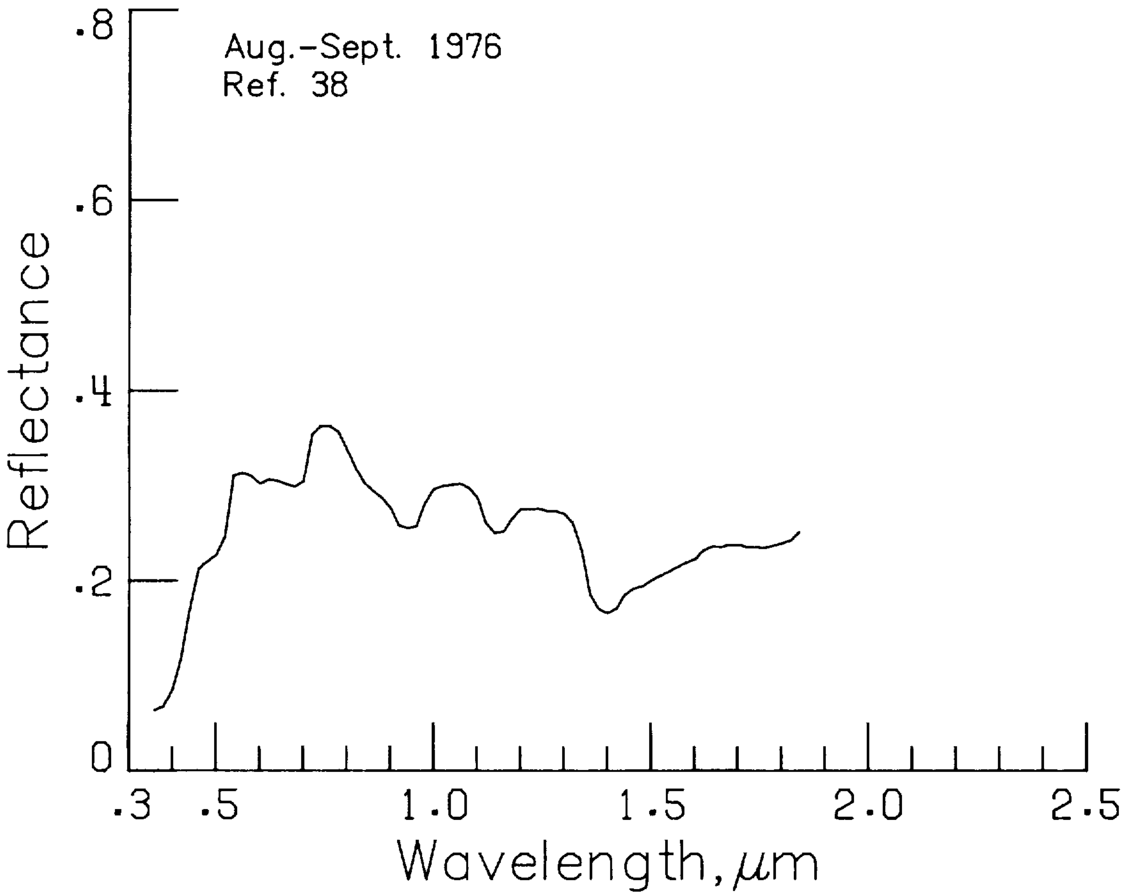
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.173	1.18	.237	1.62	.158	2.06	
.32		.76	.236	1.20	.234	1.64	.169	2.08	
.34		.78	.247	1.22	.233	1.66	.170	2.10	
.36		.80	.255	1.24	.236	1.68	.170	2.12	
.38		.82	.255	1.26	.247	1.70	.173	2.14	
.40		.84	.255	1.28	.248	1.72	.169	2.16	
.42	.038	.86	.251	1.30	.246	1.74	.164	2.18	
.44	.037	.88	.245	1.32	.235	1.76	.159	2.20	
.46	.042	.90	.242	1.34	.216	1.78	.149	2.22	
.48	.044	.92	.236	1.36	.194	1.80	.135	2.24	
.50	.047	.94	.236	1.38	.164	1.82	.123	2.26	
.52	.049	.96	.236	1.40	.135	1.84	.107	2.28	
.54	.066	.98	.236	1.42	.110	1.86	.090	2.30	
.56	.076	1.00	.235	1.44	.100	1.88	.080	2.32	
.58	.072	1.02	.245	1.46	.098	1.90	.074	2.34	
.60	.066	1.04	.249	1.48	.102	1.92	.066	2.36	
.62	.059	1.06	.253	1.50	.119	1.94	.063	2.38	
.64	.053	1.08	.255	1.52	.136	1.96	.057	2.40	
.66	.056	1.10	.255	1.54	.148	1.98	.057	2.42	
.68	.072	1.12	.254	1.56	.154	2.00		2.44	
.70	.082	1.14	.246	1.58	.154	2.02		2.46	
.72	.104	1.16	.242	1.60	.157	2.04		2.48	

NO.23 - OATS



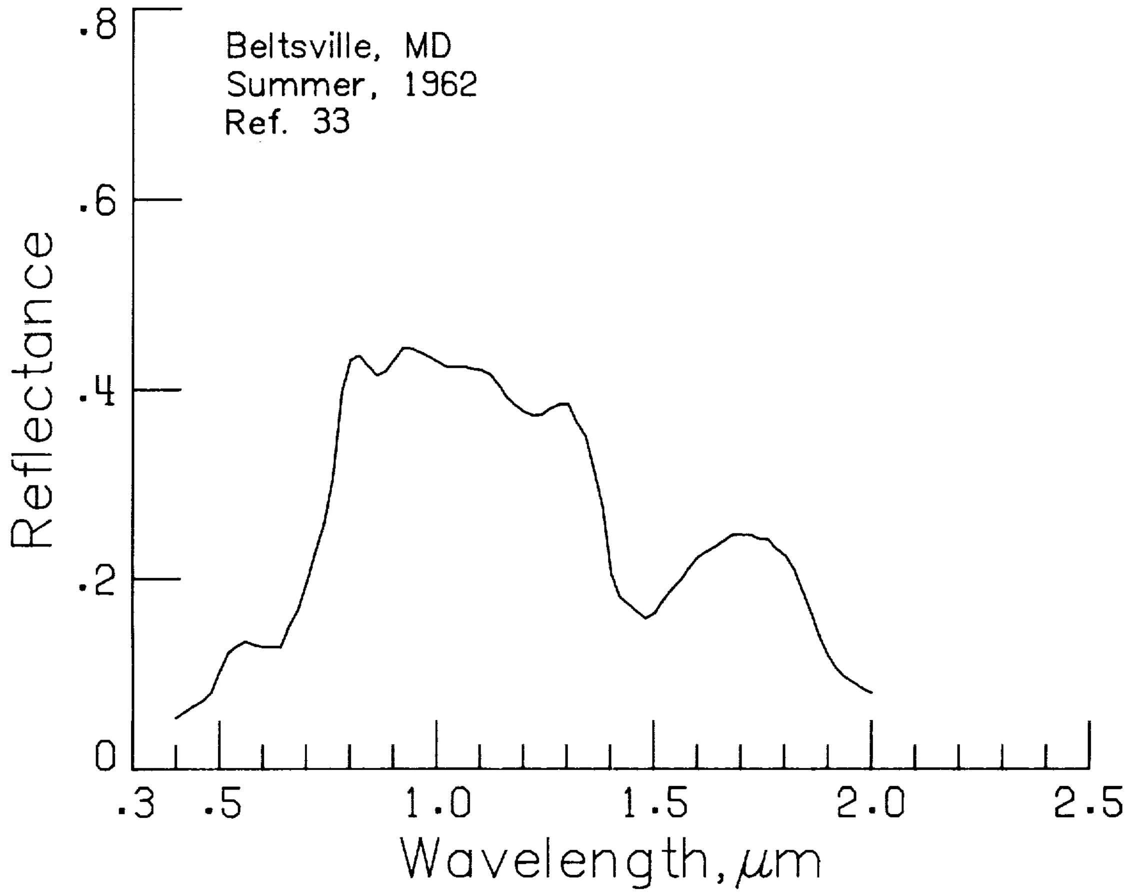
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.232	1.18	.262	1.62	.196	2.06	.086
.32		.76	.255	1.20	.260	1.64	.203	2.08	.089
.34		.78	.271	1.22	.261	1.66	.208	2.10	.094
.36		.80	.270	1.24	.264	1.68	.208	2.12	.098
.38		.82	.278	1.26	.273	1.70	.208	2.14	.102
.40		.84	.290	1.28	.281	1.72	.207	2.16	.106
.42		.86	.308	1.30	.273	1.74	.200	2.18	.109
.44	.077	.88	.309	1.32	.264	1.76	.185	2.20	.112
.46	.074	.90	.302	1.34	.254	1.78	.175	2.22	.115
.48	.078	.92	.289	1.36	.219	1.80	.170	2.24	.119
.50	.082	.94	.277	1.38	.193	1.82	.166	2.26	.121
.52	.086	.96	.269	1.40	.160	1.84	.162	2.28	.117
.54	.087	.98	.286	1.42	.142	1.86	.154	2.30	
.56	.091	1.00	.292	1.44	.130	1.88	.137	2.32	
.58	.095	1.02	.297	1.46	.126	1.90	.095	2.34	
.60	.096	1.04	.303	1.48	.128	1.92	.078	2.36	
.62	.098	1.06	.305	1.50	.138	1.94	.069	2.38	
.64	.097	1.08	.305	1.52	.148	1.96	.064	2.40	
.66	.106	1.10	.301	1.54	.160	1.98	.068	2.42	
.68	.146	1.12	.282	1.56	.171	2.00	.076	2.44	
.70	.179	1.14	.269	1.58	.178	2.02	.082	2.46	
.72	.210	1.16	.262	1.60	.188	2.04	.085	2.48	

NO.24 - OATS



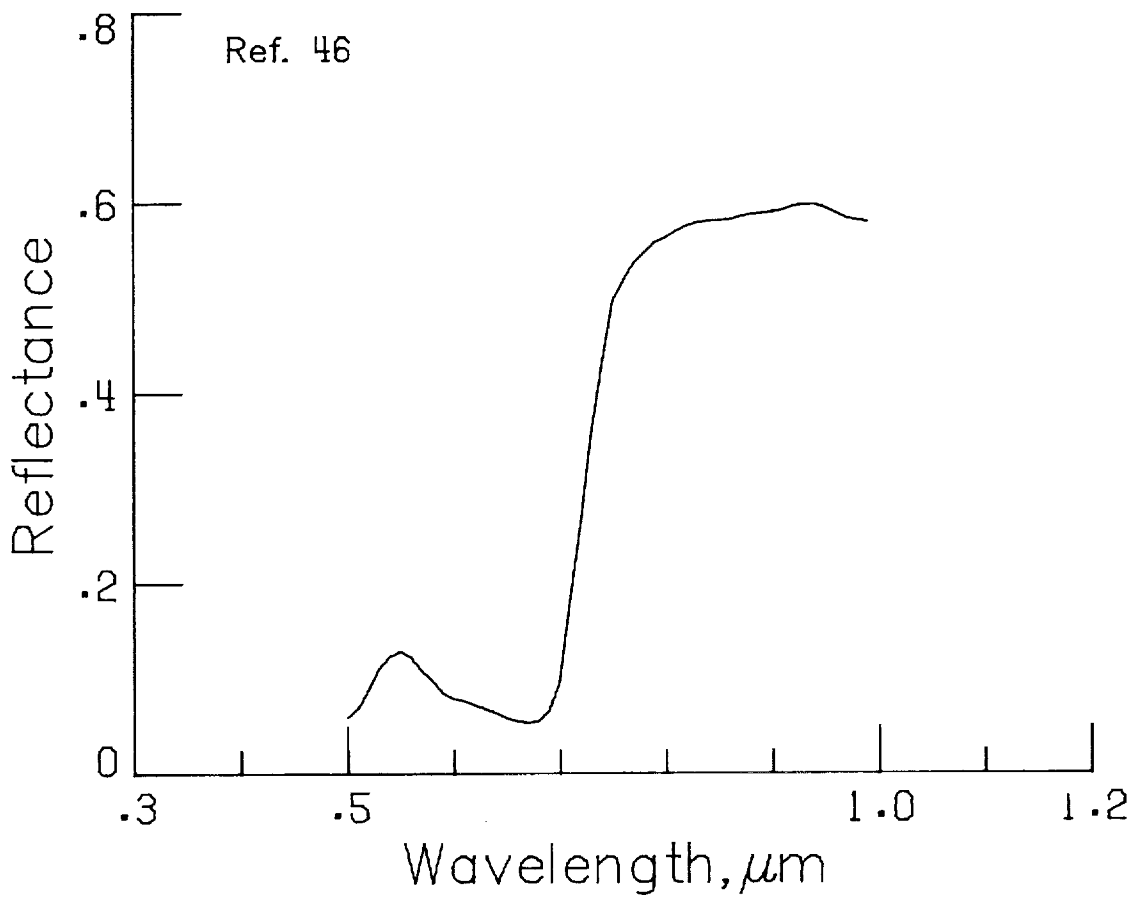
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.363	1.18	.266	1.62	.232	2.06	
.32		.76	.362	1.20	.275	1.64	.236	2.08	
.34		.78	.356	1.22	.276	1.66	.236	2.10	
.36	.064	.80	.337	1.24	.276	1.68	.238	2.12	
.38	.068	.82	.318	1.26	.273	1.70	.238	2.14	
.40	.085	.84	.302	1.28	.273	1.72	.235	2.16	
.42	.119	.86	.294	1.30	.270	1.74	.235	2.18	
.44	.171	.88	.287	1.32	.260	1.76	.235	2.20	
.46	.213	.90	.277	1.34	.232	1.78	.237	2.22	
.48	.221	.92	.258	1.36	.185	1.80	.239	2.24	
.50	.227	.94	.255	1.38	.169	1.82	.242	2.26	
.52	.247	.96	.257	1.40	.166	1.84	.251	2.28	
.54	.311	.98	.282	1.42	.171	1.86		2.30	
.56	.313	1.00	.296	1.44	.186	1.88		2.32	
.58	.310	1.02	.300	1.46	.192	1.90		2.34	
.60	.302	1.04	.301	1.48	.194	1.92		2.36	
.62	.306	1.06	.302	1.50	.200	1.94		2.38	
.64	.305	1.08	.297	1.52	.205	1.96		2.40	
.66	.301	1.10	.287	1.54	.210	1.98		2.42	
.68	.299	1.12	.260	1.56	.215	2.00		2.44	
.70	.305	1.14	.250	1.58	.219	2.02		2.46	
.72	.354	1.16	.252	1.60	.223	2.04		2.48	

NO.25 - PEANUTS



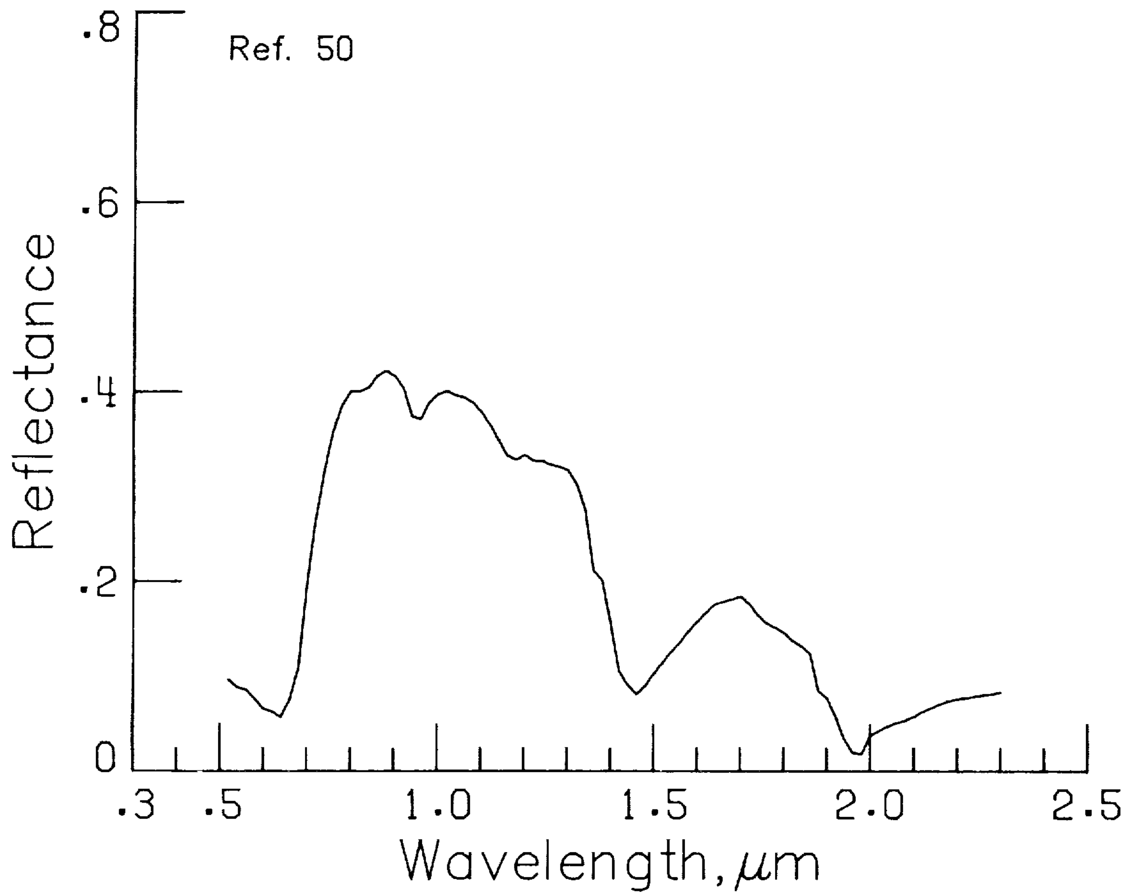
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.259	1.18	.383	1.62	.229	2.06	
.32		.76	.307	1.20	.376	1.64	.234	2.08	
.34		.78	.397	1.22	.372	1.66	.240	2.10	
.36		.80	.432	1.24	.373	1.68	.247	2.12	
.38		.82	.436	1.26	.380	1.70	.246	2.14	
.40	.054	.84	.425	1.28	.384	1.72	.246	2.16	
.42	.061	.86	.415	1.30	.385	1.74	.242	2.18	
.44	.067	.88	.419	1.32	.364	1.76	.241	2.20	
.46	.072	.90	.432	1.34	.351	1.78	.231	2.22	
.48	.081	.92	.444	1.36	.315	1.80	.224	2.24	
.50	.104	.94	.443	1.38	.276	1.82	.210	2.26	
.52	.123	.96	.439	1.40	.205	1.84	.186	2.28	
.54	.130	.98	.435	1.42	.180	1.86	.164	2.30	
.56	.135	1.00	.429	1.44	.173	1.88	.138	2.32	
.58	.131	1.02	.424	1.46	.165	1.90	.120	2.34	
.60	.129	1.04	.424	1.48	.159	1.92	.105	2.36	
.62	.129	1.06	.424	1.50	.164	1.94	.096	2.38	
.64	.129	1.08	.422	1.52	.177	1.96	.091	2.40	
.66	.151	1.10	.421	1.54	.189	1.98	.084	2.42	
.68	.167	1.12	.416	1.56	.198	2.00	.080	2.44	
.70	.196	1.14	.405	1.58	.212	2.02		2.46	
.72	.228	1.16	.391	1.60	.223	2.04		2.48	

NO.26 - POTATOES



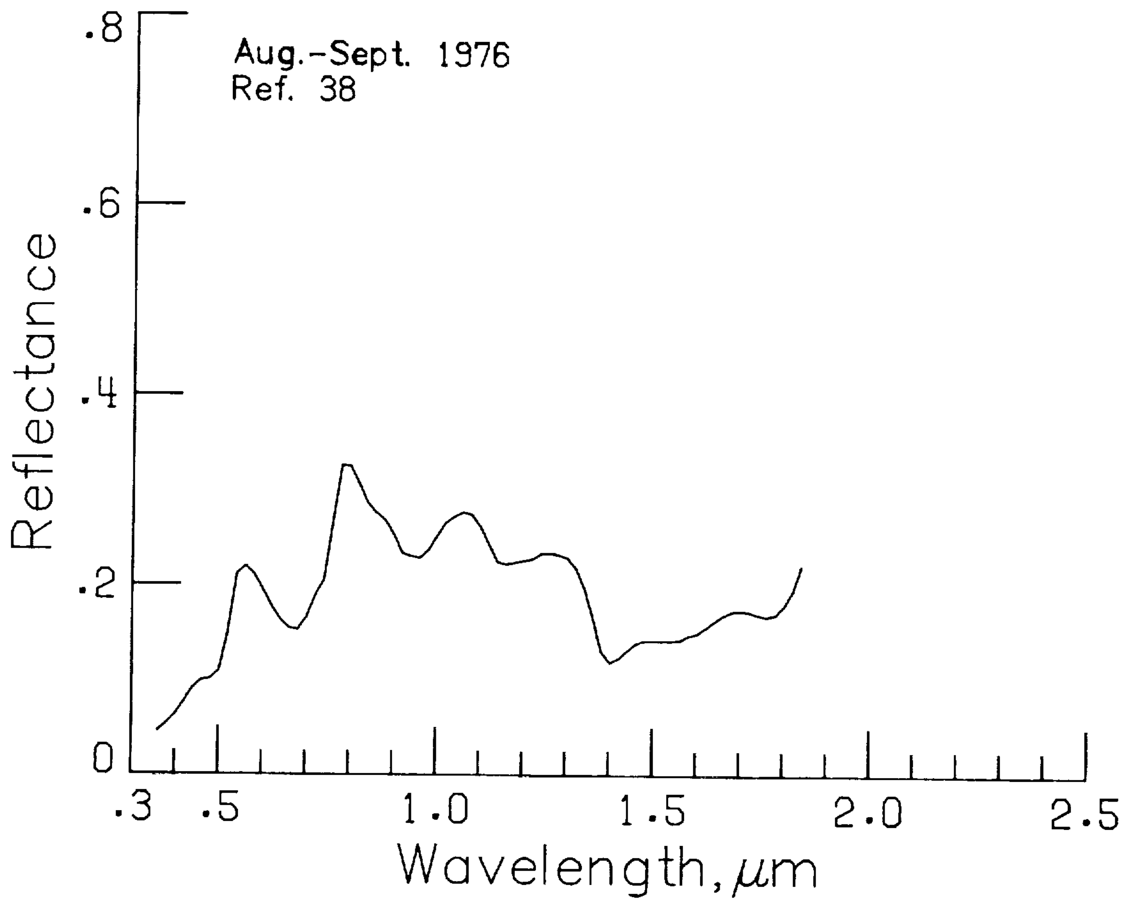
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48		.66	.055	.84	.581	1.02	
.31		.49		.67	.054	.85	.582	1.03	
.32		.50	.060	.68	.056	.86	.583	1.04	
.33		.51	.069	.69	.067	.87	.586	1.05	
.34		.52	.089	.70	.098	.88	.589	1.06	
.35		.53	.111	.71	.187	.89	.589	1.07	
.36		.54	.124	.72	.265	.90	.591	1.08	
.37		.55	.129	.73	.360	.91	.593	1.09	
.38		.56	.123	.74	.432	.92	.597	1.10	
.39		.57	.109	.75	.498	.93	.598	1.11	
.40		.58	.099	.76	.519	.94	.598	1.12	
.41		.59	.085	.77	.538	.95	.595	1.13	
.42		.60	.079	.78	.549	.96	.590	1.14	
.43		.61	.077	.79	.559	.97	.584	1.15	
.44		.62	.073	.80	.564	.98	.582	1.16	
.45		.63	.068	.81	.571	.99	.580	1.17	
.46		.64	.064	.82	.576	1.00		1.18	
.47		.65	.059	.83	.580	1.01		1.19	

NO.27 - POTATOES



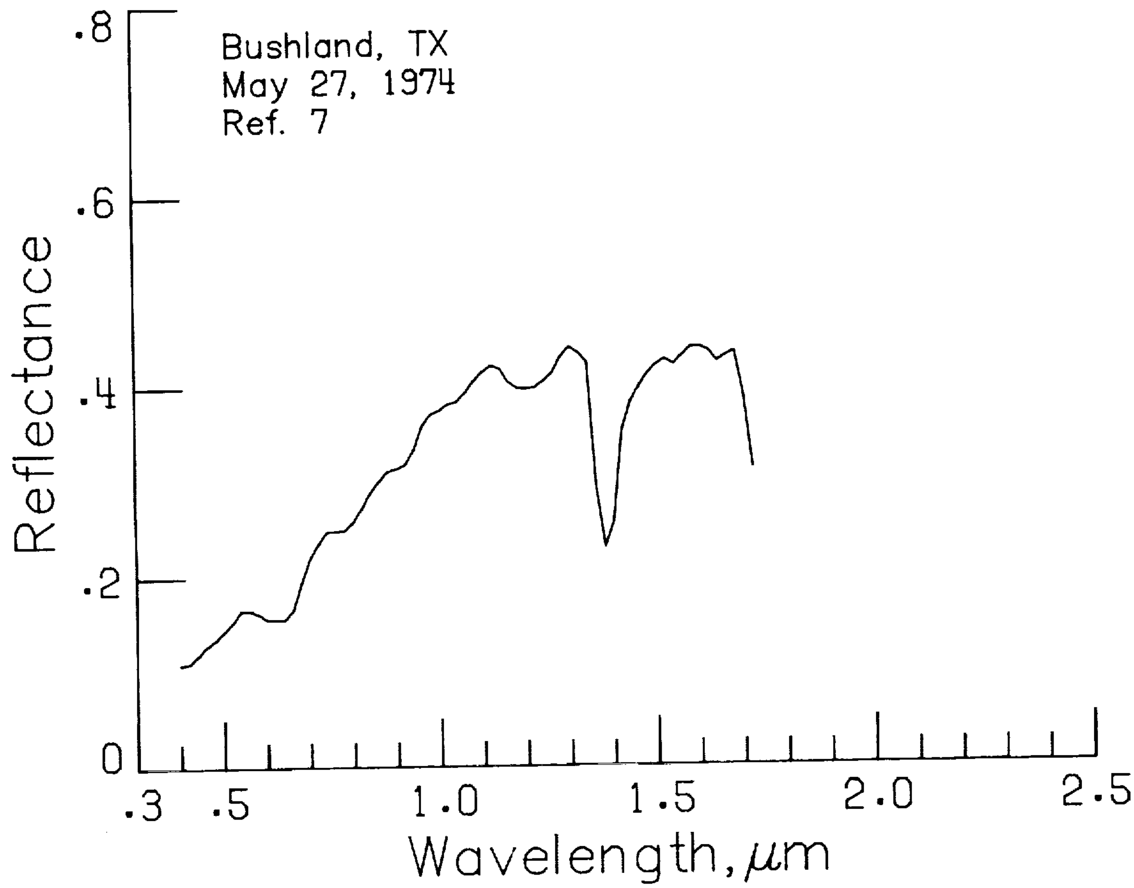
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.320	1.18	.329	1.62	.167	2.06	.051
.32		.76	.360	1.20	.334	1.64	.176	2.08	.053
.34		.78	.387	1.22	.328	1.66	.179	2.10	.057
.36		.80	.401	1.24	.327	1.68	.181	2.12	.063
.38		.82	.400	1.26	.324	1.70	.184	2.14	.067
.40		.84	.405	1.28	.321	1.72	.176	2.16	.071
.42		.86	.417	1.30	.318	1.74	.164	2.18	.074
.44		.88	.422	1.32	.303	1.76	.155	2.20	.076
.46		.90	.416	1.34	.276	1.78	.151	2.22	.077
.48		.92	.404	1.36	.211	1.80	.145	2.24	.079
.50		.94	.374	1.38	.201	1.82	.137	2.26	.080
.52	.096	.96	.371	1.40	.156	1.84	.131	2.28	.081
.54	.088	.98	.389	1.42	.104	1.86	.124	2.30	.083
.56	.086	1.00	.398	1.44	.090	1.88	.084	2.32	
.58	.076	1.02	.401	1.46	.081	1.90	.077	2.34	
.60	.066	1.04	.396	1.48	.090	1.92	.057	2.36	
.62	.063	1.06	.394	1.50	.103	1.94	.034	2.38	
.64	.057	1.08	.388	1.52	.114	1.96	.019	2.40	
.66	.075	1.10	.378	1.54	.126	1.98	.018	2.42	
.68	.108	1.12	.365	1.56	.136	2.00	.038	2.44	
.70	.197	1.14	.349	1.58	.147	2.02	.043	2.46	
.72	.267	1.16	.333	1.60	.158	2.04	.048	2.48	

NO.28 - RAPESEED



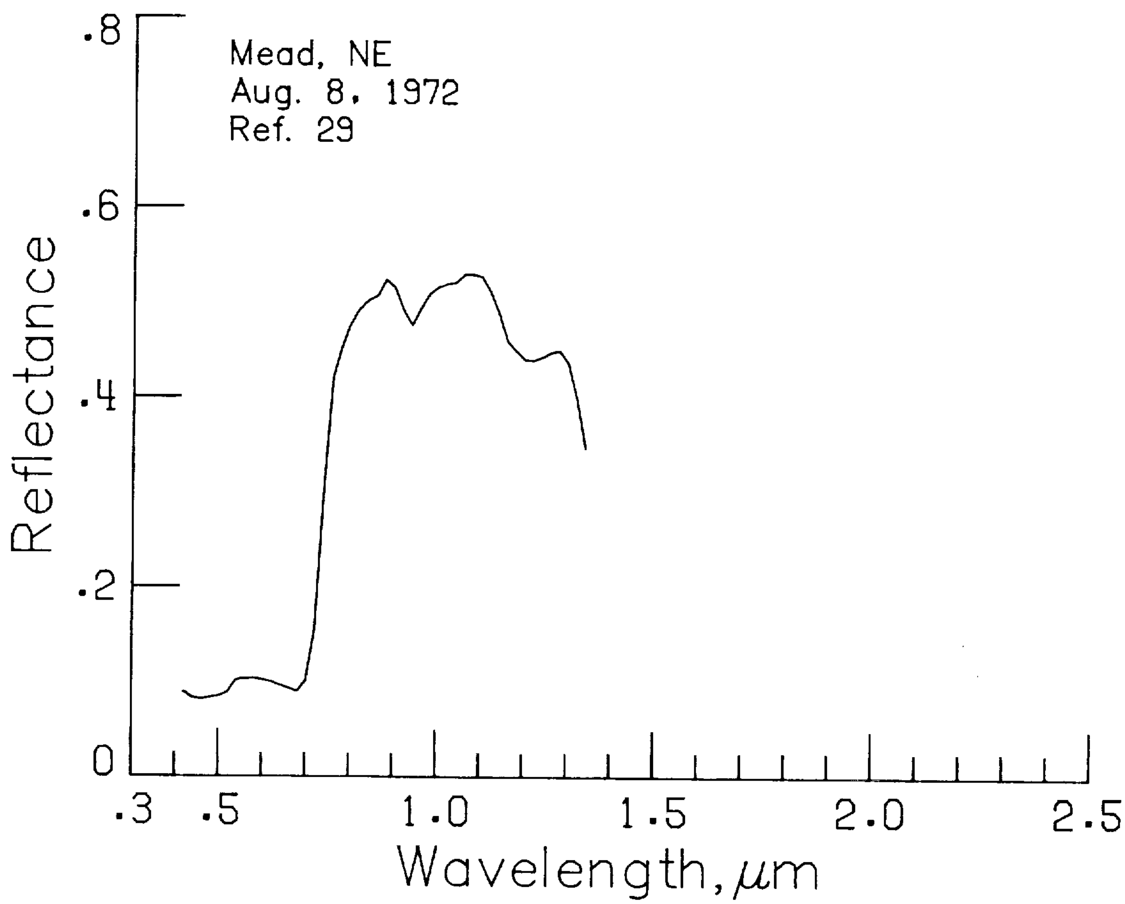
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.206	1.18	.224	1.62	.156	2.06	
.32		.76	.266	1.20	.226	1.64	.163	2.08	
.34		.78	.326	1.22	.228	1.66	.169	2.10	
.36	.046	.80	.325	1.24	.234	1.68	.173	2.12	
.38	.054	.82	.307	1.26	.234	1.70	.174	2.14	
.40	.063	.84	.286	1.28	.233	1.72	.173	2.16	
.42	.076	.86	.276	1.30	.229	1.74	.170	2.18	
.44	.091	.88	.268	1.32	.219	1.76	.168	2.20	
.46	.099	.90	.254	1.34	.198	1.78	.170	2.22	
.48	.101	.92	.234	1.36	.167	1.80	.179	2.24	
.50	.110	.94	.231	1.38	.130	1.82	.195	2.26	
.52	.148	.96	.229	1.40	.119	1.84	.221	2.28	
.54	.212	.98	.237	1.42	.124	1.86		2.30	
.56	.220	1.00	.252	1.44	.132	1.88		2.32	
.58	.211	1.02	.266	1.46	.139	1.90		2.34	
.60	.195	1.04	.272	1.48	.142	1.92		2.36	
.62	.178	1.06	.277	1.50	.142	1.94		2.38	
.64	.163	1.08	.274	1.52	.142	1.96		2.40	
.66	.155	1.10	.262	1.54	.142	1.98		2.42	
.68	.153	1.12	.243	1.56	.143	2.00		2.44	
.70	.166	1.14	.225	1.58	.148	2.02		2.46	
.72	.189	1.16	.222	1.60	.150	2.04		2.48	

NO. 29 - SORGHUM



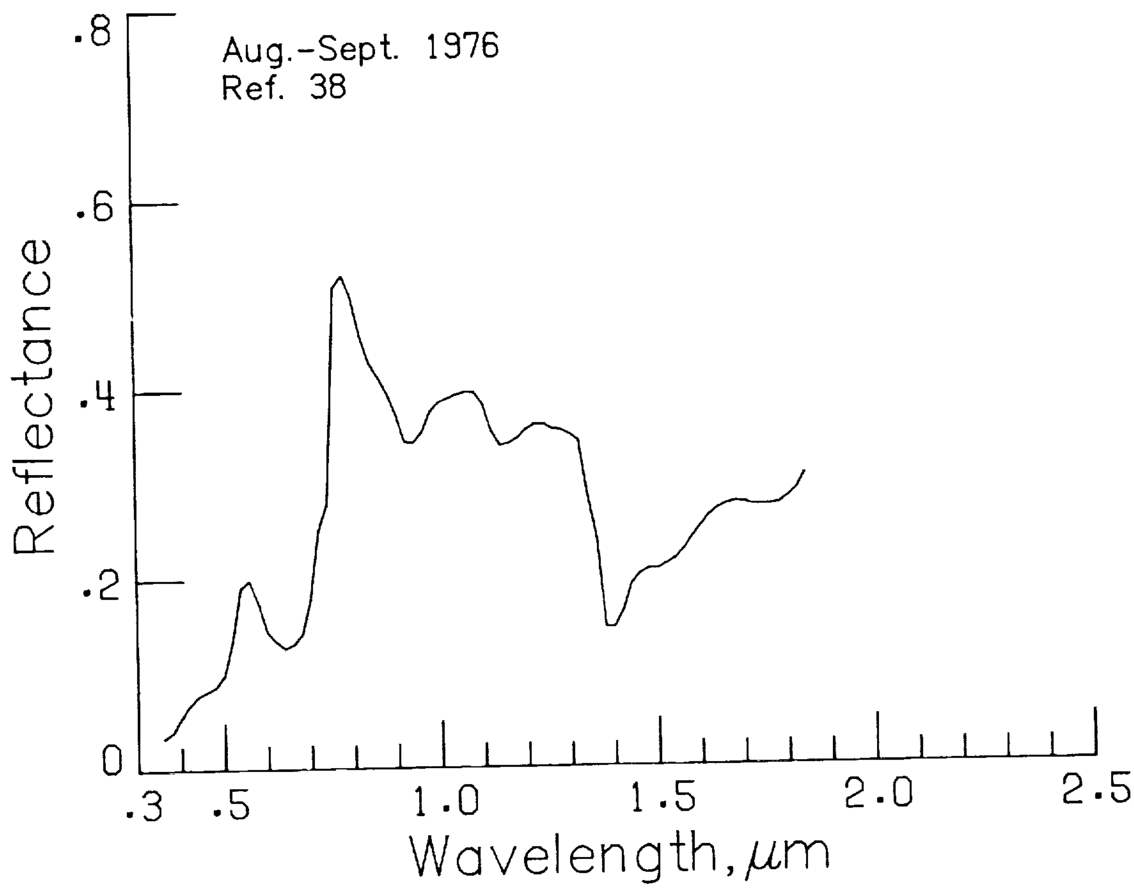
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.249	1.18	.398	1.62	.436	2.06	
.32		.76	.250	1.20	.398	1.64	.425	2.08	
.34		.78	.250	1.22	.399	1.66	.431	2.10	
.36		.80	.259	1.24	.406	1.68	.435	2.12	
.38		.82	.273	1.26	.414	1.70	.389	2.14	
.40	.109	.84	.289	1.28	.431	1.72	.314	2.16	
.42	.111	.86	.301	1.30	.441	1.74		2.18	
.44	.119	.88	.312	1.32	.435	1.76		2.20	
.46	.129	.90	.314	1.34	.425	1.78		2.22	
.48	.135	.92	.318	1.36	.293	1.80		2.24	
.50	.144	.94	.333	1.38	.231	1.82		2.26	
.52	.153	.96	.359	1.40	.257	1.84		2.28	
.54	.166	.98	.371	1.42	.353	1.86		2.30	
.56	.166	1.00	.375	1.44	.383	1.88		2.32	
.58	.162	1.02	.382	1.46	.399	1.90		2.34	
.60	.156	1.04	.384	1.48	.412	1.92		2.36	
.62	.156	1.06	.393	1.50	.422	1.94		2.38	
.64	.156	1.08	.406	1.52	.427	1.96		2.40	
.66	.166	1.10	.415	1.54	.422	1.98		2.42	
.68	.195	1.12	.422	1.56	.431	2.00		2.44	
.70	.221	1.14	.419	1.58	.440	2.02		2.46	
.72	.236	1.16	.404	1.60	.440	2.04		2.48	

NO.30 - SOYBEANS



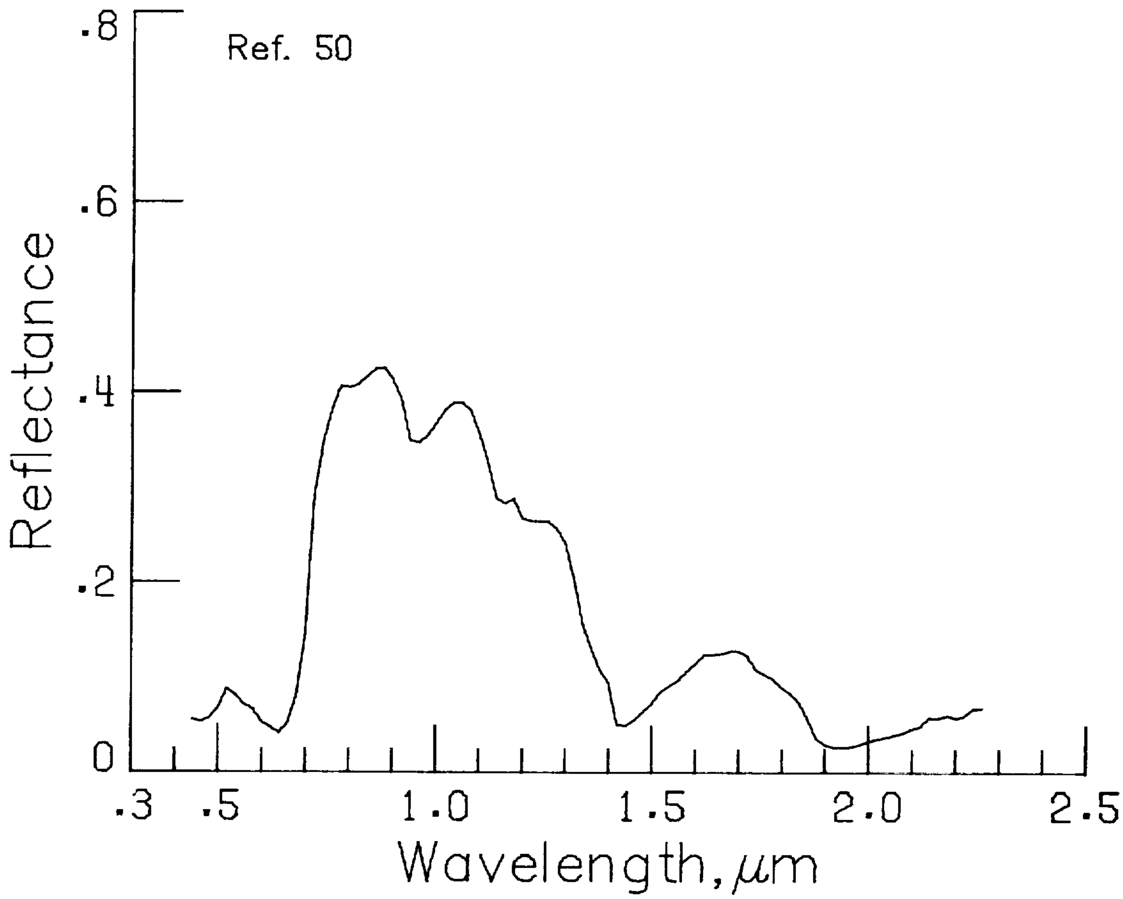
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.301	1.18	.449	1.62		2.06	
.32		.76	.421	1.20	.440	1.64		2.08	
.34		.78	.454	1.22	.440	1.66		2.10	
.36		.80	.478	1.24	.443	1.68		2.12	
.38		.82	.493	1.26	.448	1.70		2.14	
.40		.84	.503	1.28	.449	1.72		2.16	
.42	.089	.86	.507	1.30	.436	1.74		2.18	
.44	.083	.88	.524	1.32	.398	1.76		2.20	
.46	.082	.90	.516	1.34	.347	1.78		2.22	
.48	.083	.92	.492	1.36		1.80		2.24	
.50	.085	.94	.476	1.38		1.82		2.26	
.52	.088	.96	.494	1.40		1.84		2.28	
.54	.102	.98	.509	1.42		1.86		2.30	
.56	.104	1.00	.516	1.44		1.88		2.32	
.58	.104	1.02	.520	1.46		1.90		2.34	
.60	.102	1.04	.521	1.48		1.92		2.36	
.62	.100	1.06	.530	1.50		1.94		2.38	
.64	.097	1.08	.530	1.52		1.96		2.40	
.66	.093	1.10	.528	1.54		1.98		2.42	
.68	.090	1.12	.511	1.56		2.00		2.44	
.70	.101	1.14	.489	1.58		2.02		2.46	
.72	.153	1.16	.459	1.60		2.04		2.48	

NO.31 - SOYBEANS



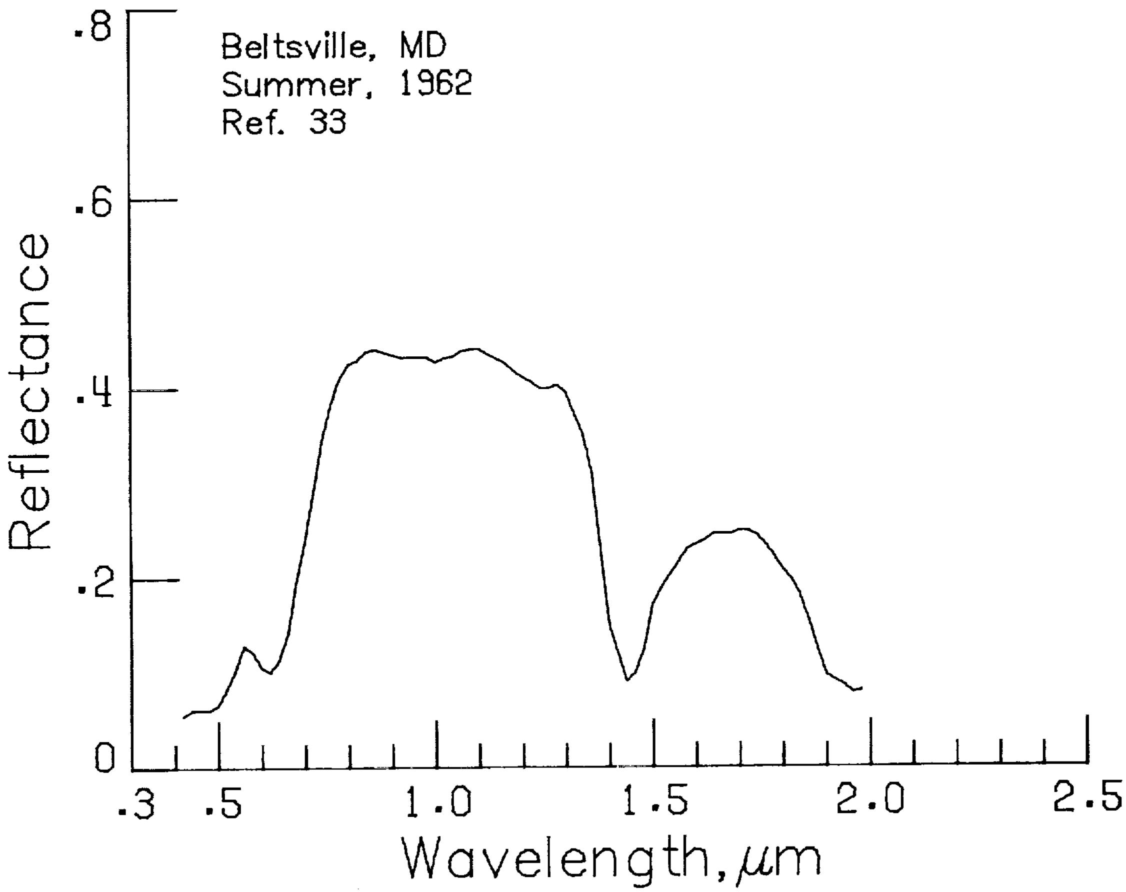
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.279	1.18	.347	1.62	.264	2.06	
.32		.76	.509	1.20	.356	1.64	.271	2.08	
.34		.78	.520	1.22	.361	1.66	.275	2.10	
.36	.034	.80	.497	1.24	.361	1.68	.277	2.12	
.38	.040	.82	.457	1.26	.357	1.70	.276	2.14	
.40	.056	.84	.428	1.28	.355	1.72	.274	2.16	
.42	.069	.86	.413	1.30	.351	1.74	.274	2.18	
.44	.079	.88	.396	1.32	.344	1.76	.274	2.20	
.46	.083	.90	.374	1.34	.285	1.78	.276	2.22	
.48	.088	.92	.344	1.36	.241	1.80	.282	2.24	
.50	.100	.94	.344	1.38	.147	1.82	.291	2.26	
.52	.138	.96	.354	1.40	.147	1.84	.307	2.28	
.54	.192	.98	.377	1.42	.164	1.86		2.30	
.56	.199	1.00	.386	1.44	.193	1.88		2.32	
.58	.176	1.02	.390	1.46	.203	1.90		2.34	
.60	.145	1.04	.394	1.48	.208	1.92		2.36	
.62	.135	1.06	.397	1.50	.207	1.94		2.38	
.64	.128	1.08	.396	1.52	.213	1.96		2.40	
.66	.132	1.10	.384	1.54	.218	1.98		2.42	
.68	.143	1.12	.355	1.56	.227	2.00		2.44	
.70	.178	1.14	.340	1.58	.241	2.02		2.46	
.72	.252	1.16	.342	1.60	.253	2.04		2.48	

NO.32 - SUGAR BEETS



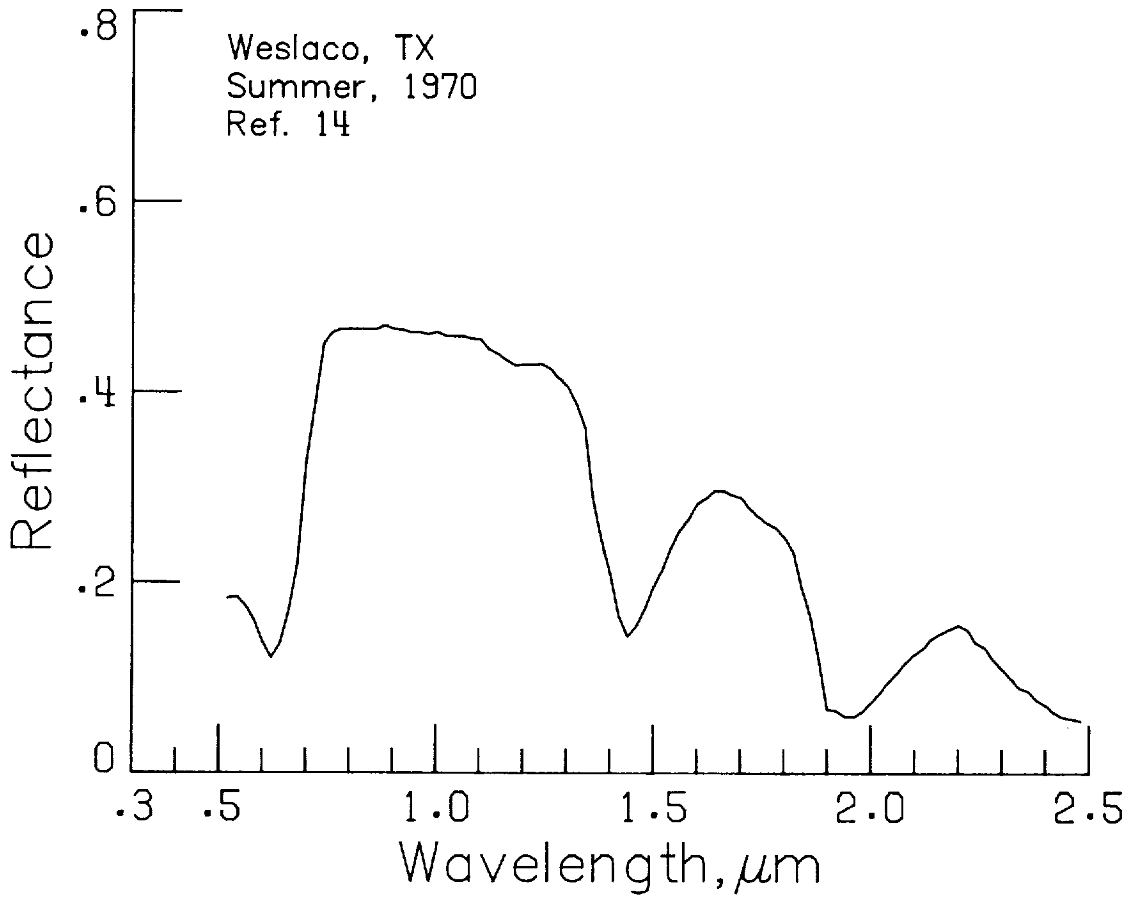
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.348	1.18	.289	1.62	.125	2.06	.040
.32		.76	.383	1.20	.268	1.64	.125	2.08	.043
.34		.78	.407	1.22	.265	1.66	.126	2.10	.046
.36		.80	.406	1.24	.265	1.68	.128	2.12	.050
.38		.82	.409	1.26	.264	1.70	.128	2.14	.058
.40		.84	.417	1.28	.257	1.72	.123	2.16	.058
.42		.86	.425	1.30	.241	1.74	.109	2.18	.060
.44	.055	.88	.426	1.32	.203	1.76	.103	2.20	.058
.46	.053	.90	.414	1.34	.158	1.78	.099	2.22	.060
.48	.058	.92	.392	1.36	.131	1.80	.090	2.24	.067
.50	.068	.94	.349	1.38	.109	1.82	.084	2.26	.068
.52	.089	.96	.347	1.40	.094	1.84	.074	2.28	
.54	.082	.98	.355	1.42	.050	1.86	.057	2.30	
.56	.072	1.00	.367	1.44	.050	1.88	.036	2.32	
.58	.066	1.02	.382	1.46	.056	1.90	.030	2.34	
.60	.053	1.04	.390	1.48	.064	1.92	.027	2.36	
.62	.048	1.06	.390	1.50	.074	1.94	.027	2.38	
.64	.042	1.08	.381	1.52	.086	1.96	.028	2.40	
.66	.052	1.10	.356	1.54	.092	1.98	.030	2.42	
.68	.080	1.12	.328	1.56	.098	2.00	.034	2.44	
.70	.144	1.14	.289	1.58	.108	2.02	.036	2.46	
.72	.293	1.16	.284	1.60	.115	2.04	.038	2.48	

NO.33 - SUGAR BEETS



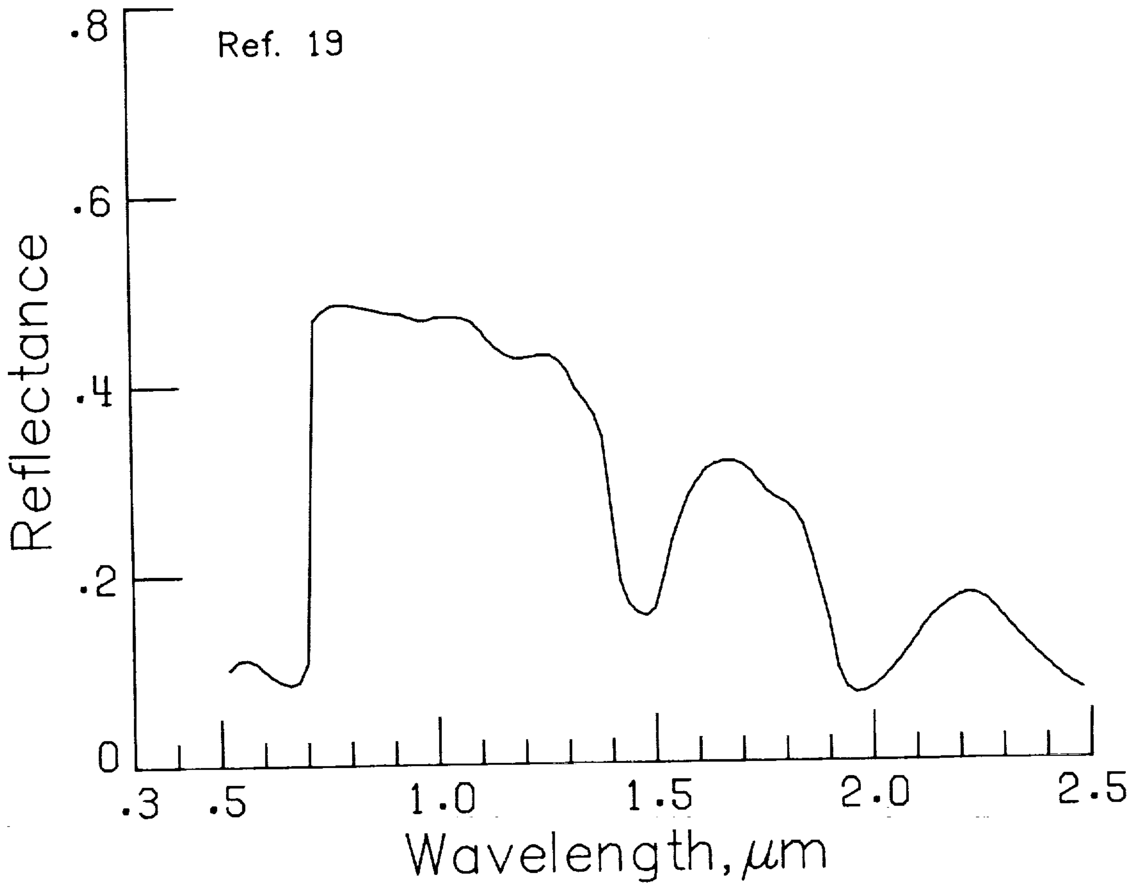
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.345	1.18	.418	1.62	.240	2.06	
.32		.76	.384	1.20	.411	1.64	.246	2.08	
.34		.78	.410	1.22	.407	1.66	.246	2.10	
.36		.80	.425	1.24	.399	1.68	.246	2.12	
.38		.82	.429	1.26	.400	1.70	.250	2.14	
.40		.84	.439	1.28	.403	1.72	.249	2.16	
.42	.056	.86	.441	1.30	.395	1.74	.244	2.18	
.44	.062	.88	.438	1.32	.372	1.76	.234	2.20	
.46	.062	.90	.435	1.34	.351	1.78	.222	2.22	
.48	.062	.92	.433	1.36	.311	1.80	.207	2.24	
.50	.067	.94	.433	1.38	.228	1.82	.197	2.26	
.52	.083	.96	.433	1.40	.152	1.84	.182	2.28	
.54	.104	.98	.433	1.42	.120	1.86	.155	2.30	
.56	.129	1.00	.427	1.44	.091	1.88	.125	2.32	
.58	.122	1.02	.432	1.46	.101	1.90	.097	2.34	
.60	.106	1.04	.434	1.48	.124	1.92	.092	2.36	
.62	.101	1.06	.440	1.50	.171	1.94	.087	2.38	
.64	.114	1.08	.441	1.52	.190	1.96	.079	2.40	
.66	.142	1.10	.441	1.54	.204	1.98	.081	2.42	
.68	.196	1.12	.436	1.56	.217	2.00		2.44	
.70	.238	1.14	.431	1.58	.231	2.02		2.46	
.72	.291	1.16	.426	1.60	.235	2.04		2.48	

NO.34 - SUGARCANE LEAF



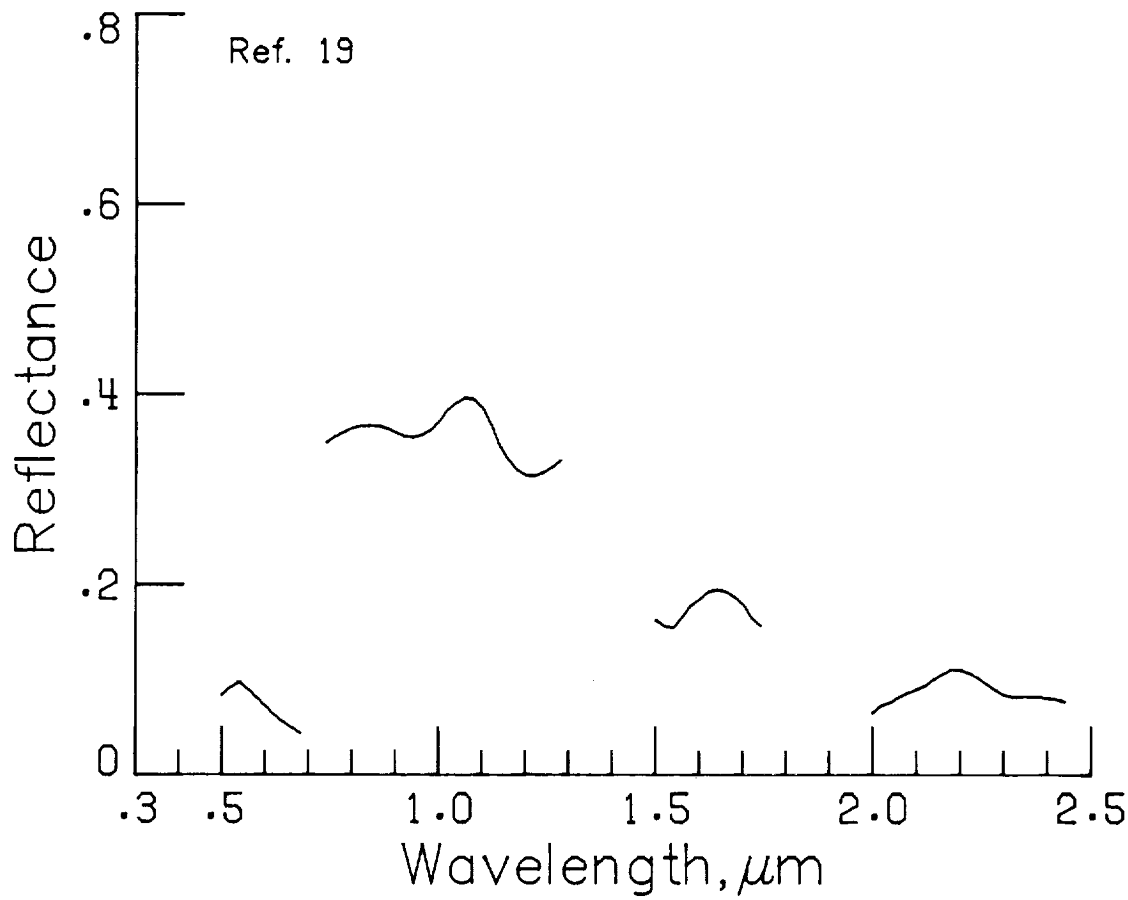
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.452	1.18	.429	1.62	.290	2.06	.106
.32		.76	.463	1.20	.430	1.64	.297	2.08	.117
.34		.78	.467	1.22	.430	1.66	.296	2.10	.125
.36		.80	.467	1.24	.430	1.68	.293	2.12	.132
.38		.82	.467	1.26	.426	1.70	.290	2.14	.142
.40		.84	.467	1.28	.415	1.72	.278	2.16	.147
.42		.86	.467	1.30	.407	1.74	.270	2.18	.152
.44		.88	.470	1.32	.389	1.76	.263	2.20	.156
.46		.90	.467	1.34	.365	1.78	.258	2.22	.151
.48		.92	.466	1.36	.288	1.80	.248	2.24	.137
.50		.94	.463	1.38	.244	1.82	.233	2.26	.133
.52	.183	.96	.463	1.40	.209	1.84	.195	2.28	.120
.54	.185	.98	.461	1.42	.165	1.86	.166	2.30	.110
.56	.176	1.00	.464	1.44	.144	1.88	.121	2.32	.100
.58	.161	1.02	.460	1.46	.155	1.90	.067	2.34	.090
.60	.138	1.04	.459	1.48	.173	1.92	.066	2.36	.087
.62	.122	1.06	.459	1.50	.196	1.94	.060	2.38	.077
.64	.136	1.08	.457	1.52	.214	1.96	.059	2.40	.072
.66	.170	1.10	.456	1.54	.238	1.98	.064	2.42	.063
.68	.219	1.12	.446	1.56	.256	2.00	.074	2.44	.059
.70	.327	1.14	.441	1.58	.267	2.02	.084	2.46	.057
.72	.388	1.16	.434	1.60	.284	2.04	.096	2.48	.055

NO.35 - SUGARCANE LEAF



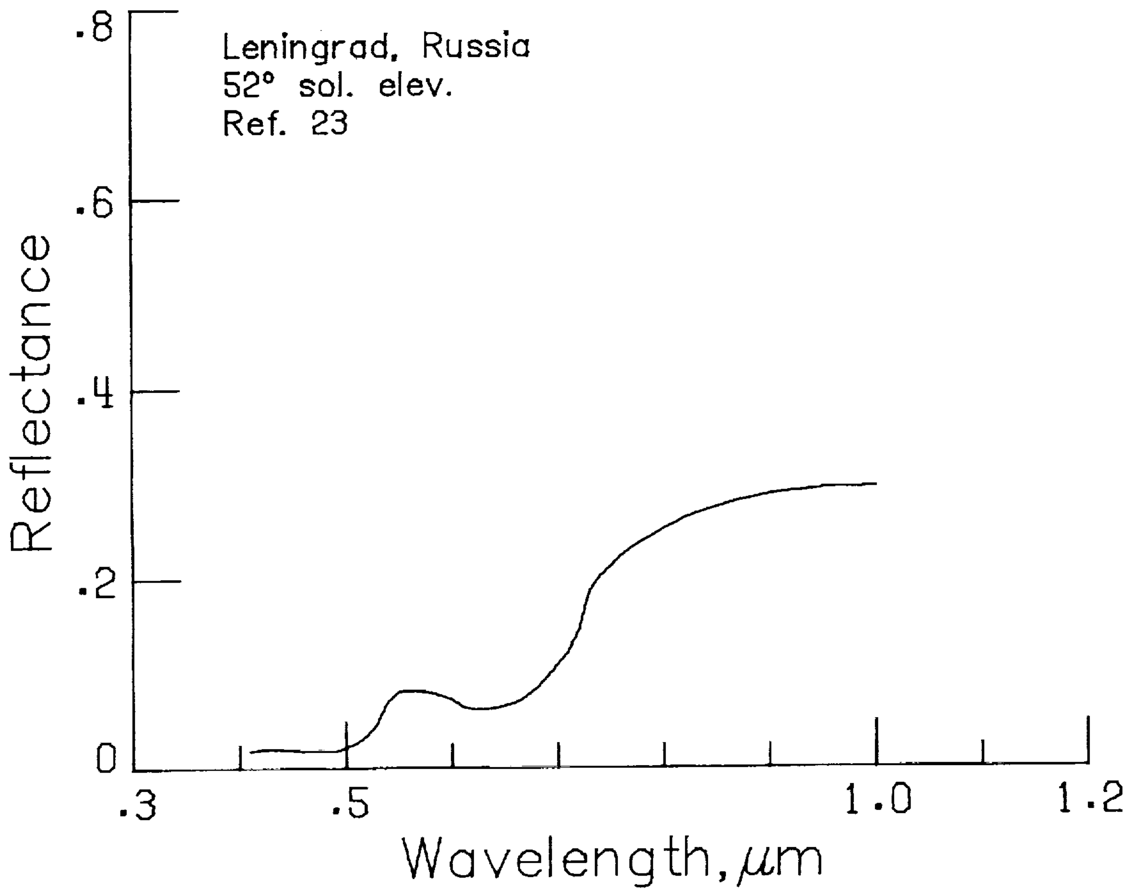
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.479	1.18	.427	1.62	.309	2.06	.104
.32		.76	.484	1.20	.427	1.64	.314	2.08	.116
.34		.78	.486	1.22	.429	1.66	.317	2.10	.129
.36		.80	.485	1.24	.430	1.68	.317	2.12	.142
.38		.82	.483	1.26	.430	1.70	.314	2.14	.153
.40		.84	.481	1.28	.425	1.72	.307	2.16	.160
.42		.86	.479	1.30	.414	1.74	.295	2.18	.167
.44		.88	.477	1.32	.394	1.76	.283	2.20	.172
.46		.90	.475	1.34	.382	1.78	.277	2.22	.175
.48		.92	.475	1.36	.369	1.80	.272	2.24	.173
.50		.94	.471	1.38	.344	1.82	.264	2.26	.169
.52	.102	.96	.468	1.40	.266	1.84	.250	2.28	.160
.54	.110	.98	.468	1.42	.190	1.86	.218	2.30	.149
.56	.112	1.00	.471	1.44	.167	1.88	.183	2.32	.139
.58	.108	1.02	.471	1.46	.158	1.90	.149	2.34	.128
.60	.100	1.04	.471	1.48	.155	1.92	.097	2.36	.118
.62	.092	1.06	.470	1.50	.162	1.94	.077	2.38	.109
.64	.087	1.08	.467	1.52	.195	1.96	.071	2.40	.100
.66	.085	1.10	.458	1.54	.234	1.98	.072	2.42	.092
.68	.088	1.12	.446	1.56	.260	2.00	.077	2.44	.084
.70	.108	1.14	.437	1.58	.283	2.02	.084	2.46	.078
.72	.469	1.16	.431	1.60	.297	2.04	.094	2.48	.073

NO.36 - SUGARCANE



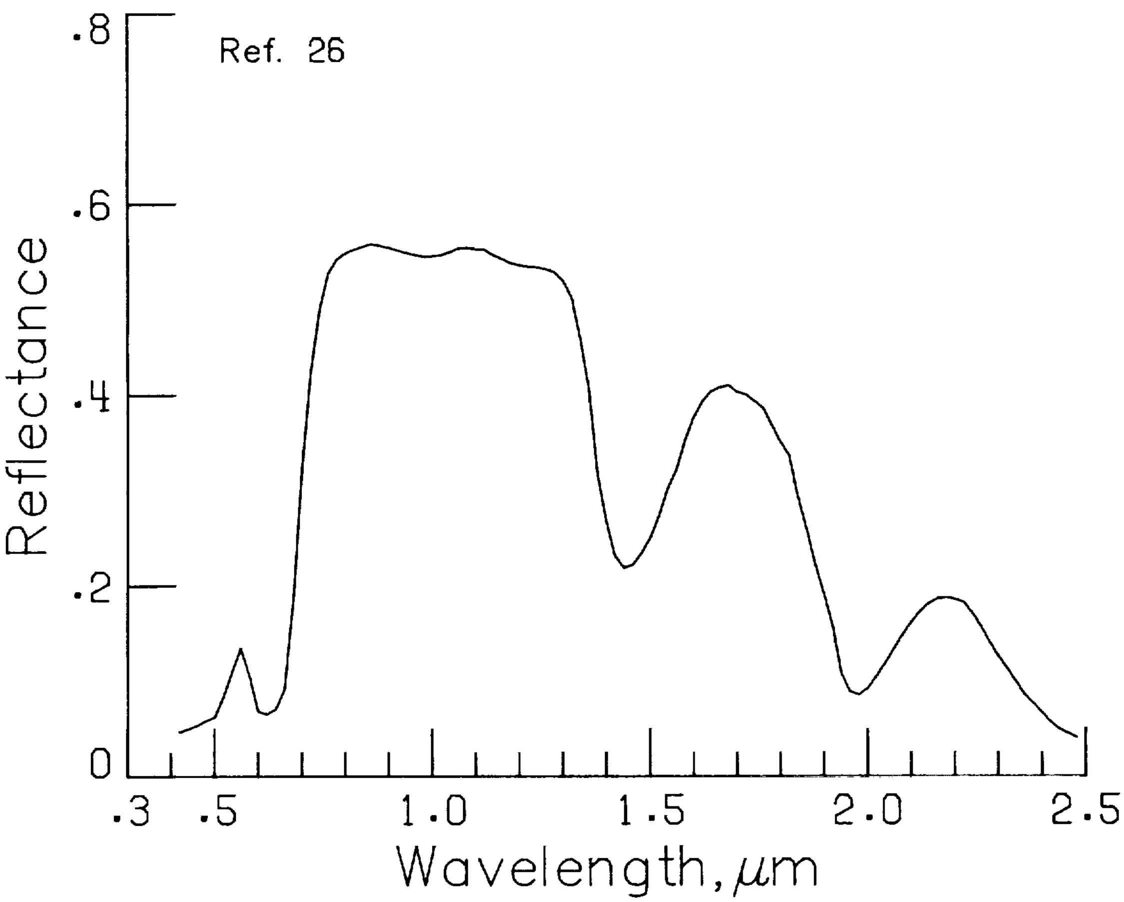
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.350	1.18	.321	1.62	.193	2.06	.082
.32		.76	.356	1.20	.315	1.64	.195	2.08	.087
.34		.78	.361	1.22	.315	1.66	.193	2.10	.090
.36		.80	.365	1.24	.319	1.68	.187	2.12	.094
.38		.82	.367	1.26	.324	1.70	.179	2.14	.101
.40		.84	.367	1.28	.331	1.72	.165	2.16	.106
.42		.86	.367	1.30		1.74	.157	2.18	.111
.44		.88	.364	1.32		1.76		2.20	.110
.46		.90	.360	1.34		1.78		2.22	.107
.48		.92	.356	1.36		1.80		2.24	.102
.50	.085	.94	.355	1.38		1.82		2.26	.096
.52	.092	.96	.358	1.40		1.84		2.28	.089
.54	.097	.98	.363	1.42		1.86		2.30	.084
.56	.089	1.00	.372	1.44		1.88		2.32	.082
.58	.081	1.02	.384	1.46		1.90		2.34	.082
.60	.072	1.04	.392	1.48		1.92		2.36	.082
.62	.063	1.06	.396	1.50	.163	1.94		2.38	.082
.64	.055	1.08	.395	1.52	.157	1.96		2.40	.081
.66	.050	1.10	.386	1.54	.155	1.98		2.42	.080
.68	.044	1.12	.368	1.56	.167	2.00	.066	2.44	.077
.70		1.14	.346	1.58	.179	2.02	.073	2.46	
.72		1.16	.331	1.60	.186	2.04	.077	2.48	

NO.37 - SUNFLOWER



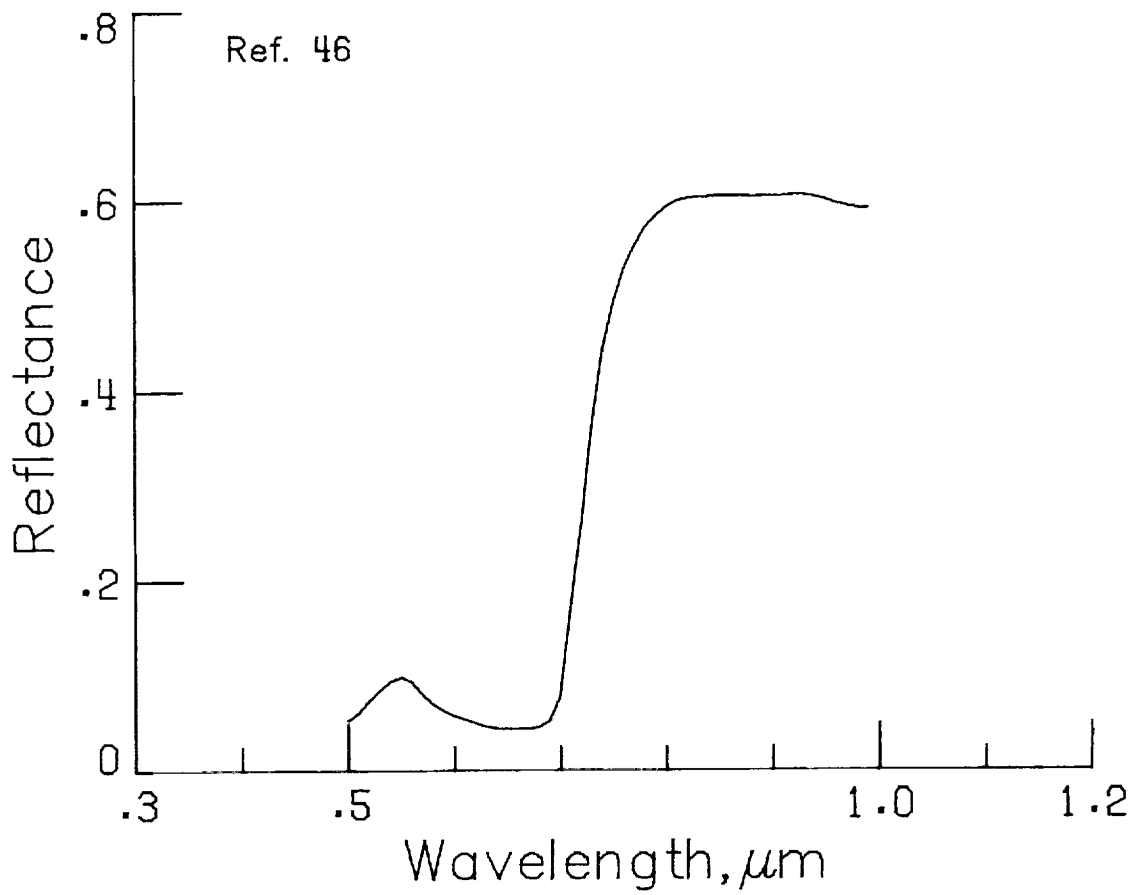
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.018	.66	.069	.84	.272	1.02	
.31		.49	.018	.67	.076	.85	.276	1.03	
.32		.50	.023	.68	.085	.86	.279	1.04	
.33		.51	.027	.69	.097	.87	.282	1.05	
.34		.52	.035	.70	.110	.88	.284	1.06	
.35		.53	.048	.71	.123	.89	.287	1.07	
.36		.54	.072	.72	.146	.90	.289	1.08	
.37		.55	.082	.73	.188	.91	.290	1.09	
.38		.56	.082	.74	.204	.92	.292	1.10	
.39		.57	.082	.75	.213	.93	.292	1.11	
.40		.58	.080	.76	.225	.94	.294	1.12	
.41	.019	.59	.077	.77	.233	.95	.295	1.13	
.42	.021	.60	.073	.78	.240	.96	.296	1.14	
.43	.021	.61	.065	.79	.246	.97	.296	1.15	
.44	.021	.62	.062	.80	.253	.98	.295	1.16	
.45	.019	.63	.062	.81	.258	.99	.296	1.17	
.46	.018	.64	.064	.82	.264	1.00	.296	1.18	
.47	.018	.65	.066	.83	.268	1.01		1.19	

NO.38 - TOBACCO



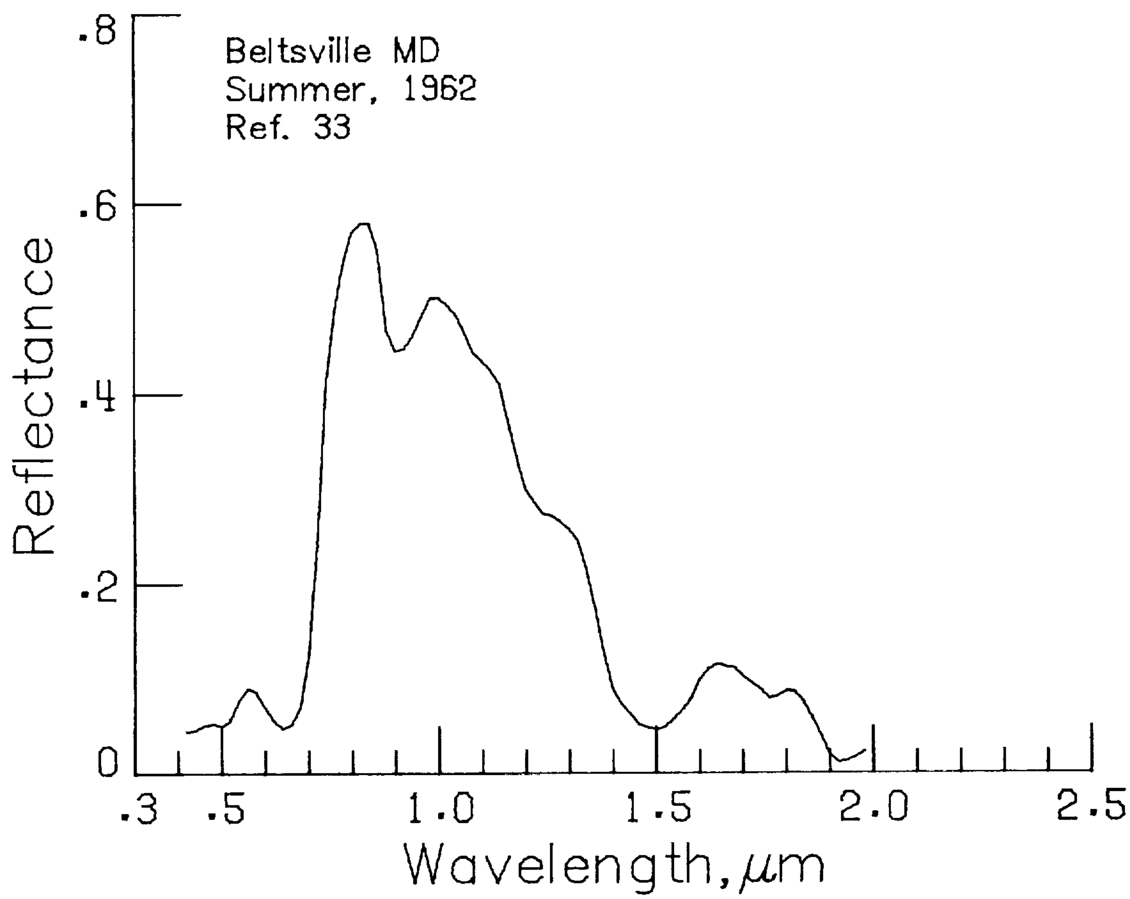
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.488	1.18	.538	1.62	.393	2.06	.134
.32		.76	.528	1.20	.536	1.64	.404	2.08	.149
.34		.78	.542	1.22	.534	1.66	.408	2.10	.162
.36		.80	.549	1.24	.534	1.68	.410	2.12	.173
.38		.82	.552	1.26	.532	1.70	.403	2.14	.182
.40		.84	.556	1.28	.529	1.72	.400	2.16	.187
.42	.047	.86	.558	1.30	.520	1.74	.393	2.18	.188
.44	.050	.88	.556	1.32	.503	1.76	.386	2.20	.186
.46	.054	.90	.554	1.34	.460	1.78	.368	2.22	.182
.48	.059	.92	.552	1.36	.406	1.80	.350	2.24	.171
.50	.063	.94	.549	1.38	.316	1.82	.337	2.26	.156
.52	.083	.96	.547	1.40	.267	1.84	.293	2.28	.140
.54	.109	.98	.545	1.42	.231	1.86	.260	2.30	.125
.56	.135	1.00	.546	1.44	.219	1.88	.222	2.32	.113
.58	.106	1.02	.547	1.46	.222	1.90	.191	2.34	.099
.60	.068	1.04	.550	1.48	.234	1.92	.157	2.36	.086
.62	.066	1.06	.554	1.50	.250	1.94	.107	2.38	.077
.64	.071	1.08	.554	1.52	.273	1.96	.089	2.40	.067
.66	.092	1.10	.552	1.54	.302	1.98	.086	2.42	.057
.68	.184	1.12	.552	1.56	.322	2.00	.092	2.44	.050
.70	.322	1.14	.546	1.58	.353	2.02	.105	2.46	.045
.72	.423	1.16	.543	1.60	.377	2.04	.119	2.48	.041

NO.39 - TOMATOES



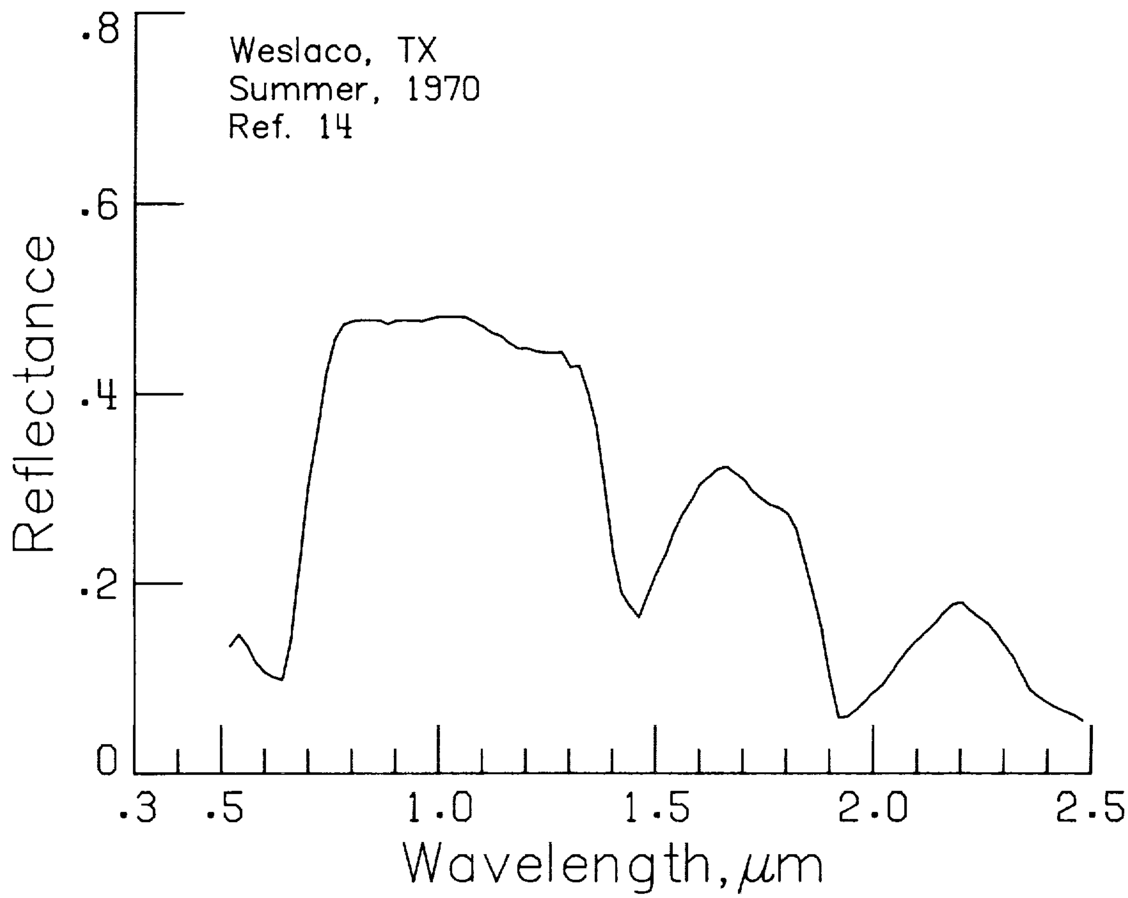
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48		.66	.044	.84	.605	1.02	
.31		.49		.67	.044	.85	.606	1.03	
.32		.50	.054	.68	.046	.86	.606	1.04	
.33		.51	.061	.69	.053	.87	.606	1.05	
.34		.52	.074	.70	.078	.88	.605	1.06	
.35		.53	.085	.71	.175	.89	.606	1.07	
.36		.54	.095	.72	.264	.90	.606	1.08	
.37		.55	.099	.73	.367	.91	.606	1.09	
.38		.56	.094	.74	.443	.92	.607	1.10	
.39		.57	.081	.75	.492	.93	.607	1.11	
.40		.58	.070	.76	.529	.94	.605	1.12	
.41		.59	.062	.77	.553	.95	.602	1.13	
.42		.60	.057	.78	.573	.96	.598	1.14	
.43		.61	.054	.79	.585	.97	.596	1.15	
.44		.62	.050	.80	.595	.98	.593	1.16	
.45		.63	.046	.81	.601	.99	.593	1.17	
.46		.64	.045	.82	.604	1.00		1.18	
.47		.65	.044	.83	.605	1.01		1.19	

NO.40 - TOMATOES



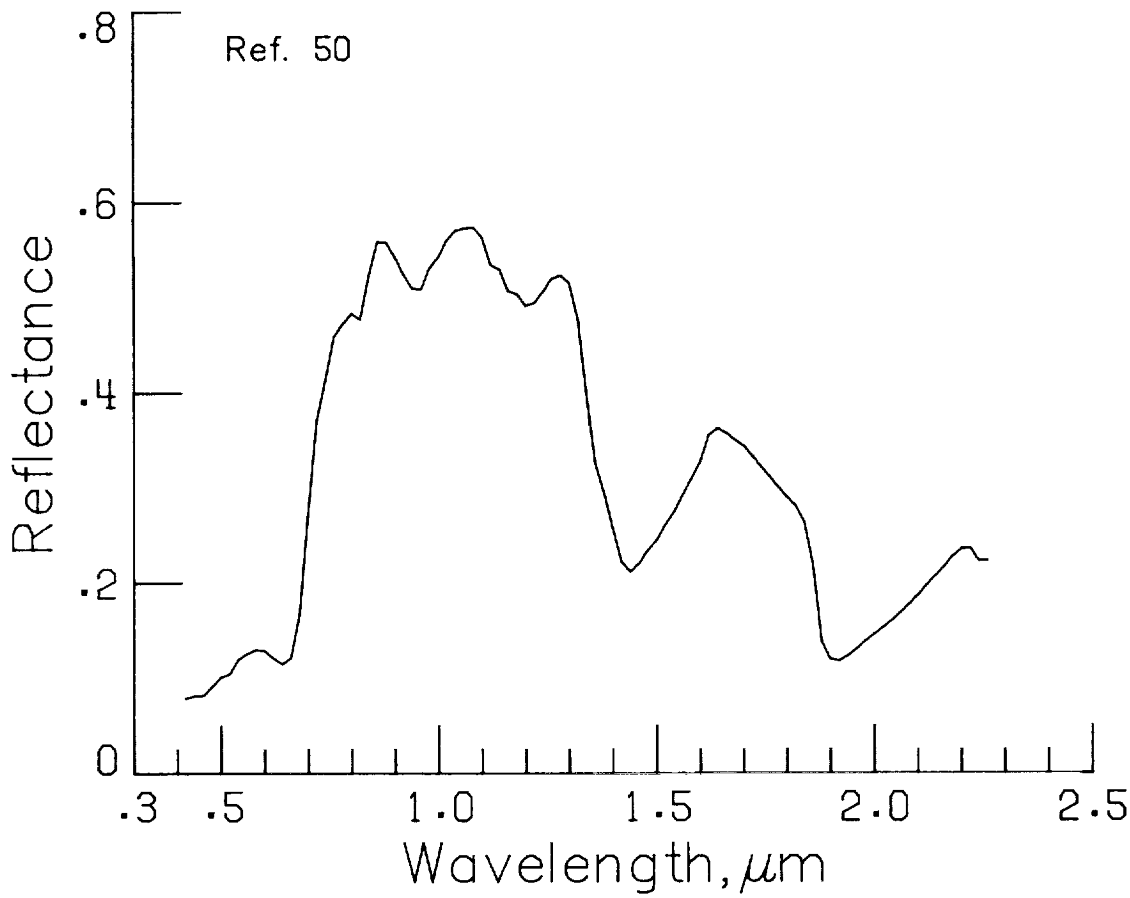
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.405	1.18	.333	1.62	.111	2.06	
.32		.76	.487	1.20	.299	1.64	.116	2.08	
.34		.78	.536	1.22	.286	1.66	.113	2.10	
.36		.80	.569	1.24	.273	1.68	.111	2.12	
.38		.82	.579	1.26	.271	1.70	.102	2.14	
.40		.84	.579	1.28	.265	1.72	.095	2.16	
.42	.045	.86	.551	1.30	.257	1.74	.089	2.18	
.44	.047	.88	.466	1.32	.245	1.76	.080	2.20	
.46	.051	.90	.445	1.34	.215	1.78	.083	2.22	
.48	.054	.92	.447	1.36	.173	1.80	.088	2.24	
.50	.051	.94	.460	1.38	.128	1.82	.086	2.26	
.52	.056	.96	.481	1.40	.090	1.84	.075	2.28	
.54	.078	.98	.501	1.42	.074	1.86	.058	2.30	
.56	.090	1.00	.500	1.44	.062	1.88	.040	2.32	
.58	.087	1.02	.493	1.46	.052	1.90	.019	2.34	
.60	.070	1.04	.483	1.48	.048	1.92	.012	2.36	
.62	.056	1.06	.464	1.50	.047	1.94	.014	2.38	
.64	.048	1.08	.443	1.52	.050	1.96	.018	2.40	
.66	.052	1.10	.434	1.54	.058	1.98	.024	2.42	
.68	.069	1.12	.424	1.56	.068	2.00		2.44	
.70	.124	1.14	.410	1.58	.080	2.02		2.46	
.72	.239	1.16	.371	1.60	.100	2.04		2.48	

NO.41 - WATERMELON LEAF



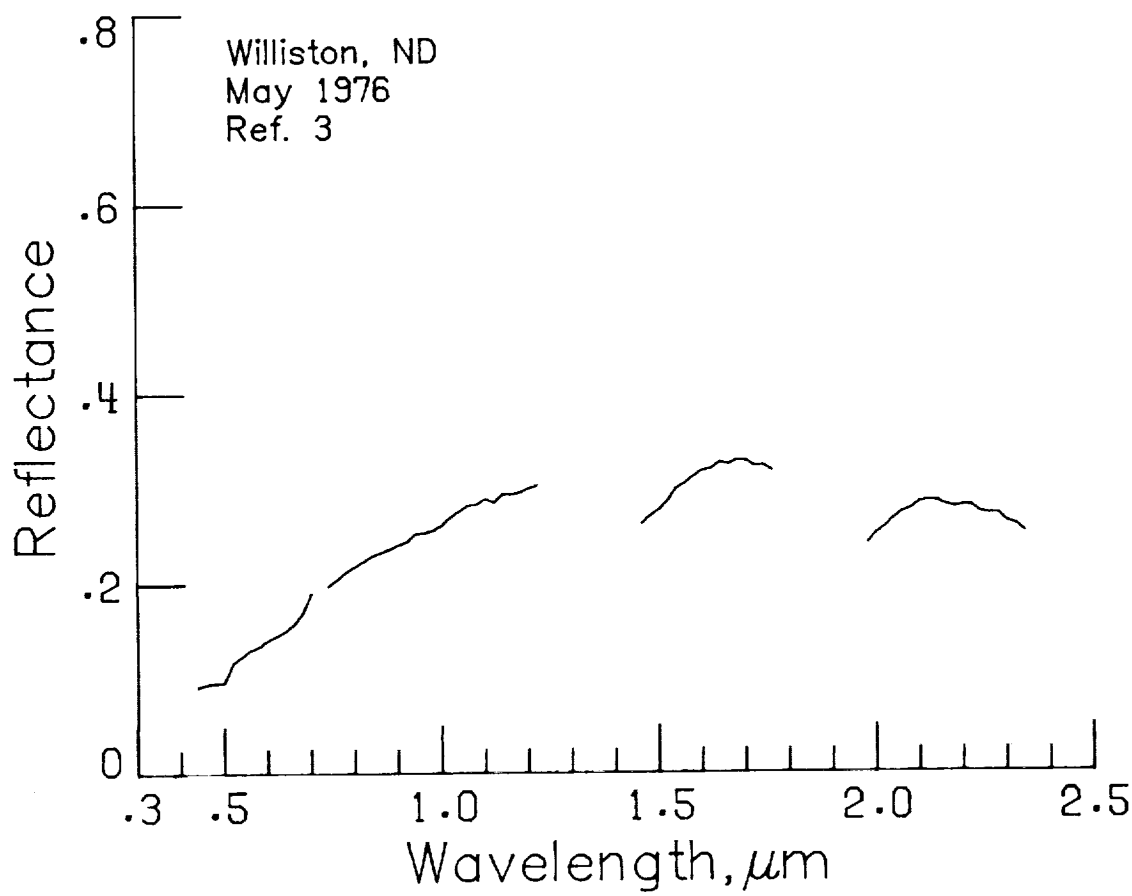
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.423	1.18	.448	1.62	.313	2.06	.120
.32		.76	.459	1.20	.448	1.64	.321	2.08	.131
.34		.78	.473	1.22	.445	1.66	.323	2.10	.141
.36		.80	.477	1.24	.444	1.68	.316	2.12	.150
.38		.82	.478	1.26	.444	1.70	.310	2.14	.158
.40		.84	.477	1.28	.444	1.72	.297	2.16	.170
.42		.86	.477	1.30	.429	1.74	.290	2.18	.178
.44		.88	.474	1.32	.430	1.76	.283	2.20	.180
.46		.90	.477	1.34	.402	1.78	.280	2.22	.172
.48		.92	.477	1.36	.366	1.80	.274	2.24	.164
.50		.94	.477	1.38	.302	1.82	.258	2.26	.158
.52	.135	.96	.477	1.40	.230	1.84	.223	2.28	.148
.54	.147	.98	.479	1.42	.189	1.86	.188	2.30	.136
.56	.134	1.00	.481	1.44	.175	1.88	.152	2.32	.124
.58	.116	1.02	.481	1.46	.164	1.90	.101	2.34	.105
.60	.107	1.04	.481	1.48	.188	1.92	.059	2.36	.088
.62	.101	1.06	.480	1.50	.211	1.94	.060	2.38	.081
.64	.099	1.08	.476	1.52	.229	1.96	.067	2.40	.074
.66	.141	1.10	.471	1.54	.255	1.98	.076	2.42	.069
.68	.221	1.12	.464	1.56	.274	2.00	.086	2.44	.065
.70	.306	1.14	.461	1.58	.288	2.02	.093	2.46	.061
.72	.362	1.16	.454	1.60	.305	2.04	.106	2.48	.056

NO.42 - WHEAT



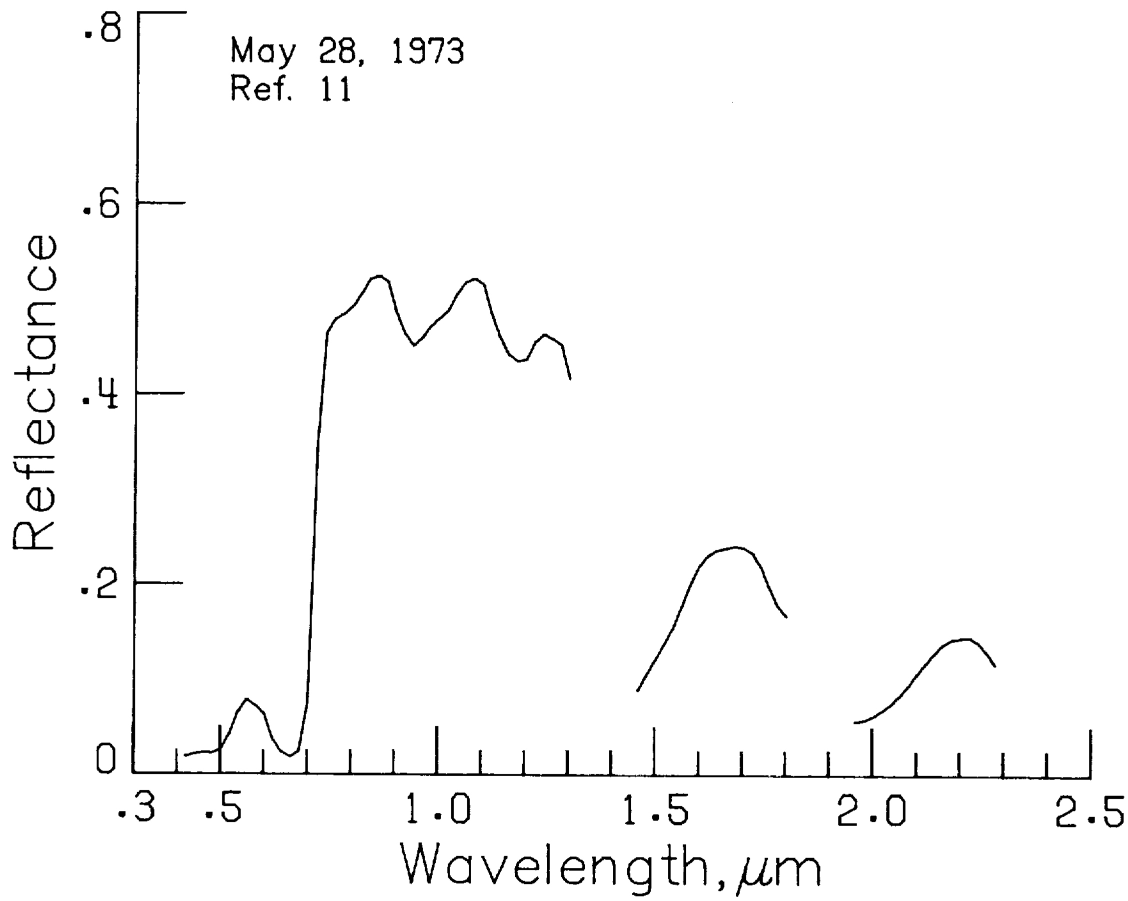
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.415	1.18	.503	1.62	.356	2.06	.169
.32		.76	.460	1.20	.491	1.64	.362	2.08	.177
.34		.78	.473	1.22	.494	1.66	.357	2.10	.187
.36		.80	.483	1.24	.506	1.68	.350	2.12	.198
.38		.82	.477	1.26	.520	1.70	.344	2.14	.207
.40		.84	.523	1.28	.523	1.72	.333	2.16	.217
.42	.079	.86	.559	1.30	.515	1.74	.323	2.18	.228
.44	.082	.88	.558	1.32	.477	1.76	.312	2.20	.236
.46	.082	.90	.543	1.34	.396	1.78	.301	2.22	.236
.48	.092	.92	.524	1.36	.326	1.80	.291	2.24	.223
.50	.102	.94	.510	1.38	.294	1.82	.281	2.26	.223
.52	.105	.96	.508	1.40	.257	1.84	.265	2.28	
.54	.120	.98	.531	1.42	.222	1.86	.219	2.30	
.56	.126	1.00	.542	1.44	.212	1.88	.138	2.32	
.58	.130	1.02	.561	1.46	.221	1.90	.120	2.34	
.60	.129	1.04	.570	1.48	.235	1.92	.119	2.36	
.62	.121	1.06	.573	1.50	.245	1.94	.124	2.38	
.64	.115	1.08	.574	1.52	.261	1.96	.131	2.40	
.66	.122	1.10	.563	1.54	.275	1.98	.140	2.42	
.68	.168	1.12	.534	1.56	.293	2.00	.146	2.44	
.70	.274	1.14	.529	1.58	.310	2.02	.153	2.46	
.72	.371	1.16	.507	1.60	.328	2.04	.161	2.48	

NO.43 - SEEDLING WHEAT



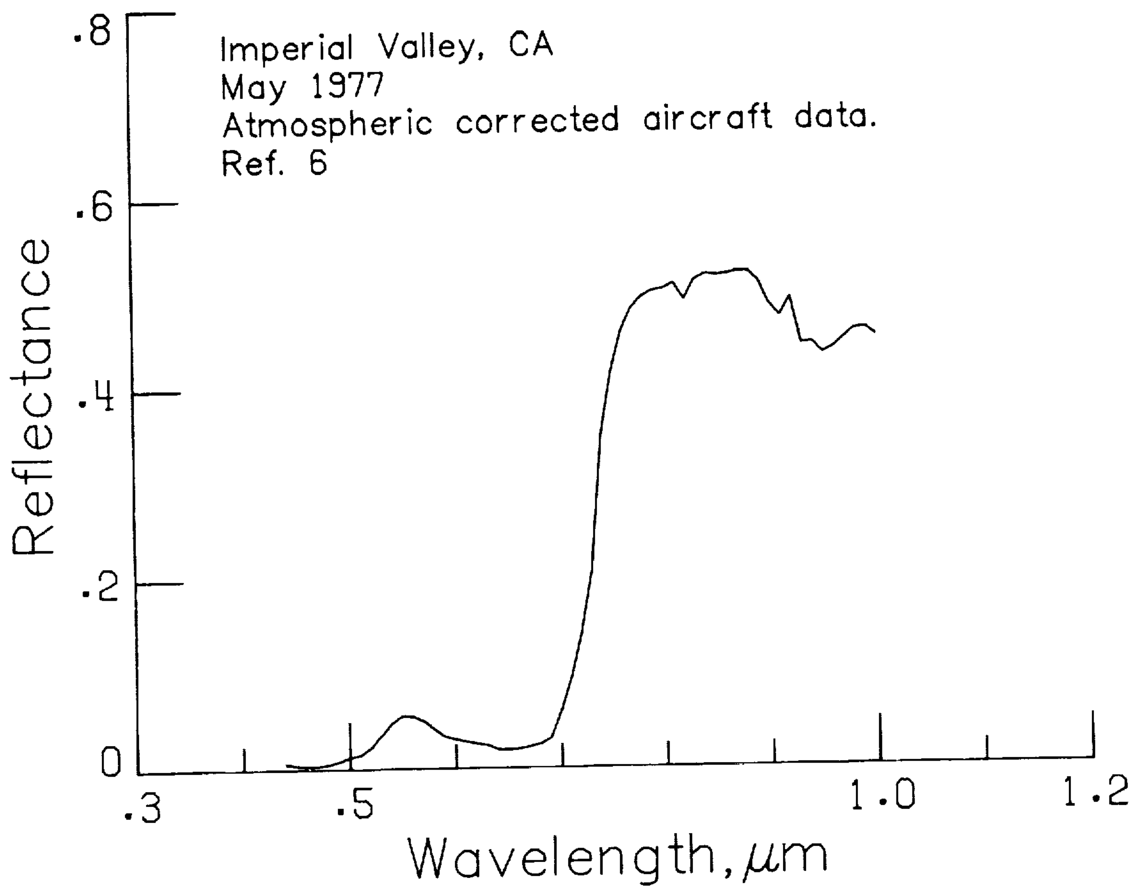
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.198	1.18	.296	1.62	.321	2.06	.274
.32		.76	.205	1.20	.300	1.64	.327	2.08	.278
.34		.78	.213	1.22	.303	1.66	.325	2.10	.285
.36		.80	.218	1.24		1.68	.330	2.12	.286
.38		.82	.224	1.26		1.70	.329	2.14	.285
.40		.84	.229	1.28		1.72	.324	2.16	.281
.42		.86	.233	1.30		1.74	.324	2.18	.279
.44	.092	.88	.237	1.32		1.76	.319	2.20	.281
.46	.095	.90	.241	1.34		1.78		2.22	.280
.48	.096	.92	.244	1.36		1.80		2.24	.273
.50	.097	.94	.252	1.38		1.82		2.26	.271
.52	.118	.96	.253	1.40		1.84		2.28	.272
.54	.124	.98	.256	1.42		1.86		2.30	.263
.56	.131	1.00	.261	1.44		1.88		2.32	.260
.58	.134	1.02	.269	1.46	.262	1.90		2.34	.253
.60	.141	1.04	.276	1.48	.271	1.92		2.36	
.62	.145	1.06	.282	1.50	.277	1.94		2.38	
.64	.150	1.08	.284	1.52	.287	1.96		2.40	
.66	.158	1.10	.289	1.54	.300	1.98	.242	2.42	
.68	.169	1.12	.285	1.56	.305	2.00	.252	2.44	
.70	.190	1.14	.294	1.58	.313	2.02	.258	2.46	
.72		1.16	.294	1.60	.319	2.04	.267	2.48	

NO.44 - YOUNG WHEAT



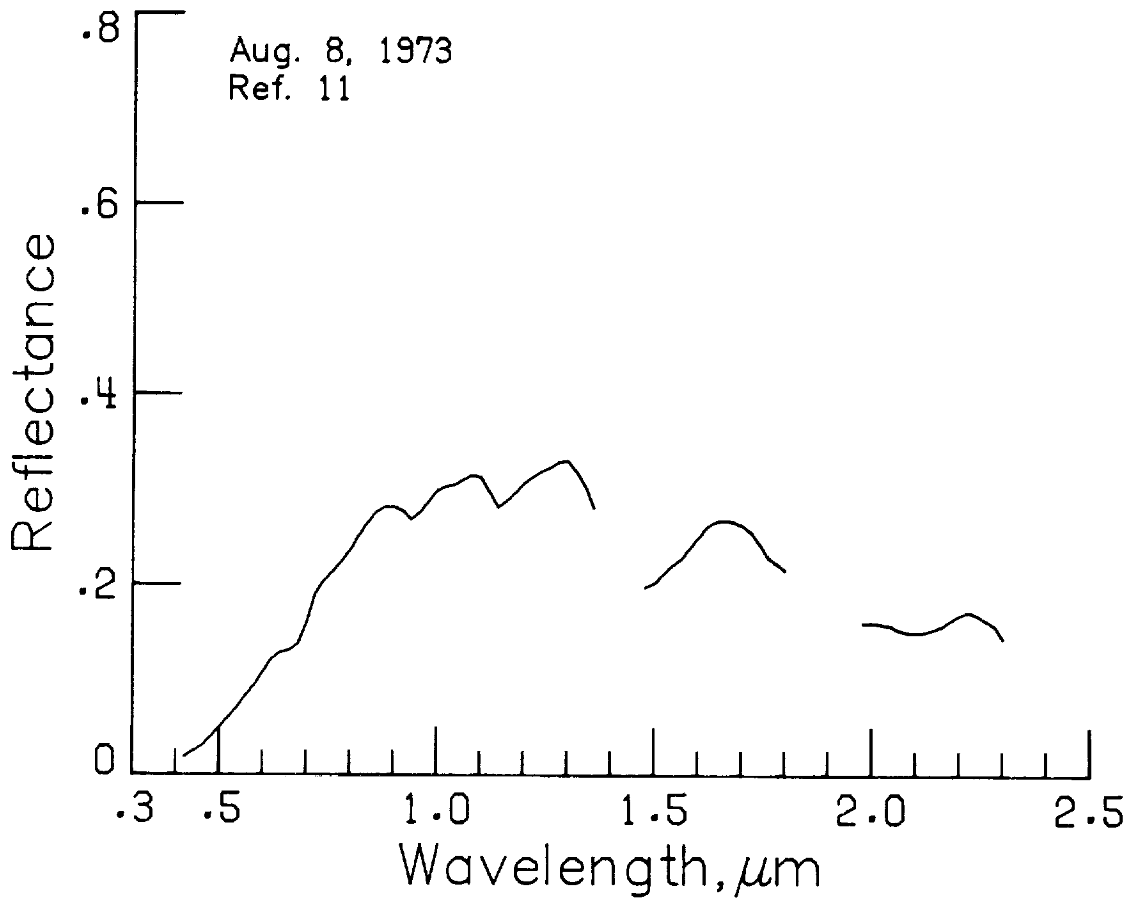
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.466	1.18	.436	1.62	.232	2.06	.084
.32		.76	.480	1.20	.438	1.64	.238	2.08	.094
.34		.78	.485	1.22	.457	1.66	.239	2.10	.107
.36		.80	.493	1.24	.464	1.68	.241	2.12	.118
.38		.82	.507	1.26	.459	1.70	.240	2.14	.129
.40		.84	.522	1.28	.453	1.72	.235	2.16	.139
.42	.019	.86	.525	1.30	.418	1.74	.221	2.18	.144
.44	.021	.88	.519	1.32		1.76	.198	2.20	.145
.46	.022	.90	.486	1.34		1.78	.179	2.22	.146
.48	.022	.92	.464	1.36		1.80	.168	2.24	.141
.50	.026	.94	.452	1.38		1.82		2.26	.131
.52	.042	.96	.460	1.40		1.84		2.28	.118
.54	.065	.98	.473	1.42		1.86		2.30	
.56	.079	1.00	.481	1.44		1.88		2.32	
.58	.072	1.02	.489	1.46	.090	1.90		2.34	
.60	.064	1.04	.507	1.48	.106	1.92		2.36	
.62	.036	1.06	.519	1.50	.122	1.94		2.38	
.64	.023	1.08	.522	1.52	.139	1.96	.057	2.40	
.66	.019	1.10	.517	1.54	.156	1.98	.058	2.42	
.68	.024	1.12	.485	1.56	.179	2.00	.062	2.44	
.70	.075	1.14	.460	1.58	.202	2.02	.068	2.46	
.72	.346	1.16	.442	1.60	.221	2.04	.075	2.48	

NO.45 - BOOTED WHEAT



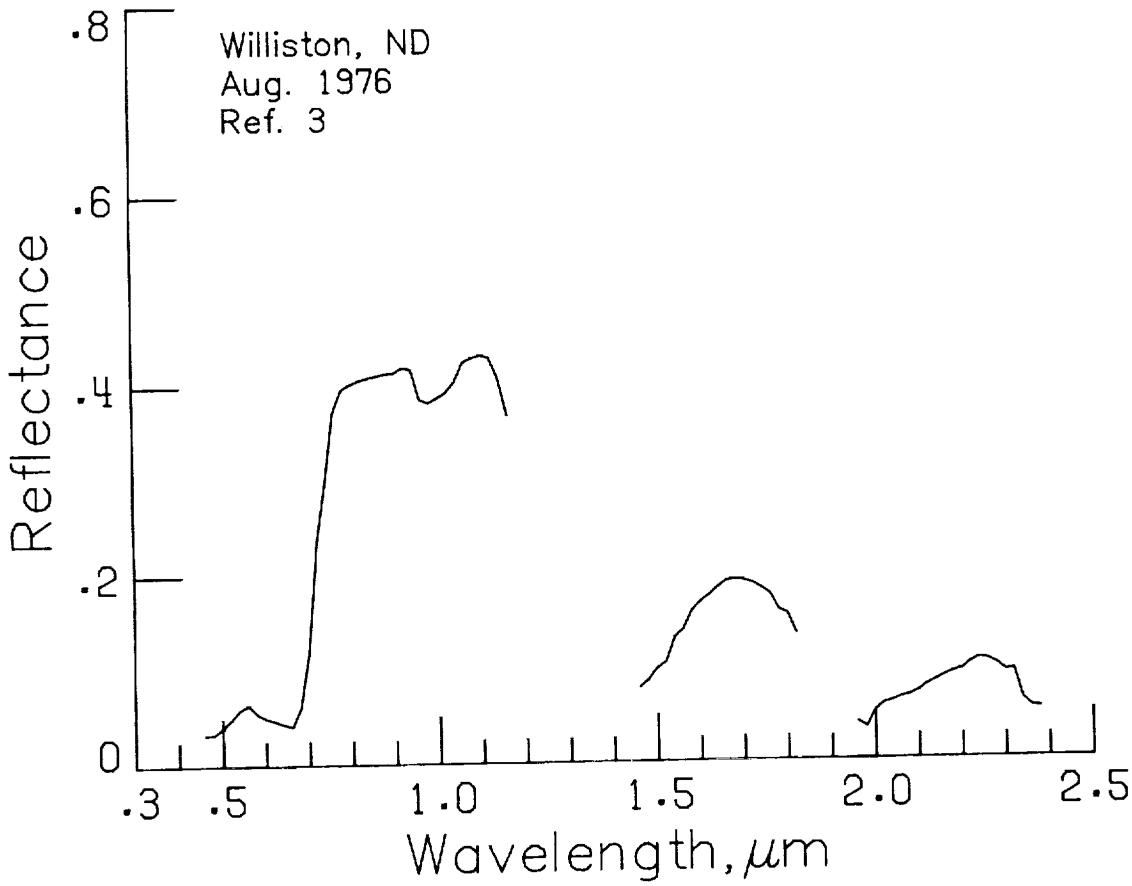
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.006	.66	.021	.84	.518	1.02	
.31		.49	.009	.67	.023	.85	.516	1.03	
.32		.50	.013	.68	.026	.86	.518	1.04	
.33		.51	.015	.69	.032	.87	.520	1.05	
.34		.52	.023	.70	.060	.88	.520	1.06	
.35		.53	.036	.71	.094	.89	.510	1.07	
.36		.54	.049	.72	.141	.90	.486	1.08	
.37		.55	.056	.73	.206	.91	.474	1.09	
.38		.56	.055	.74	.350	.92	.493	1.10	
.39		.57	.050	.75	.415	.93	.444	1.11	
.40		.58	.041	.76	.459	.94	.446	1.12	
.41		.59	.034	.77	.484	.95	.434	1.13	
.42		.60	.031	.78	.495	.96	.440	1.14	
.43		.61	.028	.79	.501	.97	.450	1.15	
.44	.006	.62	.026	.80	.503	.98	.459	1.16	
.45	.004	.63	.024	.81	.509	.99	.460	1.17	
.46	.003	.64	.020	.82	.492	1.00	.452	1.18	
.47	.004	.65	.020	.83	.513	1.01		1.19	

NO.46 - MATURE WHEAT



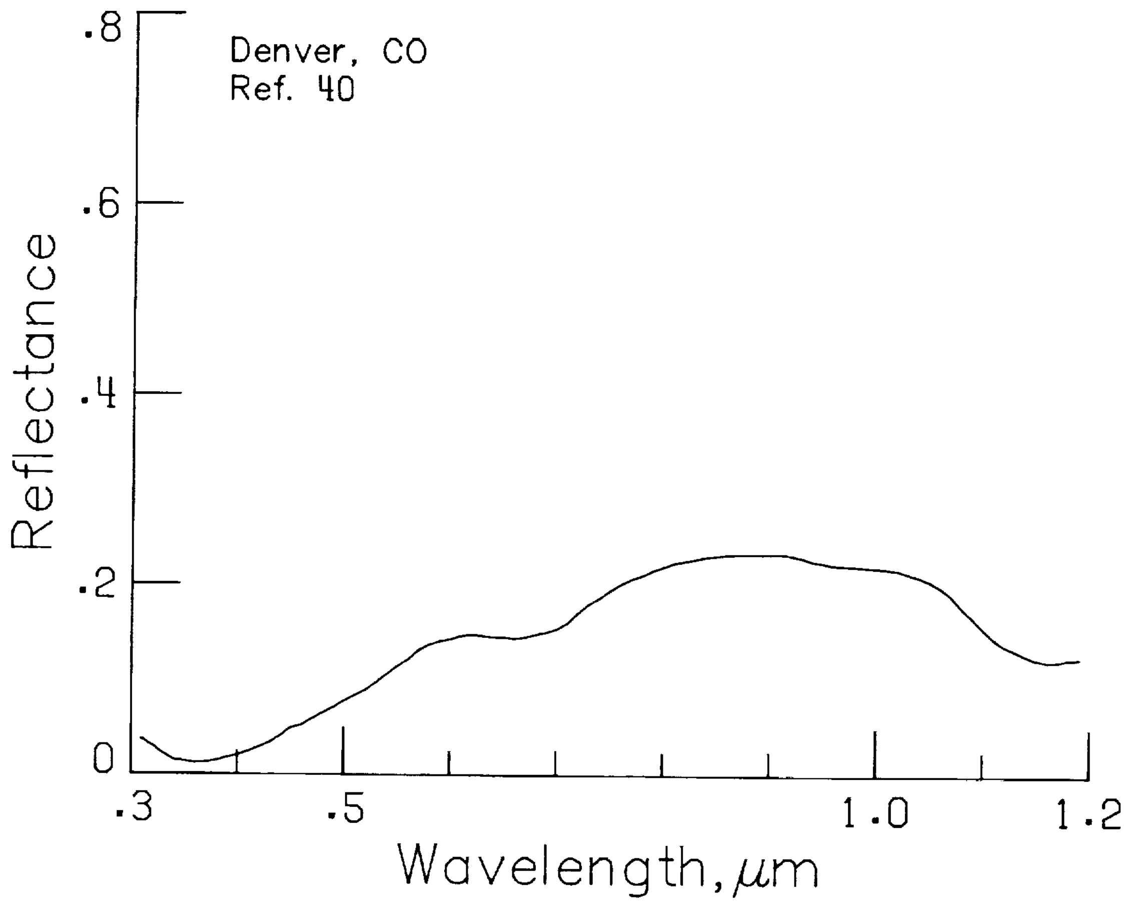
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.205	1.18	.298	1.62	.262	2.06	.154
.32		.76	.215	1.20	.308	1.64	.267	2.08	.151
.34		.78	.225	1.22	.315	1.66	.268	2.10	.150
.36		.80	.237	1.24	.320	1.68	.267	2.12	.151
.38		.82	.252	1.26	.324	1.70	.263	2.14	.154
.40		.84	.266	1.28	.330	1.72	.256	2.16	.158
.42	.019	.86	.277	1.30	.331	1.74	.244	2.18	.164
.44	.025	.88	.282	1.32	.319	1.76	.229	2.20	.169
.46	.031	.90	.282	1.34	.304	1.78	.223	2.22	.173
.48	.040	.92	.278	1.36	.281	1.80	.216	2.24	.169
.50	.050	.94	.269	1.38		1.82		2.26	.164
.52	.060	.96	.277	1.40		1.84		2.28	.158
.54	.070	.98	.288	1.42		1.86		2.30	.145
.56	.083	1.00	.300	1.44		1.88		2.32	
.58	.094	1.02	.304	1.46		1.90		2.34	
.60	.108	1.04	.306	1.48	.198	1.92		2.36	
.62	.122	1.06	.311	1.50	.202	1.94		2.38	
.64	.129	1.08	.316	1.52	.212	1.96		2.40	
.66	.131	1.10	.314	1.54	.221	1.98	.160	2.42	
.68	.138	1.12	.298	1.56	.228	2.00	.161	2.44	
.70	.160	1.14	.282	1.58	.239	2.02	.159	2.46	
.72	.192	1.16	.289	1.60	.250	2.04	.158	2.48	

NO.47 - MATURE WHEAT



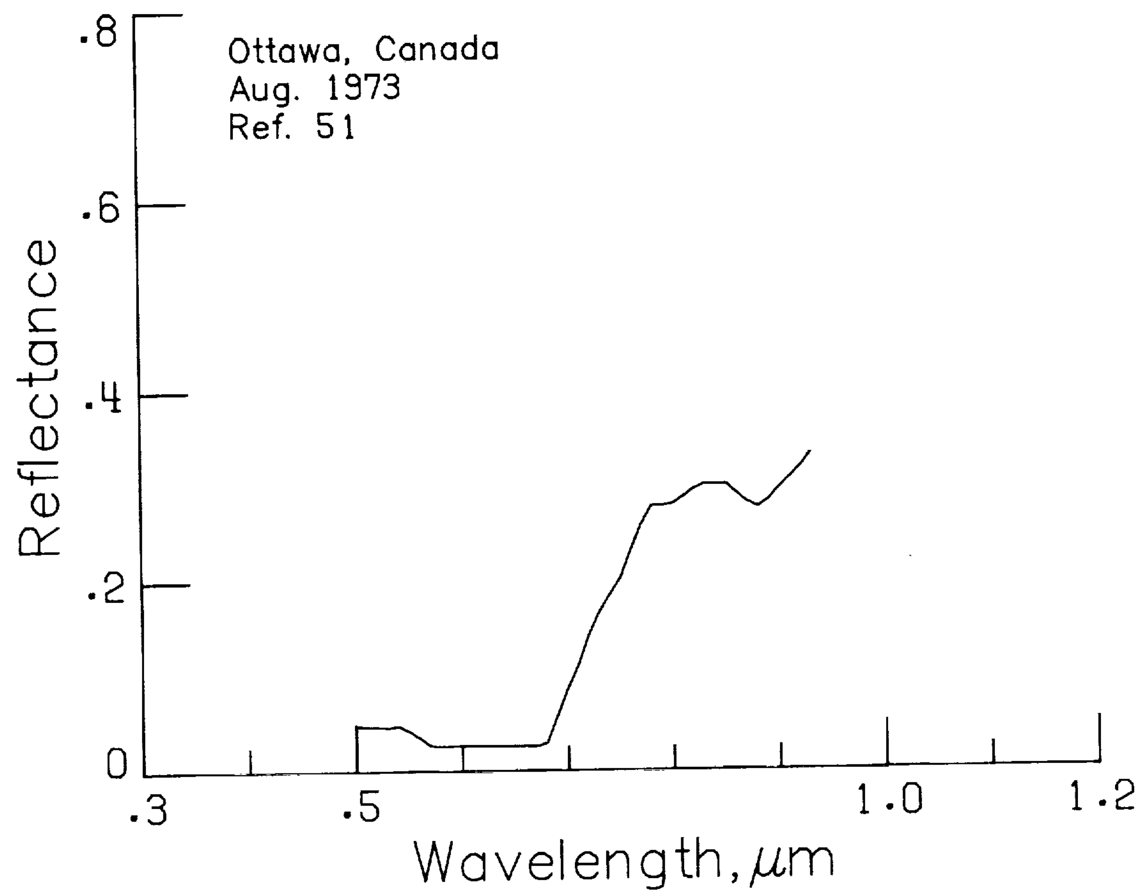
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.296	1.18		1.62	.175	2.06	.065
.32		.76	.372	1.20		1.64	.184	2.08	.067
.34		.78	.396	1.22		1.66	.190	2.10	.072
.36		.80	.402	1.24		1.68	.192	2.12	.078
.38		.82	.406	1.26		1.70	.190	2.14	.083
.40		.84	.408	1.28		1.72	.187	2.16	.087
.42		.86	.411	1.30		1.74	.182	2.18	.091
.44		.88	.413	1.32		1.76	.176	2.20	.094
.46	.033	.90	.413	1.34		1.78	.158	2.22	.101
.48	.034	.92	.418	1.36		1.80	.155	2.24	.105
.50	.041	.94	.417	1.38		1.82	.133	2.26	.104
.52	.050	.96	.385	1.40		1.84		2.28	.099
.54	.060	.98	.381	1.42		1.86		2.30	.092
.56	.065	1.00	.387	1.44		1.88		2.32	.093
.58	.055	1.02	.392	1.46	.079	1.90		2.34	.061
.60	.050	1.04	.403	1.48	.087	1.92		2.36	.053
.62	.047	1.06	.424	1.50	.099	1.94		2.38	.053
.64	.044	1.08	.428	1.52	.105	1.96	.039	2.40	
.66	.041	1.10	.431	1.54	.131	1.98	.034	2.42	
.68	.062	1.12	.428	1.56	.139	2.00	.052	2.44	
.70	.119	1.14	.406	1.58	.159	2.02	.059	2.46	
.72	.234	1.16	.367	1.60	.168	2.04	.061	2.48	

NO.48 - WHEAT STUBBLE



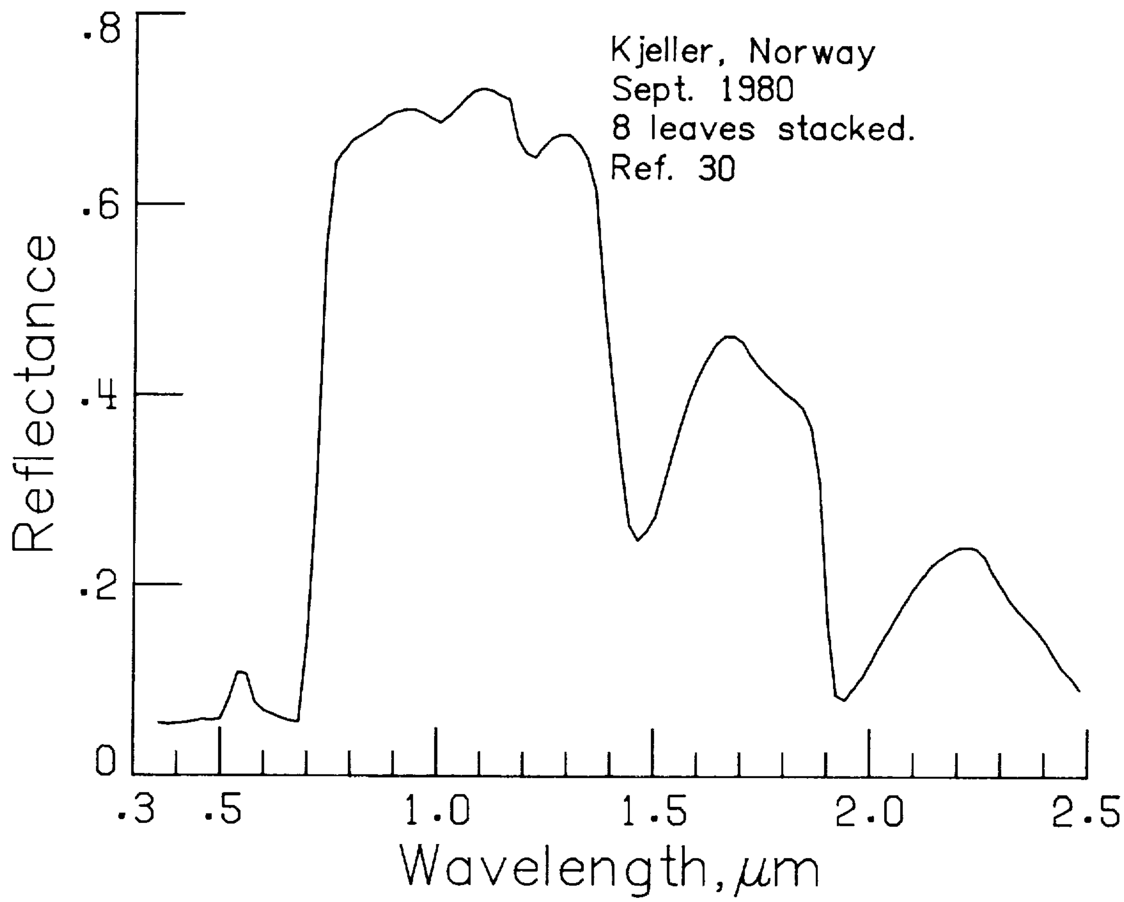
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.065	.66	.144	.84	.231	1.02	.217
.31	.036	.49	.070	.67	.145	.85	.232	1.03	.213
.32	.029	.50	.078	.68	.148	.86	.233	1.04	.210
.33	.021	.51	.083	.69	.150	.87	.234	1.05	.205
.34	.015	.52	.089	.70	.154	.88	.234	1.06	.199
.35	.013	.53	.097	.71	.160	.89	.234	1.07	.190
.36	.012	.54	.106	.72	.171	.90	.234	1.08	.177
.37	.013	.55	.114	.73	.180	.91	.234	1.09	.167
.38	.014	.56	.121	.74	.187	.92	.232	1.10	.156
.39	.018	.57	.131	.75	.194	.93	.230	1.11	.145
.40	.020	.58	.137	.76	.201	.94	.226	1.12	.138
.41	.024	.59	.141	.77	.207	.95	.224	1.13	.133
.42	.028	.60	.143	.78	.211	.96	.222	1.14	.128
.43	.033	.61	.146	.79	.216	.97	.221	1.15	.123
.44	.040	.62	.148	.80	.220	.98	.221	1.16	.121
.45	.049	.63	.146	.81	.224	.99	.220	1.17	.122
.46	.052	.64	.145	.82	.226	1.00	.219	1.18	.124
.47	.058	.65	.145	.83	.228	1.01	.218	1.19	.125

NO.49 - TREMBLING ASPEN



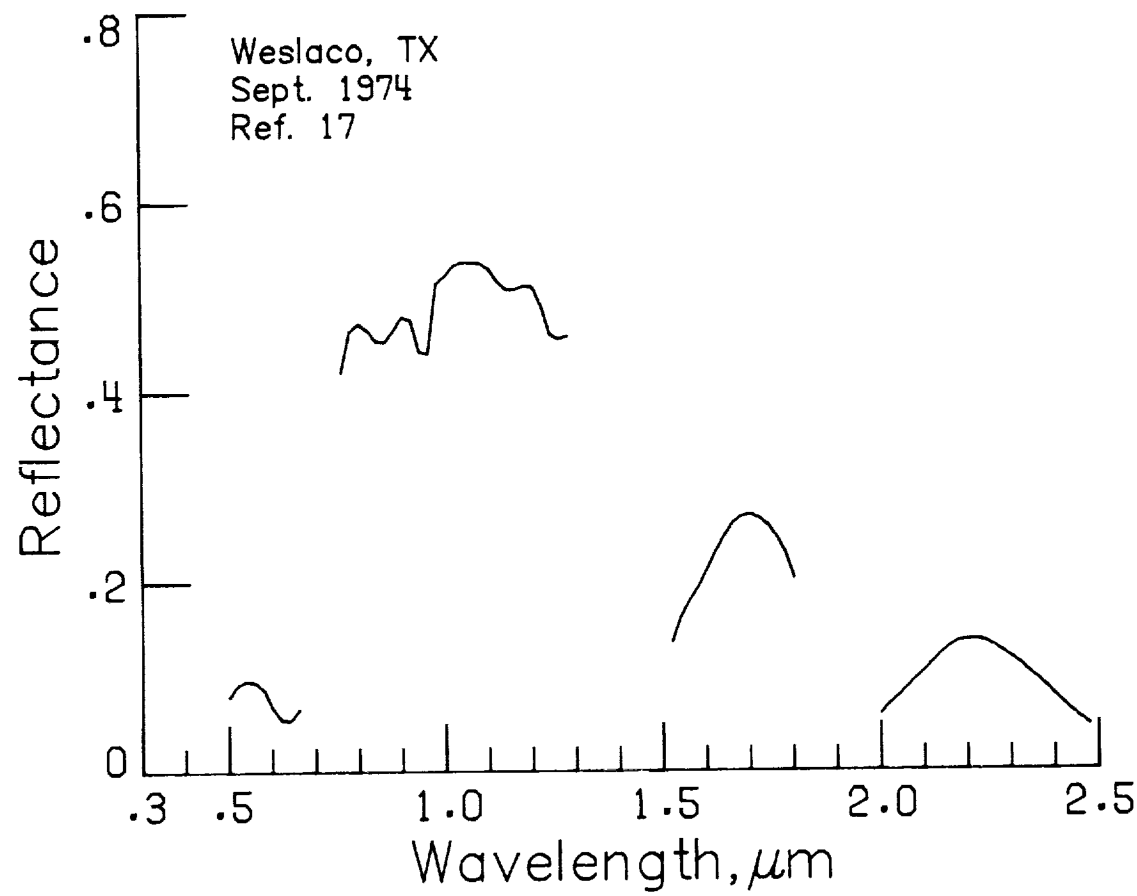
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48		.66	.026	.84	.300	1.02	
.31		.49		.67	.026	.85	.300	1.03	
.32		.50	.048	.68	.029	.86	.291	1.04	
.33		.51	.047	.69	.058	.87	.281	1.05	
.34		.52	.047	.70	.086	.88	.276	1.06	
.35		.53	.046	.71	.111	.89	.283	1.07	
.36		.54	.048	.72	.143	.90	.296	1.08	
.37		.55	.043	.73	.167	.91	.307	1.09	
.38		.56	.035	.74	.185	.92	.318	1.10	
.39		.57	.027	.75	.202	.93	.332	1.11	
.40		.58	.026	.76	.231	.94		1.12	
.41		.59	.026	.77	.258	.95		1.13	
.42		.60	.026	.78	.278	.96		1.14	
.43		.61	.026	.79	.278	.97		1.15	
.44		.62	.026	.80	.280	.98		1.16	
.45		.63	.026	.81	.287	.99		1.17	
.46		.64	.026	.82	.295	1.00		1.18	
.47		.65	.026	.83	.300	1.01		1.19	

NO.50 - BIRCH LEAVES



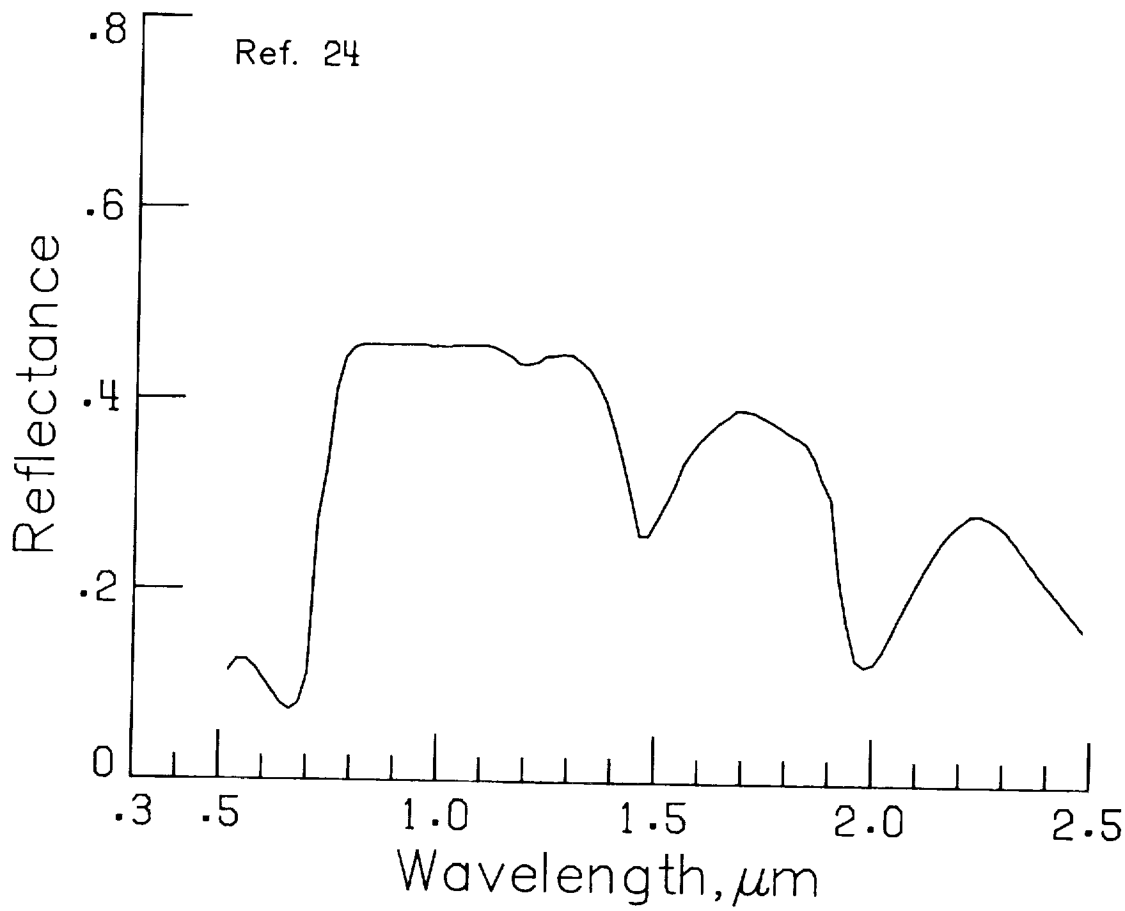
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.557	1.18	.669	1.62	.440	2.06	.169
.32		.76	.645	1.20	.654	1.64	.455	2.08	.184
.34		.78	.657	1.22	.651	1.66	.463	2.10	.199
.36	.055	.80	.669	1.24	.662	1.68	.463	2.12	.211
.38	.054	.82	.674	1.26	.671	1.70	.457	2.14	.223
.40	.055	.84	.680	1.28	.674	1.72	.441	2.16	.230
.42	.056	.86	.686	1.30	.673	1.74	.430	2.18	.236
.44	.057	.88	.694	1.32	.665	1.76	.420	2.20	.240
.46	.059	.90	.698	1.34	.650	1.78	.412	2.22	.242
.48	.058	.92	.700	1.36	.615	1.80	.403	2.24	.240
.50	.060	.94	.700	1.38	.504	1.82	.396	2.26	.231
.52	.081	.96	.697	1.40	.414	1.84	.387	2.28	.213
.54	.109	.98	.691	1.42	.332	1.86	.366	2.30	.199
.56	.107	1.00	.687	1.44	.264	1.88	.309	2.32	.184
.58	.077	1.02	.694	1.46	.248	1.90	.162	2.34	.173
.60	.068	1.04	.703	1.48	.258	1.92	.086	2.36	.164
.62	.065	1.06	.712	1.50	.273	1.94	.081	2.38	.154
.64	.061	1.08	.720	1.52	.307	1.96	.093	2.40	.143
.66	.058	1.10	.722	1.54	.341	1.98	.104	2.42	.127
.68	.057	1.12	.720	1.56	.372	2.00	.121	2.44	.113
.70	.147	1.14	.715	1.58	.401	2.02	.138	2.46	.104
.72	.307	1.16	.711	1.60	.423	2.04	.153	2.48	.091

NO.51 - REDBLUSH CITRUS



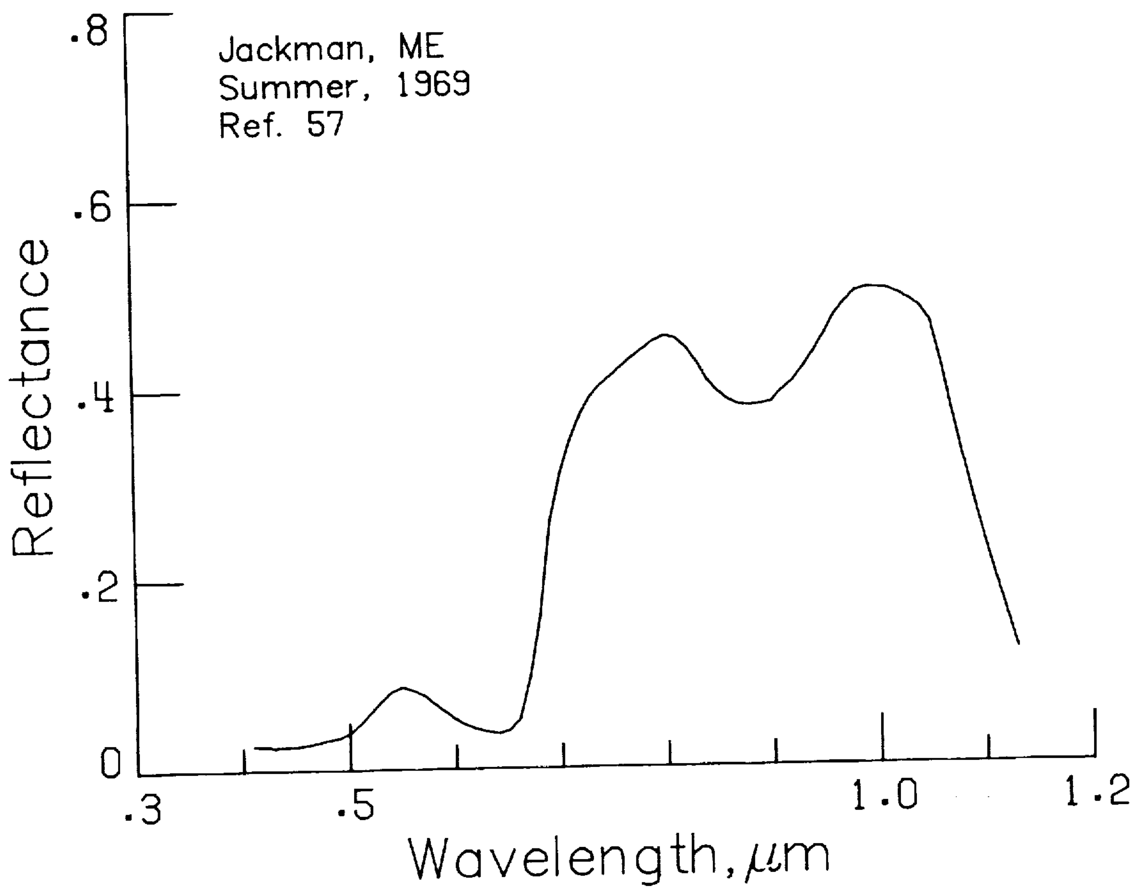
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74		1.18	.512	1.62	.232	2.06	.087
.32		.76	.422	1.20	.511	1.64	.248	2.08	.097
.34		.78	.465	1.22	.491	1.66	.261	2.10	.105
.36		.80	.473	1.24	.460	1.68	.268	2.12	.114
.38		.82	.466	1.26	.456	1.70	.270	2.14	.124
.40		.84	.454	1.28	.459	1.72	.266	2.16	.131
.42		.86	.453	1.30		1.74	.258	2.18	.136
.44		.88	.466	1.32		1.76	.245	2.20	.137
.46		.90	.480	1.34		1.78	.229	2.22	.137
.48		.92	.477	1.36		1.80	.203	2.24	.136
.50	.081	.94	.442	1.38		1.82		2.26	.131
.52	.093	.96	.441	1.40		1.84		2.28	.124
.54	.097	.98	.515	1.42		1.86		2.30	.118
.56	.095	1.00	.523	1.44		1.88		2.32	.112
.58	.087	1.02	.534	1.46		1.90		2.34	.103
.60	.067	1.04	.537	1.48		1.92		2.36	.096
.62	.056	1.06	.537	1.50		1.94		2.38	.087
.64	.055	1.08	.536	1.52	.137	1.96		2.40	.078
.66	.066	1.10	.530	1.54	.163	1.98		2.42	.069
.68		1.12	.516	1.56	.180	2.00	.060	2.44	.061
.70		1.14	.508	1.58	.194	2.02	.070	2.46	.053
.72		1.16	.508	1.60	.213	2.04	.078	2.48	.047

NO.52 - AMERICAN ELM LEAF



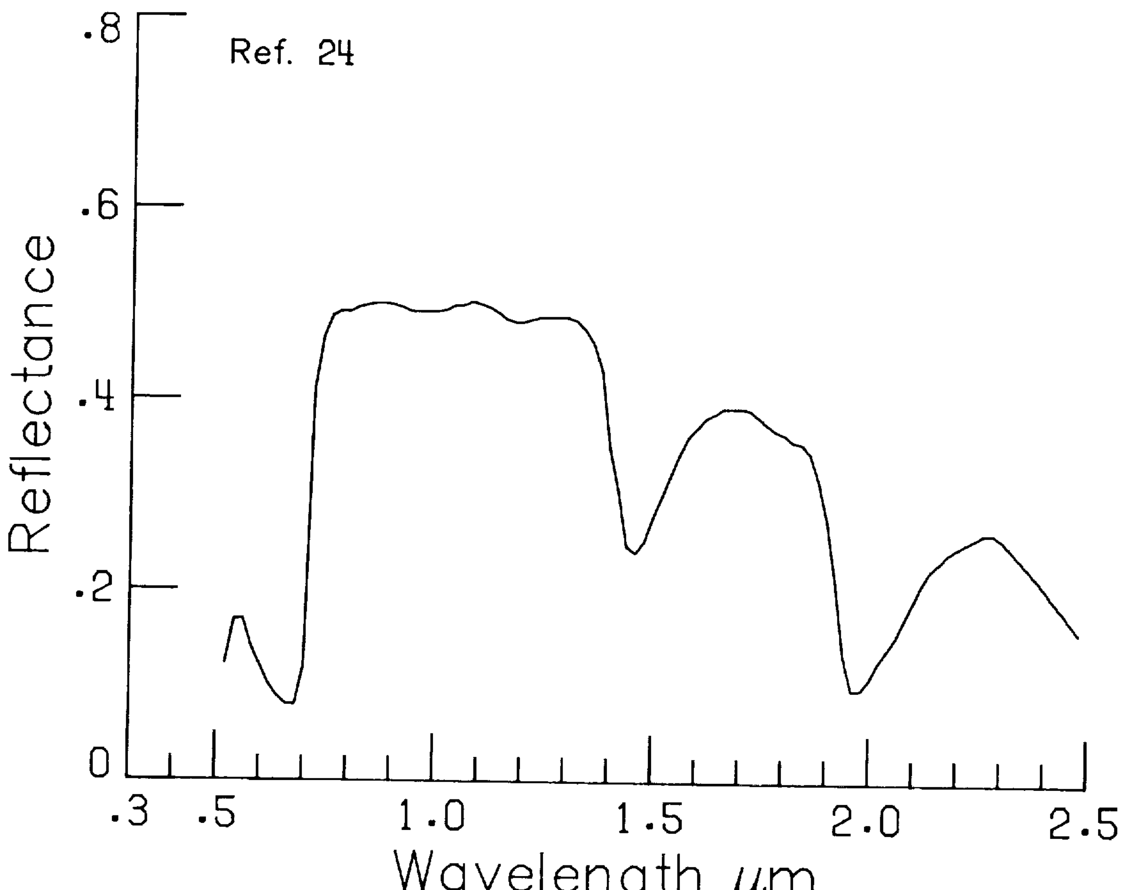
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.327	1.18	.439	1.62	.371	2.06	.178
.32		.76	.410	1.20	.439	1.64	.379	2.08	.196
.34		.78	.444	1.22	.441	1.66	.385	2.10	.214
.36		.80	.455	1.24	.447	1.68	.393	2.12	.230
.38		.82	.458	1.26	.448	1.70	.392	2.14	.246
.40		.84	.458	1.28	.449	1.72	.391	2.16	.260
.42		.86	.458	1.30	.449	1.74	.386	2.18	.270
.44		.88	.458	1.32	.442	1.76	.381	2.20	.278
.46		.90	.458	1.34	.434	1.78	.375	2.22	.285
.48		.92	.458	1.36	.420	1.80	.369	2.24	.285
.50		.94	.458	1.38	.401	1.82	.364	2.26	.282
.52	.115	.96	.458	1.40	.372	1.84	.358	2.28	.277
.54	.127	.98	.457	1.42	.338	1.86	.343	2.30	.269
.56	.126	1.00	.456	1.44	.300	1.88	.318	2.32	.258
.58	.118	1.02	.456	1.46	.260	1.90	.301	2.34	.246
.60	.105	1.04	.458	1.48	.260	1.92	.217	2.36	.233
.62	.092	1.06	.458	1.50	.277	1.94	.168	2.38	.221
.64	.080	1.08	.458	1.52	.294	1.96	.131	2.40	.210
.66	.074	1.10	.458	1.54	.313	1.98	.124	2.42	.199
.68	.081	1.12	.456	1.56	.337	2.00	.127	2.44	.188
.70	.112	1.14	.452	1.58	.350	2.02	.140	2.46	.176
.72	.273	1.16	.447	1.60	.362	2.04	.158	2.48	.165

NO.53 - BALSAM FIR



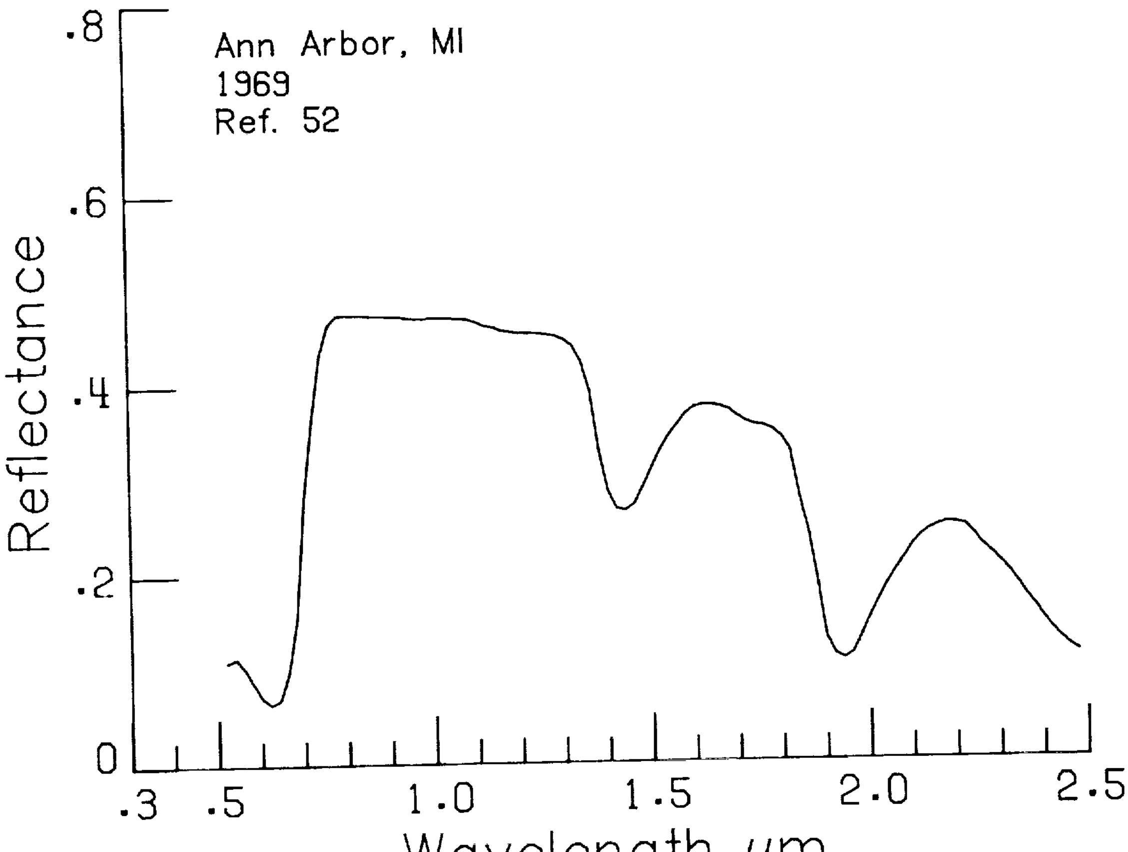
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.032	.66	.052	.84	.406	1.02	.494
.31		.49	.034	.67	.096	.85	.393	1.03	.488
.32		.50	.039	.68	.160	.86	.384	1.04	.480
.33		.51	.049	.69	.259	.87	.379	1.05	.465
.34		.52	.060	.70	.308	.88	.379	1.06	.420
.35		.53	.072	.71	.344	.89	.380	1.07	.368
.36		.54	.083	.72	.371	.90	.382	1.08	.320
.37		.55	.087	.73	.391	.91	.394	1.09	.274
.38		.56	.083	.74	.403	.92	.403	1.10	.232
.39		.57	.078	.75	.412	.93	.418	1.11	.192
.40		.58	.068	.76	.422	.94	.434	1.12	.155
.41	.026	.59	.060	.77	.432	.95	.452	1.13	.120
.42	.025	.60	.052	.78	.440	.96	.473	1.14	
.43	.025	.61	.045	.79	.448	.97	.486	1.15	
.44	.025	.62	.041	.80	.453	.98	.497	1.16	
.45	.026	.63	.038	.81	.450	.99	.500	1.17	
.46	.027	.64	.037	.82	.441	1.00	.500	1.18	
.47	.029	.65	.040	.83	.425	1.01	.499	1.19	

NO.54 - SILVER MAPLE LEAF



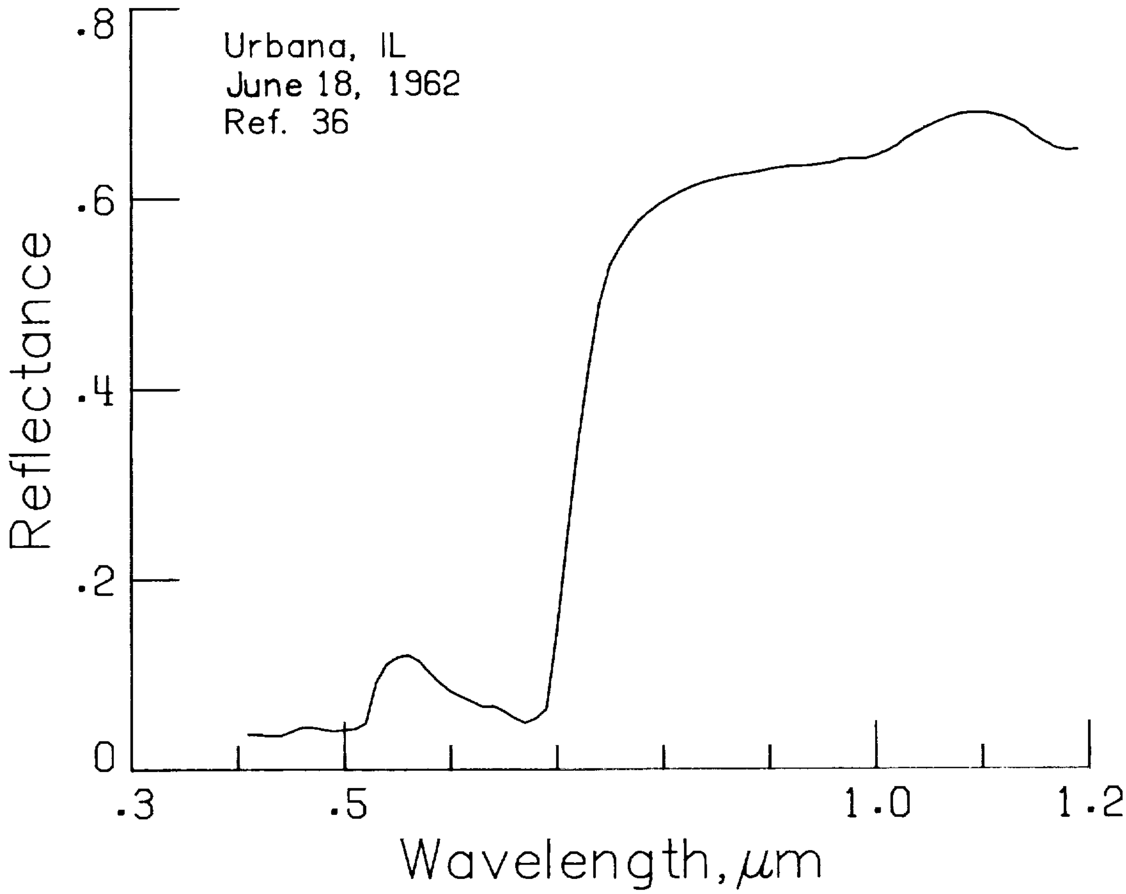
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.466	1.18	.482	1.62	.383	2.06	.154
.32		.76	.489	1.20	.482	1.64	.387	2.08	.173
.34		.78	.493	1.22	.485	1.66	.393	2.10	.192
.36		.80	.492	1.24	.487	1.68	.393	2.12	.211
.38		.82	.497	1.26	.487	1.70	.393	2.14	.225
.40		.84	.499	1.28	.487	1.72	.391	2.16	.233
.42		.86	.501	1.30	.487	1.74	.384	2.18	.243
.44		.88	.501	1.32	.484	1.76	.375	2.20	.248
.46		.90	.500	1.34	.475	1.78	.369	2.22	.253
.48		.92	.497	1.36	.461	1.80	.365	2.24	.258
.50		.94	.493	1.38	.433	1.82	.358	2.26	.263
.52	.124	.96	.493	1.40	.351	1.84	.356	2.28	.264
.54	.169	.98	.493	1.42	.306	1.86	.346	2.30	.257
.56	.170	1.00	.493	1.44	.248	1.88	.317	2.32	.248
.58	.140	1.02	.494	1.46	.241	1.90	.277	2.34	.238
.60	.120	1.04	.499	1.48	.253	1.92	.214	2.36	.228
.62	.101	1.06	.500	1.50	.279	1.94	.134	2.38	.217
.64	.089	1.08	.503	1.52	.300	1.96	.098	2.40	.206
.66	.081	1.10	.501	1.54	.323	1.98	.099	2.42	.193
.68	.080	1.12	.497	1.56	.345	2.00	.110	2.44	.183
.70	.121	1.14	.492	1.58	.363	2.02	.128	2.46	.170
.72	.411	1.16	.485	1.60	.373	2.04	.140	2.48	.159

NO.55 - SUGAR MAPLE LEAF



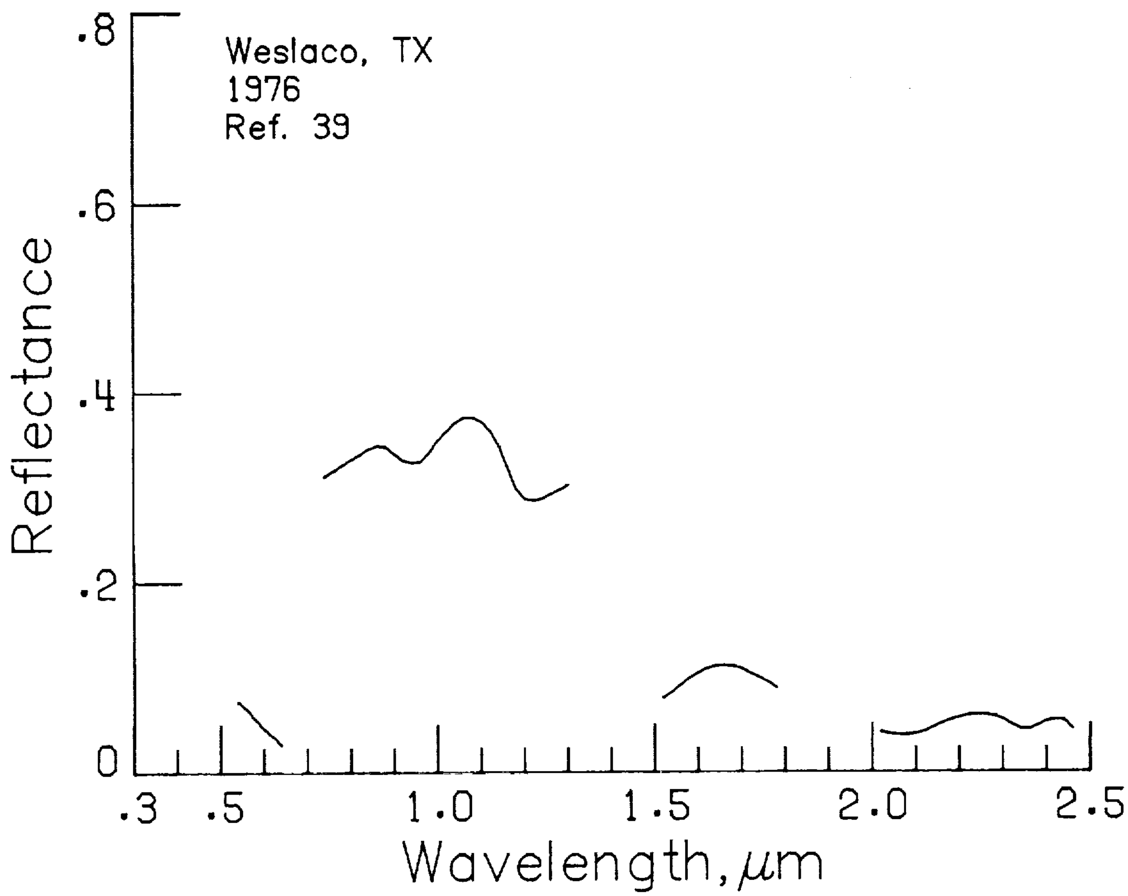
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.433	1.18	.455	1.62	.375	2.06	.199
.32		.76	.464	1.20	.453	1.64	.375	2.08	.212
.34		.78	.473	1.22	.453	1.66	.374	2.10	.226
.36		.80	.474	1.24	.453	1.68	.370	2.12	.236
.38		.82	.474	1.26	.452	1.70	.363	2.14	.242
.40		.84	.474	1.28	.451	1.72	.357	2.16	.245
.42		.86	.473	1.30	.447	1.74	.354	2.18	.248
.44		.88	.473	1.32	.440	1.76	.353	2.20	.247
.46		.90	.472	1.34	.424	1.78	.349	2.22	.245
.48		.92	.472	1.36	.393	1.80	.341	2.24	.236
.50		.94	.471	1.38	.327	1.82	.327	2.26	.224
.52	.110	.96	.470	1.40	.285	1.84	.278	2.28	.215
.54	.114	.98	.469	1.42	.267	1.86	.240	2.30	.206
.56	.102	1.00	.470	1.44	.265	1.88	.185	2.32	.196
.58	.086	1.02	.471	1.46	.272	1.90	.129	2.34	.184
.60	.071	1.04	.470	1.48	.290	1.92	.111	2.36	.170
.62	.065	1.06	.469	1.50	.309	1.94	.107	2.38	.159
.64	.070	1.08	.468	1.52	.328	1.96	.113	2.40	.146
.66	.098	1.10	.465	1.54	.343	1.98	.131	2.42	.135
.68	.154	1.12	.462	1.56	.355	2.00	.150	2.44	.125
.70	.280	1.14	.460	1.58	.366	2.02	.169	2.46	.117
.72	.365	1.16	.456	1.60	.373	2.04	.185	2.48	.111

NO.56 - BURR OAK LEAF



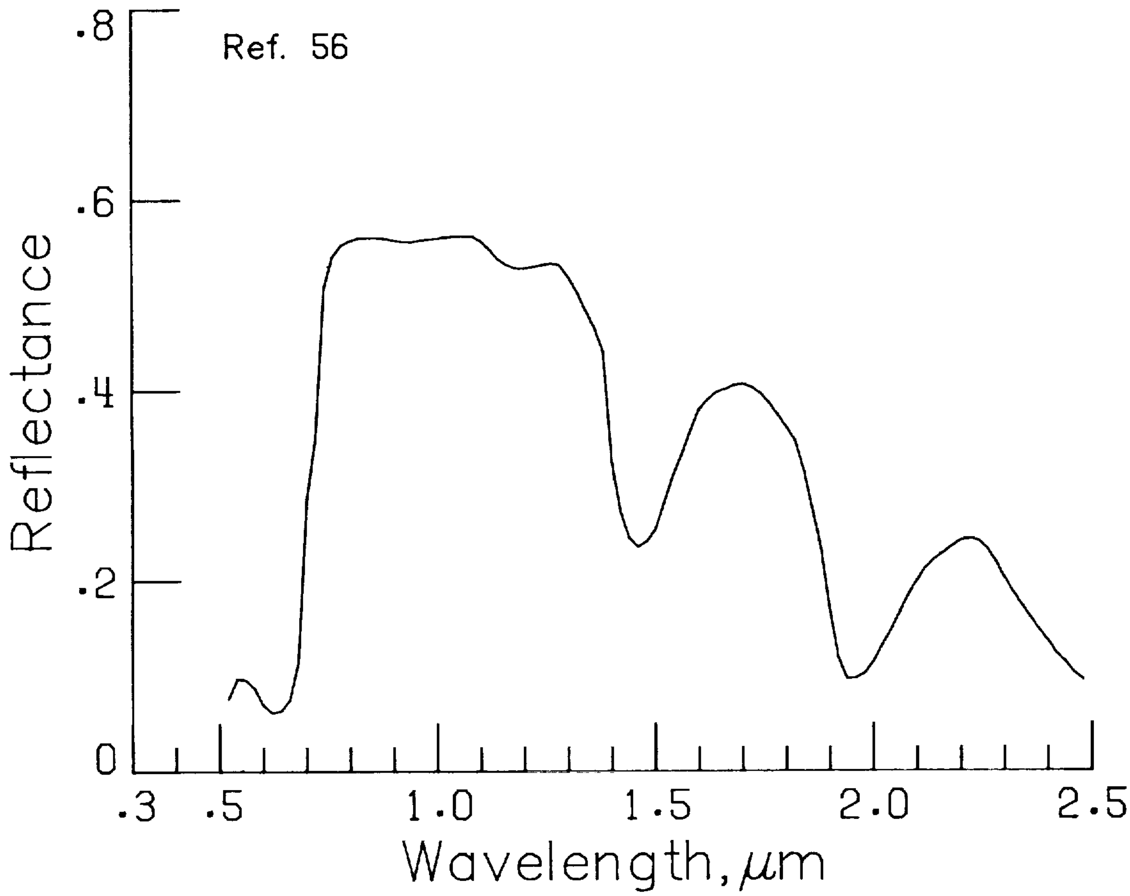
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.042	.66	.054	.84	.618	1.02	.655
.31		.49	.041	.67	.049	.85	.620	1.03	.663
.32		.50	.042	.68	.054	.86	.623	1.04	.670
.33		.51	.043	.69	.064	.87	.625	1.05	.676
.34		.52	.049	.70	.146	.88	.626	1.06	.681
.35		.53	.092	.71	.247	.89	.628	1.07	.685
.36		.54	.111	.72	.343	.90	.631	1.08	.688
.37		.55	.118	.73	.423	.91	.632	1.09	.690
.38		.56	.120	.74	.490	.92	.634	1.10	.690
.39		.57	.114	.75	.531	.93	.634	1.11	.688
.40		.58	.102	.76	.550	.94	.635	1.12	.685
.41	.037	.59	.091	.77	.567	.95	.636	1.13	.681
.42	.037	.60	.082	.78	.580	.96	.638	1.14	.674
.43	.036	.61	.077	.79	.589	.97	.641	1.15	.665
.44	.036	.62	.072	.80	.597	.98	.641	1.16	.658
.45	.040	.63	.066	.81	.603	.99	.641	1.17	.652
.46	.044	.64	.067	.82	.609	1.00	.644	1.18	.650
.47	.045	.65	.061	.83	.614	1.01	.649	1.19	.651

NO.57 - LIVE OAK



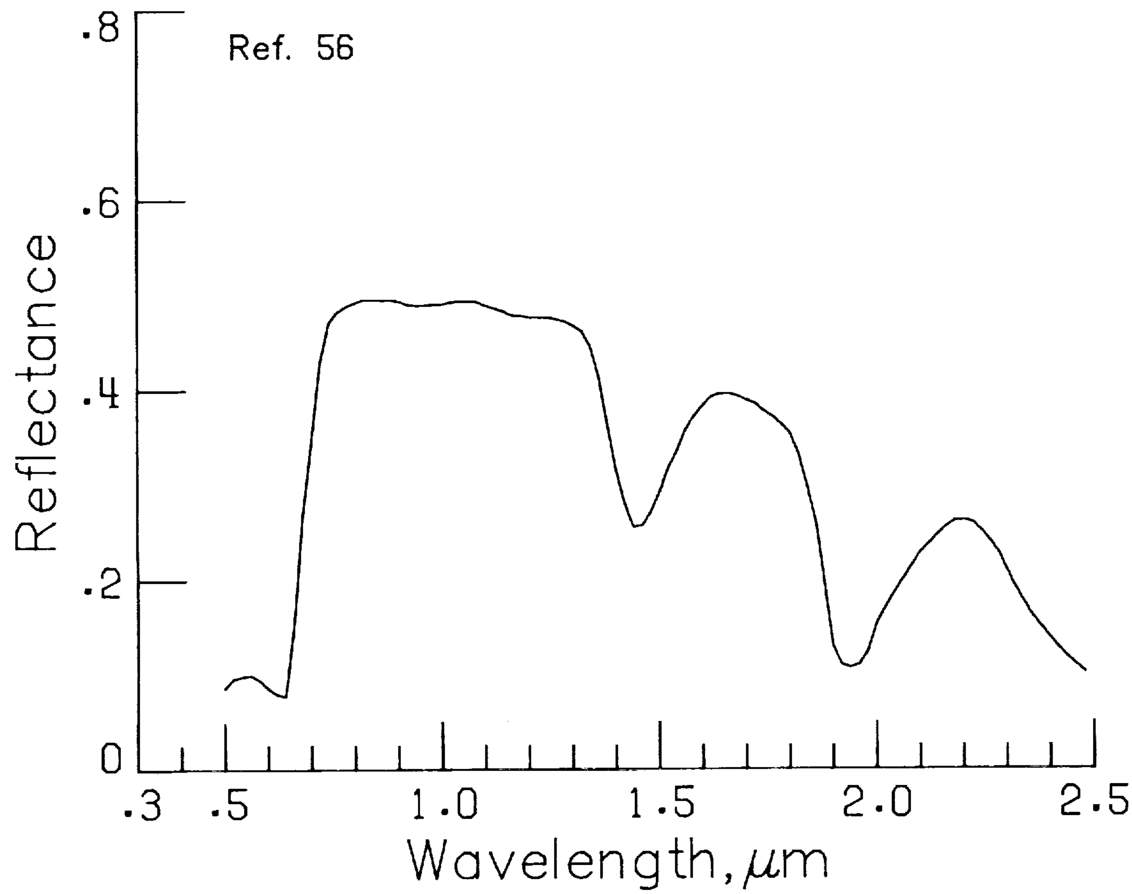
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.313	1.18	.298	1.62	.109	2.06	.039
.32		.76	.318	1.20	.288	1.64	.112	2.08	.039
.34		.78	.324	1.22	.286	1.66	.112	2.10	.040
.36		.80	.330	1.24	.289	1.68	.111	2.12	.042
.38		.82	.335	1.26	.294	1.70	.108	2.14	.047
.40		.84	.341	1.28	.298	1.72	.103	2.16	.051
.42		.86	.344	1.30	.303	1.74	.099	2.18	.054
.44		.88	.343	1.32		1.76	.094	2.20	.057
.46		.90	.336	1.34		1.78	.088	2.22	.059
.48		.92	.329	1.36		1.80		2.24	.060
.50		.94	.327	1.38		1.82		2.26	.059
.52		.96	.328	1.40		1.84		2.28	.058
.54	.074	.98	.337	1.42		1.86		2.30	.054
.56	.066	1.00	.350	1.44		1.88		2.32	.049
.58	.056	1.02	.359	1.46		1.90		2.34	.045
.60	.046	1.04	.368	1.48		1.92		2.36	.044
.62	.038	1.06	.374	1.50		1.94		2.38	.048
.64	.029	1.08	.374	1.52	.078	1.96		2.40	.053
.66		1.10	.369	1.54	.084	1.98		2.42	.054
.68		1.12	.360	1.56	.092	2.00		2.44	.053
.70		1.14	.344	1.58	.099	2.02	.042	2.46	.044
.72		1.16	.321	1.60	.105	2.04	.040	2.48	

NO.58 - ORANGE LEAF



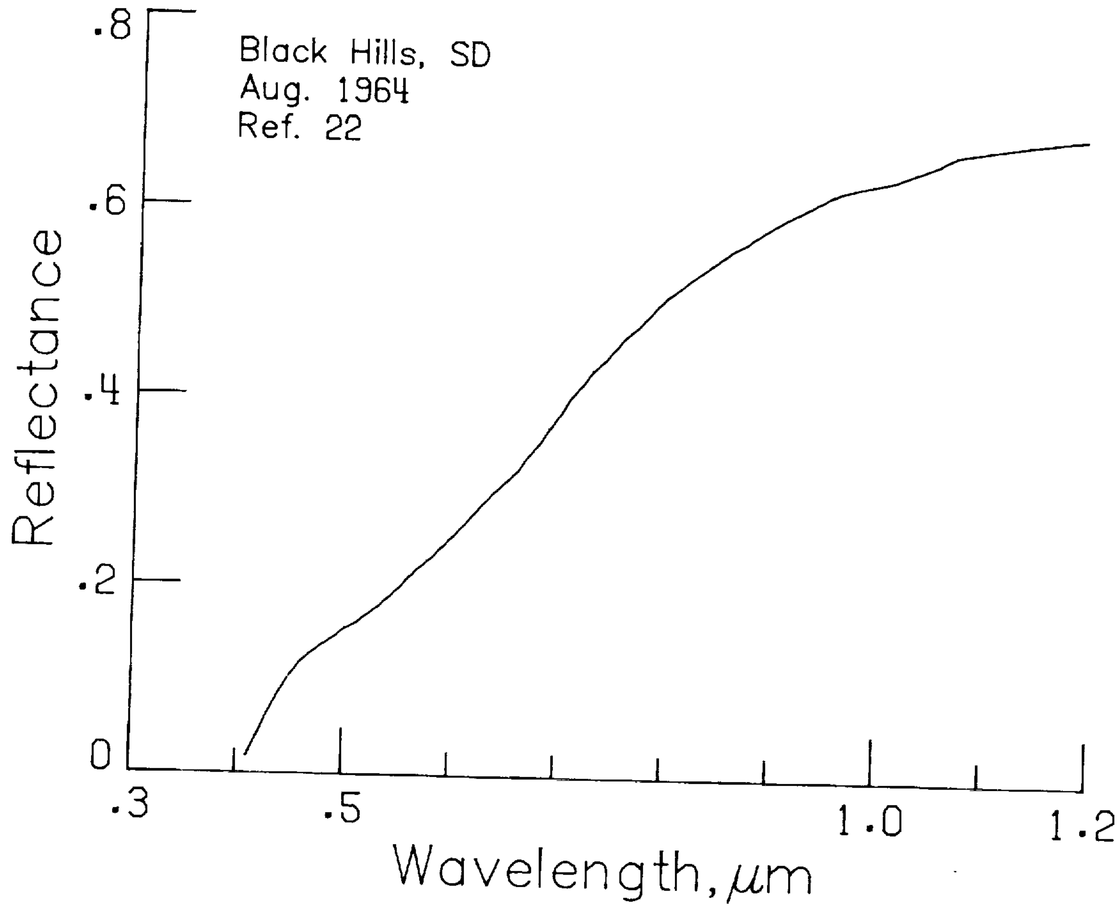
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.507	1.18	.528	1.62	.390	2.06	.166
.32		.76	.541	1.20	.528	1.64	.398	2.08	.185
.34		.78	.552	1.22	.529	1.66	.401	2.10	.200
.36		.80	.557	1.24	.531	1.68	.405	2.12	.214
.38		.82	.560	1.26	.533	1.70	.407	2.14	.222
.40		.84	.560	1.28	.531	1.72	.403	2.16	.229
.42		.86	.560	1.30	.519	1.74	.397	2.18	.236
.44		.88	.559	1.32	.504	1.76	.387	2.20	.242
.46		.90	.557	1.34	.484	1.78	.374	2.22	.244
.48		.92	.556	1.36	.466	1.80	.361	2.24	.242
.50		.94	.556	1.38	.441	1.82	.347	2.26	.234
.52	.077	.96	.557	1.40	.324	1.84	.317	2.28	.220
.54	.098	.98	.558	1.42	.273	1.86	.276	2.30	.203
.56	.096	1.00	.560	1.44	.244	1.88	.234	2.32	.187
.58	.087	1.02	.561	1.46	.236	1.90	.170	2.34	.174
.60	.069	1.04	.562	1.48	.241	1.92	.119	2.36	.161
.62	.061	1.06	.562	1.50	.254	1.94	.097	2.38	.148
.64	.064	1.08	.562	1.52	.282	1.96	.098	2.40	.136
.66	.075	1.10	.557	1.54	.310	1.98	.103	2.42	.123
.68	.115	1.12	.548	1.56	.332	2.00	.115	2.44	.114
.70	.286	1.14	.538	1.58	.357	2.02	.132	2.46	.103
.72	.351	1.16	.532	1.60	.380	2.04	.148	2.48	.096

NO.59 - PEACH LEAF



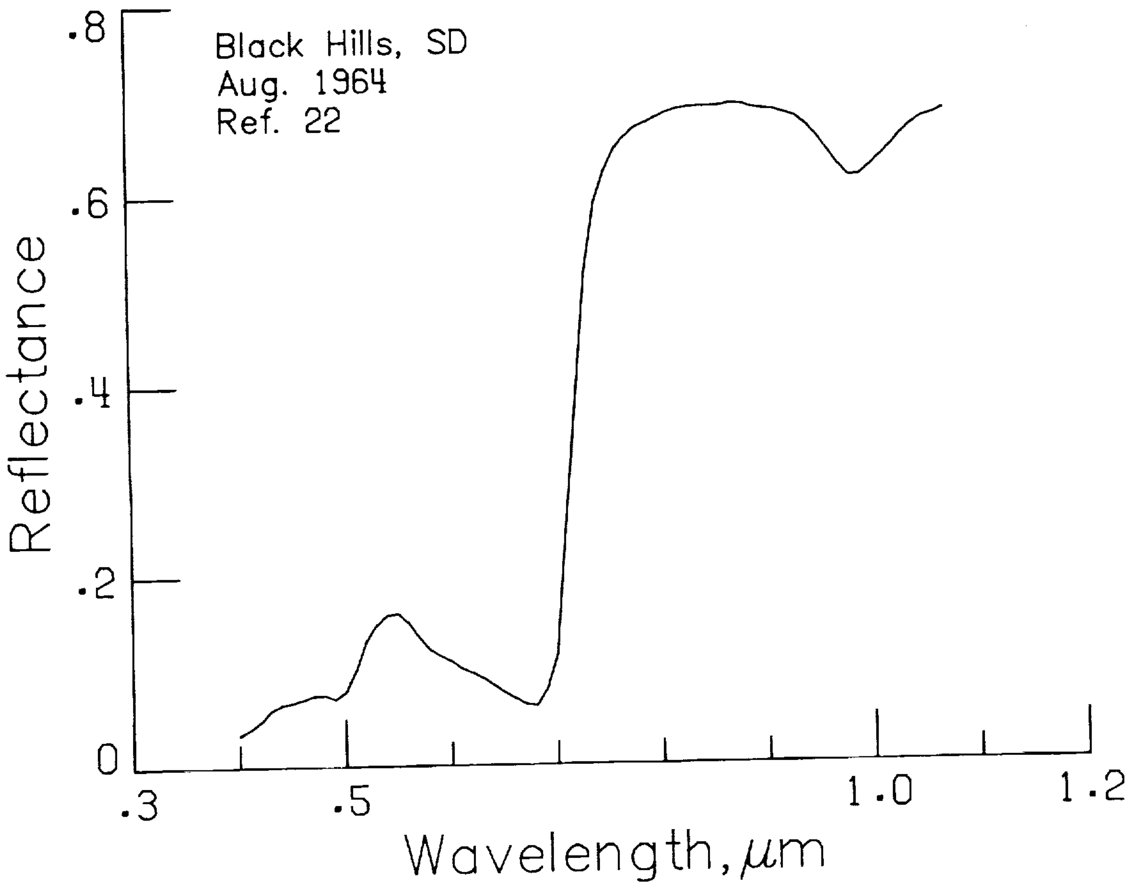
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.472	1.18	.478	1.62	.393	2.06	.201
.32		.76	.483	1.20	.477	1.64	.396	2.08	.215
.34		.78	.489	1.22	.477	1.66	.396	2.10	.229
.36		.80	.493	1.24	.477	1.68	.393	2.12	.239
.38		.82	.496	1.26	.475	1.70	.389	2.14	.248
.40		.84	.496	1.28	.473	1.72	.385	2.16	.256
.42		.86	.496	1.30	.468	1.74	.378	2.18	.262
.44		.88	.496	1.32	.462	1.76	.372	2.20	.262
.46		.90	.494	1.34	.446	1.78	.364	2.22	.260
.48		.92	.490	1.36	.414	1.80	.354	2.24	.251
.50	.087	.94	.489	1.38	.363	1.82	.332	2.26	.240
.52	.097	.96	.490	1.40	.315	1.84	.297	2.28	.228
.54	.099	.98	.491	1.42	.280	1.86	.259	2.30	.209
.56	.100	1.00	.491	1.44	.255	1.88	.196	2.32	.191
.58	.094	1.02	.493	1.46	.257	1.90	.129	2.34	.176
.60	.086	1.04	.494	1.48	.271	1.92	.110	2.36	.161
.62	.080	1.06	.494	1.50	.292	1.94	.107	2.38	.149
.64	.078	1.08	.493	1.52	.317	1.96	.110	2.40	.138
.66	.158	1.10	.489	1.54	.336	1.98	.125	2.42	.127
.68	.269	1.12	.486	1.56	.358	2.00	.153	2.44	.118
.70	.348	1.14	.483	1.58	.373	2.02	.171	2.46	.109
.72	.431	1.16	.479	1.60	.384	2.04	.186	2.48	.102

NO.60 - DEAD PONDEROSA PINE NEEDLES



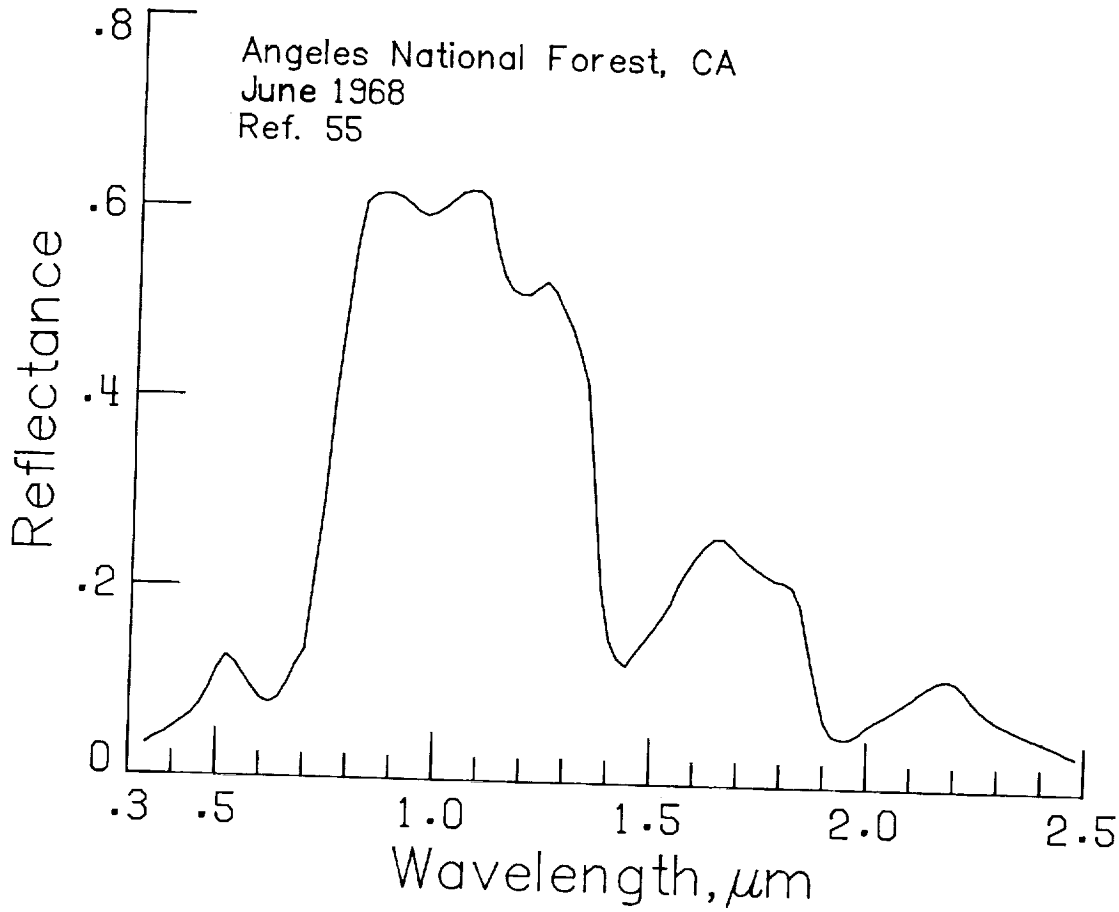
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.138	.66	.323	.84	.544	1.02	.640
.31		.49	.145	.67	.339	.85	.552	1.03	.644
.32		.50	.154	.68	.352	.86	.560	1.04	.648
.33		.51	.160	.69	.369	.87	.566	1.05	.653
.34		.52	.169	.70	.384	.88	.574	1.06	.659
.35		.53	.177	.71	.403	.89	.581	1.07	.664
.36		.54	.187	.72	.415	.90	.588	1.08	.665
.37		.55	.198	.73	.430	.91	.594	1.09	.667
.38		.56	.210	.74	.441	.92	.600	1.10	.669
.39		.57	.221	.75	.453	.93	.605	1.11	.671
.40		.58	.230	.76	.467	.94	.612	1.12	.673
.41	.019	.59	.242	.77	.476	.95	.618	1.13	.674
.42	.042	.60	.253	.78	.488	.96	.622	1.14	.676
.43	.067	.61	.265	.79	.500	.97	.625	1.15	.677
.44	.088	.62	.278	.80	.511	.98	.628	1.16	.679
.45	.106	.63	.290	.81	.519	.99	.630	1.17	.680
.46	.120	.64	.302	.82	.528	1.00	.633	1.18	.681
.47	.129	.65	.312	.83	.536	1.01	.635	1.19	.683

NO.61 - PONDEROSA PINE NEEDLES



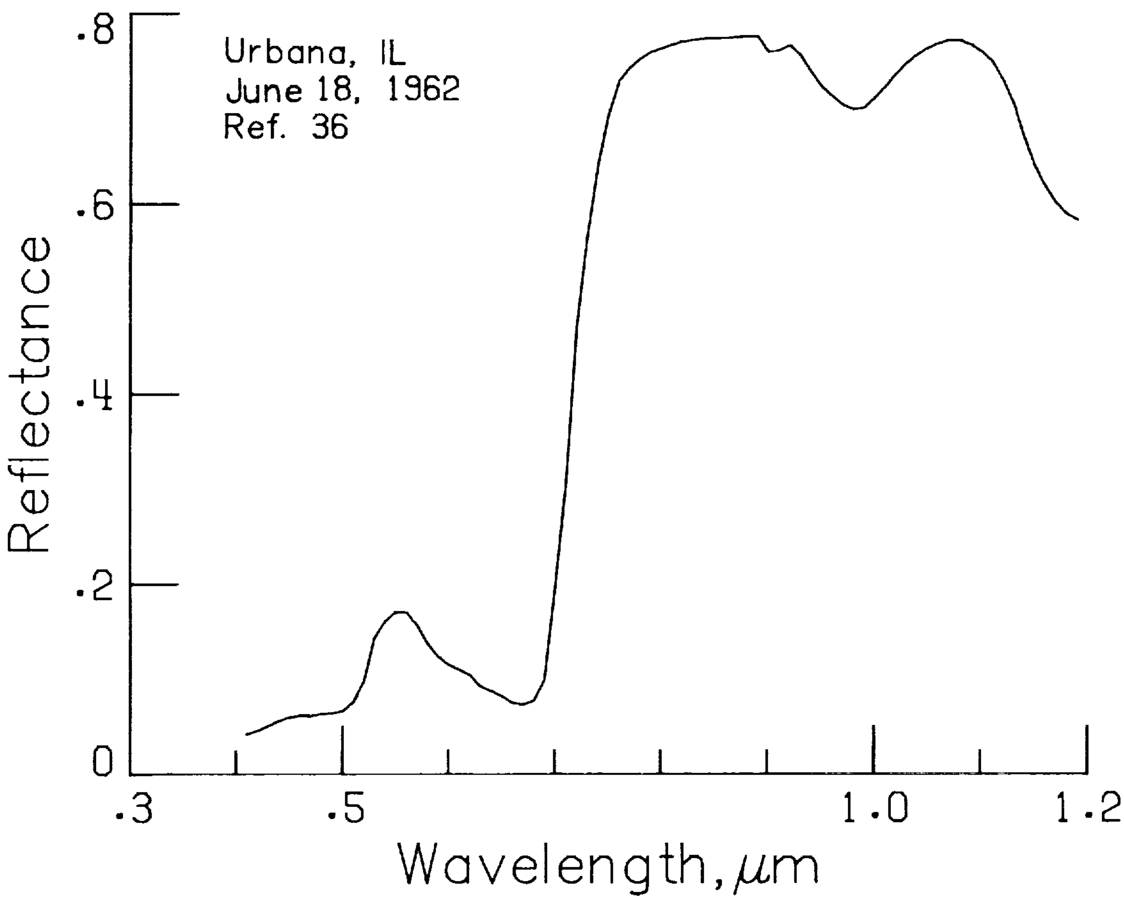
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.075	.66	.069	.84	.690	1.02	.646
.31		.49	.071	.67	.063	.85	.690	1.03	.659
.32		.50	.078	.68	.062	.86	.691	1.04	.669
.33		.51	.101	.69	.079	.87	.693	1.05	.676
.34		.52	.132	.70	.115	.88	.692	1.06	.679
.35		.53	.149	.71	.255	.89	.688	1.07	.684
.36		.54	.159	.72	.386	.90	.687	1.08	
.37		.55	.160	.73	.519	.91	.686	1.09	
.38		.56	.150	.74	.591	.92	.682	1.10	
.39		.57	.135	.75	.624	.93	.679	1.11	
.40	.034	.58	.121	.76	.647	.94	.670	1.12	
.41	.041	.59	.115	.77	.660	.95	.658	1.13	
.42	.049	.60	.109	.78	.669	.96	.643	1.14	
.43	.060	.61	.101	.79	.674	.97	.627	1.15	
.44	.065	.62	.096	.80	.679	.98	.615	1.16	
.45	.068	.63	.091	.81	.684	.99	.616	1.17	
.46	.071	.64	.083	.82	.688	1.00	.625	1.18	
.47	.075	.65	.075	.83	.689	1.01	.636	1.19	

NO.62 - PONDEROSA PINE NEEDLES



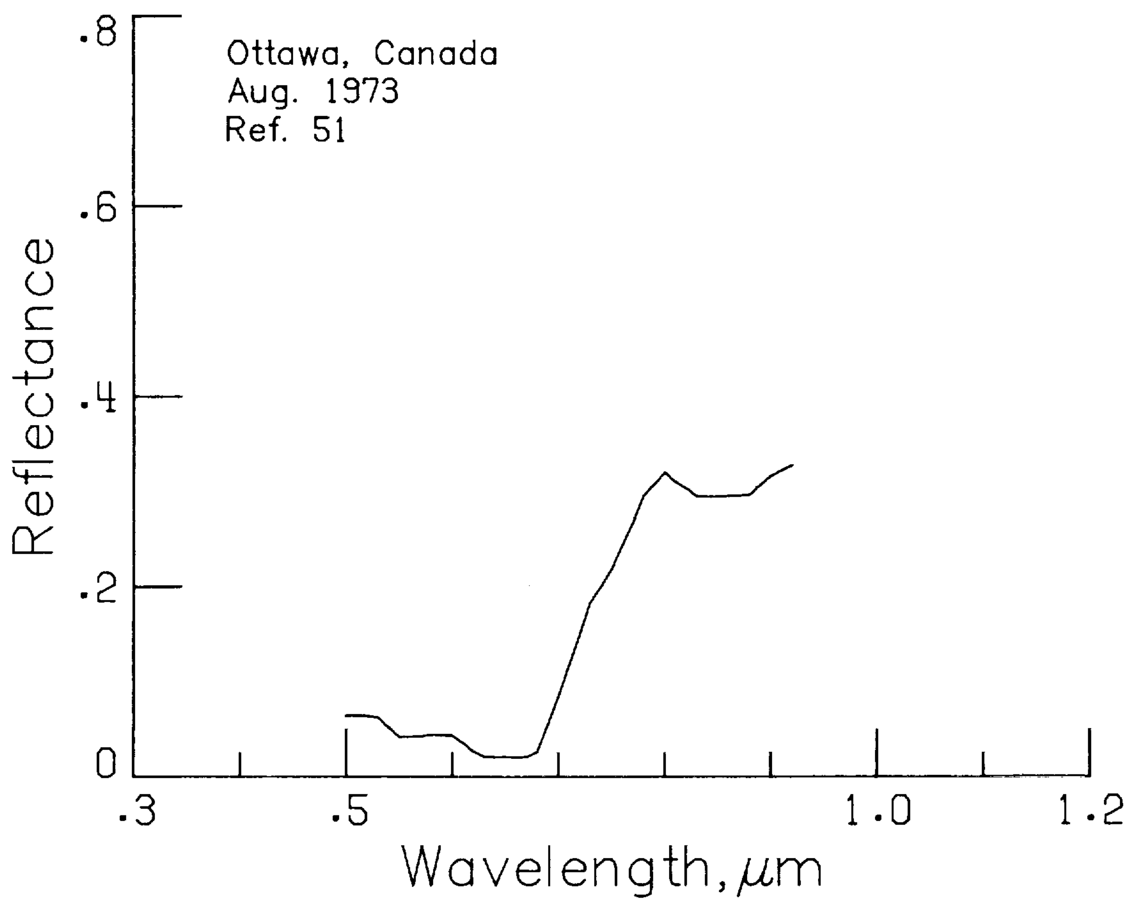
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.292	1.18	.513	1.62	.253	2.06	.082
.32		.76	.401	1.20	.513	1.64	.260	2.08	.088
.34	.033	.78	.482	1.22	.520	1.66	.260	2.10	.095
.36	.040	.80	.558	1.24	.526	1.68	.252	2.12	.103
.38	.044	.82	.607	1.26	.516	1.70	.242	2.14	.109
.40	.050	.84	.615	1.28	.497	1.72	.235	2.16	.114
.42	.057	.86	.617	1.30	.479	1.74	.228	2.18	.116
.44	.064	.88	.616	1.32	.452	1.76	.222	2.20	.113
.46	.075	.90	.612	1.34	.420	1.78	.217	2.22	.105
.48	.091	.92	.606	1.36	.315	1.80	.215	2.24	.093
.50	.114	.94	.597	1.38	.204	1.82	.210	2.26	.084
.52	.127	.96	.594	1.40	.151	1.84	.191	2.28	.077
.54	.120	.98	.597	1.42	.131	1.86	.147	2.30	.072
.56	.107	1.00	.603	1.44	.124	1.88	.105	2.32	.067
.58	.093	1.02	.611	1.46	.138	1.90	.069	2.34	.063
.60	.082	1.04	.618	1.48	.150	1.92	.054	2.36	.059
.62	.078	1.06	.621	1.50	.162	1.94	.052	2.38	.056
.64	.083	1.08	.620	1.52	.175	1.96	.052	2.40	.053
.66	.099	1.10	.612	1.54	.190	1.98	.057	2.42	.049
.68	.120	1.12	.565	1.56	.212	2.00	.066	2.44	.046
.70	.134	1.14	.533	1.58	.228	2.02	.072	2.46	.041
.72	.214	1.16	.517	1.60	.242	2.04	.076	2.48	.038

NO.63 - RED PINE NEEDLES



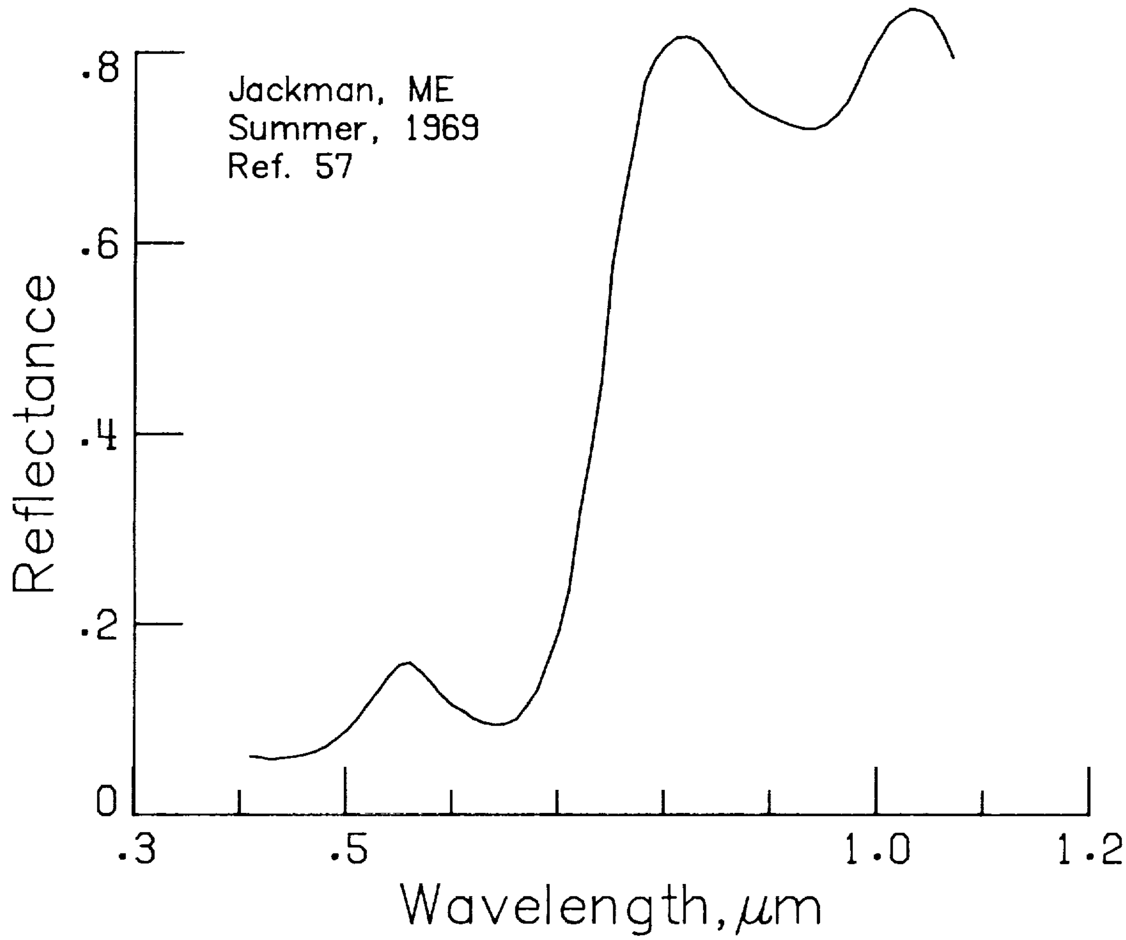
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.064	.66	.075	.84	.774	1.02	.737
.31		.49	.064	.67	.073	.85	.774	1.03	.748
.32		.50	.067	.68	.077	.86	.774	1.04	.757
.33		.51	.076	.69	.099	.87	.775	1.05	.764
.34		.52	.098	.70	.197	.88	.776	1.06	.769
.35		.53	.144	.71	.304	.89	.775	1.07	.772
.36		.54	.161	.72	.472	.90	.760	1.08	.771
.37		.55	.171	.73	.565	.91	.762	1.09	.767
.38		.56	.171	.74	.641	.92	.767	1.10	.760
.39		.57	.157	.75	.695	.93	.756	1.11	.750
.40		.58	.137	.76	.730	.94	.739	1.12	.731
.41	.043	.59	.124	.77	.744	.95	.723	1.13	.706
.42	.046	.60	.115	.78	.753	.96	.713	1.14	.670
.43	.051	.61	.110	.79	.760	.97	.704	1.15	.640
.44	.056	.62	.104	.80	.764	.98	.699	1.16	.618
.45	.060	.63	.092	.81	.768	.99	.701	1.17	.601
.46	.062	.64	.087	.82	.771	1.00	.712	1.18	.589
.47	.061	.65	.082	.83	.773	1.01	.724	1.19	.583

NO.64 - WHITE PINE



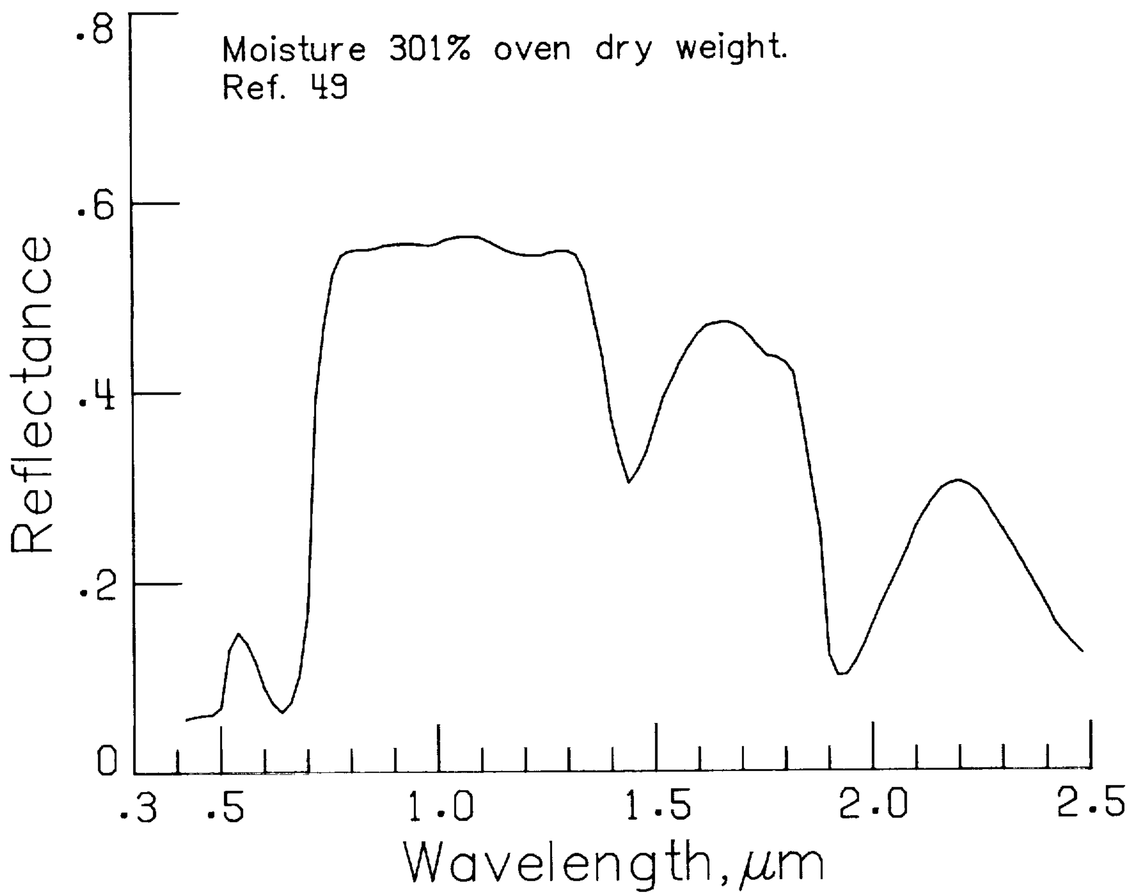
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48		.66	.020	.84	.295	1.02	
.31		.49		.67	.021	.85	.295	1.03	
.32		.50	.065	.68	.026	.86	.296	1.04	
.33		.51	.065	.69	.055	.87	.296	1.05	
.34		.52	.064	.70	.084	.88	.297	1.06	
.35		.53	.063	.71	.117	.89	.307	1.07	
.36		.54	.052	.72	.149	.90	.316	1.08	
.37		.55	.042	.73	.184	.91	.322	1.09	
.38		.56	.042	.74	.200	.92	.328	1.10	
.39		.57	.043	.75	.219	.93		1.11	
.40		.58	.044	.76	.244	.94		1.12	
.41		.59	.044	.77	.267	.95		1.13	
.42		.60	.043	.78	.296	.96		1.14	
.43		.61	.036	.79	.308	.97		1.15	
.44		.62	.027	.80	.320	.98		1.16	
.45		.63	.021	.81	.310	.99		1.17	
.46		.64	.020	.82	.304	1.00		1.18	
.47		.65	.021	.83	.295	1.01		1.19	

NO.65 - RED SPRUCE



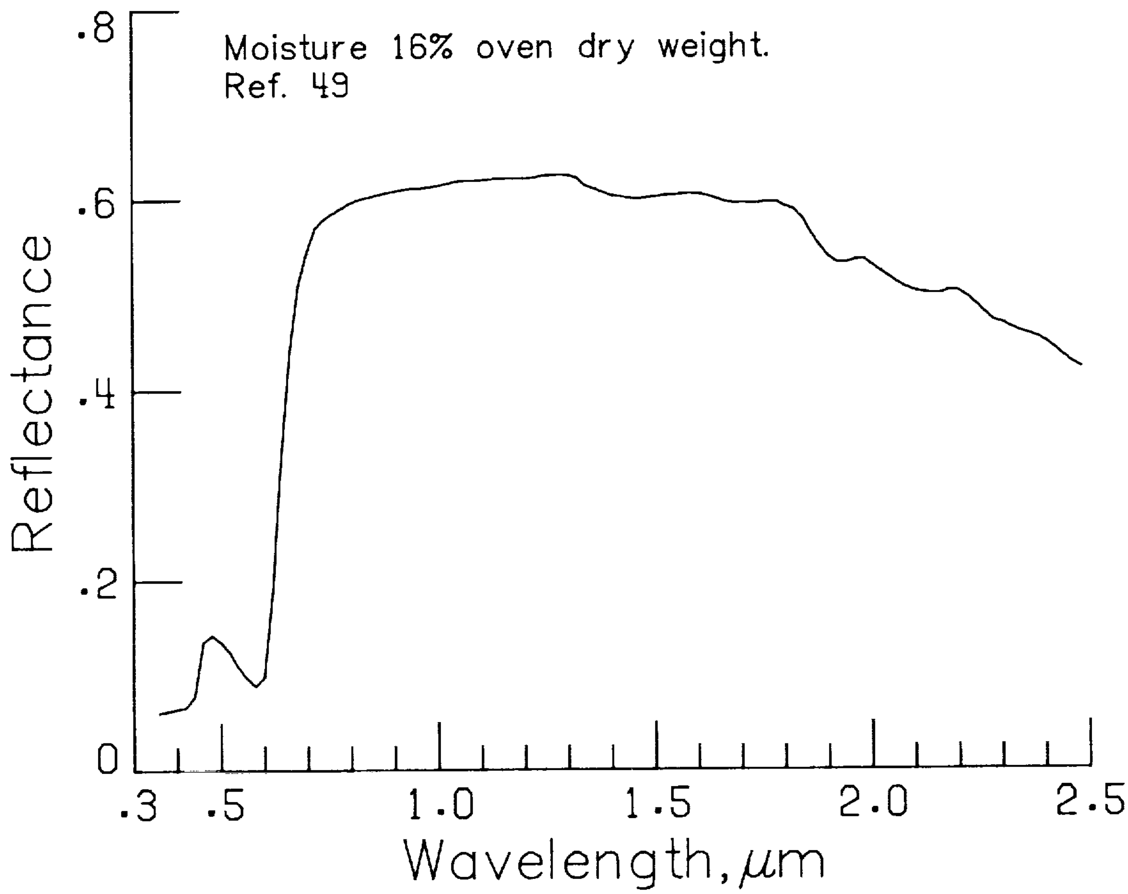
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.072	.66	.101	.84	.800	1.02	.841
.31		.49	.080	.67	.115	.85	.783	1.03	.846
.32		.50	.089	.68	.131	.86	.765	1.04	.844
.33		.51	.101	.69	.161	.87	.755	1.05	.838
.34		.52	.116	.70	.191	.88	.744	1.06	.820
.35		.53	.130	.71	.237	.89	.738	1.07	.795
.36		.54	.145	.72	.318	.90	.732	1.08	
.37		.55	.157	.73	.382	.91	.728	1.09	
.38		.56	.160	.74	.456	.92	.723	1.10	
.39		.57	.150	.75	.578	.93	.720	1.11	
.40		.58	.139	.76	.647	.94	.721	1.12	
.41	.062	.59	.125	.77	.706	.95	.725	1.13	
.42	.060	.60	.115	.78	.770	.96	.734	1.14	
.43	.058	.61	.109	.79	.795	.97	.747	1.15	
.44	.060	.62	.101	.80	.808	.98	.769	1.16	
.45	.061	.63	.097	.81	.816	.99	.795	1.17	
.46	.063	.64	.095	.82	.817	1.00	.814	1.18	
.47	.067	.65	.096	.83	.812	1.01	.832	1.19	

NO.66 - SYCAMORE LEAF



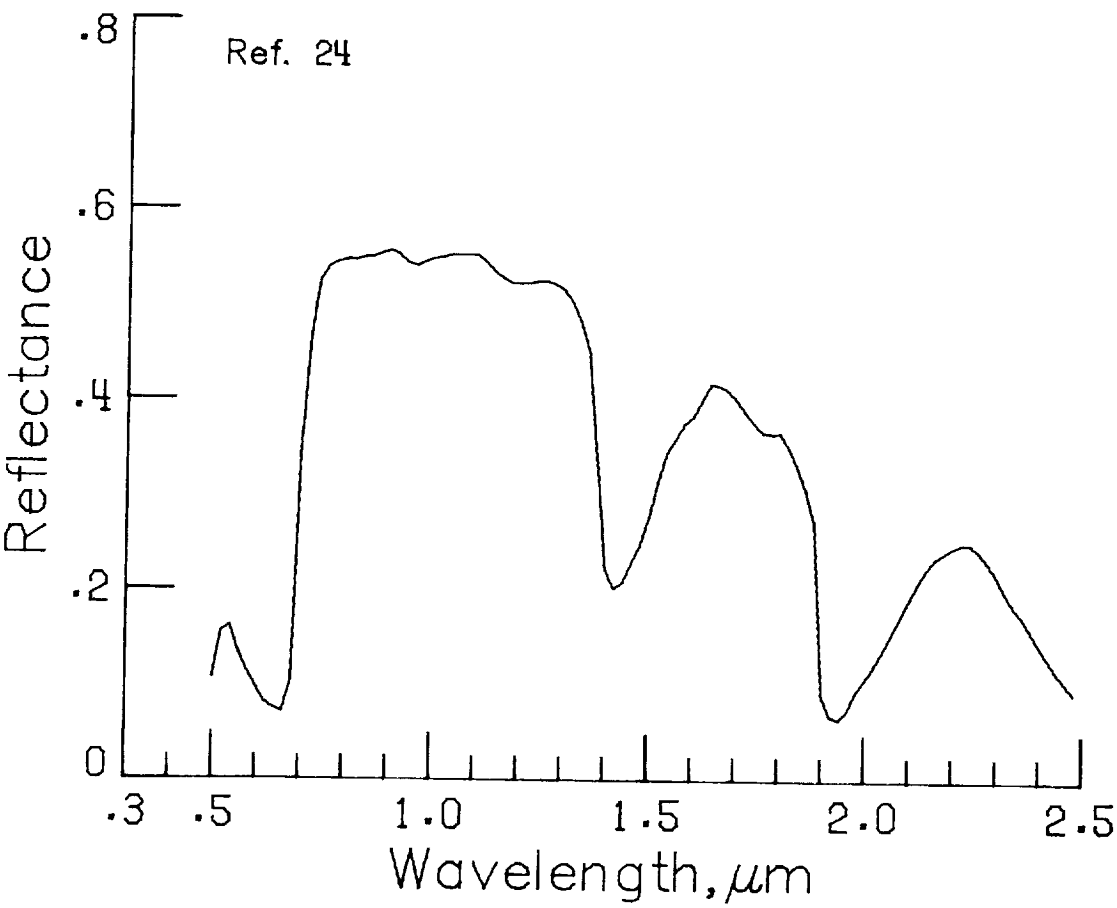
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.471	1.18	.545	1.62	.469	2.06	.214
.32		.76	.523	1.20	.543	1.64	.471	2.08	.234
.34		.78	.544	1.22	.543	1.66	.473	2.10	.257
.36		.80	.548	1.24	.543	1.68	.471	2.12	.272
.38		.82	.550	1.26	.546	1.70	.467	2.14	.286
.40		.84	.550	1.28	.548	1.72	.457	2.16	.297
.42	.057	.86	.551	1.30	.547	1.74	.446	2.18	.303
.44	.059	.88	.554	1.32	.544	1.76	.437	2.20	.304
.46	.061	.90	.555	1.34	.526	1.78	.435	2.22	.301
.48	.061	.92	.555	1.36	.481	1.80	.430	2.24	.294
.50	.068	.94	.555	1.38	.437	1.82	.419	2.26	.283
.52	.130	.96	.554	1.40	.371	1.84	.368	2.28	.267
.54	.147	.98	.554	1.42	.333	1.86	.310	2.30	.253
.56	.136	1.00	.556	1.44	.304	1.88	.253	2.32	.238
.58	.115	1.02	.560	1.46	.317	1.90	.122	2.34	.221
.60	.088	1.04	.562	1.48	.336	1.92	.101	2.36	.206
.62	.072	1.06	.563	1.50	.365	1.94	.102	2.38	.189
.64	.064	1.08	.563	1.52	.394	1.96	.114	2.40	.173
.66	.074	1.10	.562	1.54	.413	1.98	.133	2.42	.154
.68	.102	1.12	.557	1.56	.432	2.00	.155	2.44	.143
.70	.170	1.14	.553	1.58	.448	2.02	.176	2.46	.133
.72	.393	1.16	.548	1.60	.461	2.04	.195	2.48	.123

NO.67 - DEHYDRATED SYCAMORE LEAF



λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.580	1.18	.623	1.62	.604	2.06	.512
.32		.76	.586	1.20	.623	1.64	.601	2.08	.507
.34		.78	.591	1.22	.623	1.66	.598	2.10	.504
.36	.061	.80	.597	1.24	.625	1.68	.596	2.12	.502
.38	.063	.82	.600	1.26	.626	1.70	.596	2.14	.501
.40	.065	.84	.603	1.28	.627	1.72	.596	2.16	.502
.42	.067	.86	.605	1.30	.626	1.74	.596	2.18	.505
.44	.079	.88	.607	1.32	.623	1.76	.597	2.20	.503
.46	.136	.90	.609	1.34	.615	1.78	.597	2.22	.498
.48	.142	.92	.611	1.36	.611	1.80	.593	2.24	.490
.50	.135	.94	.612	1.38	.608	1.82	.589	2.26	.480
.52	.125	.96	.612	1.40	.604	1.84	.580	2.28	.472
.54	.109	.98	.614	1.42	.603	1.86	.564	2.30	.470
.56	.098	1.00	.615	1.44	.601	1.88	.551	2.32	.465
.58	.089	1.02	.617	1.46	.601	1.90	.540	2.34	.461
.60	.099	1.04	.619	1.48	.602	1.92	.534	2.36	.458
.62	.192	1.06	.620	1.50	.603	1.94	.534	2.38	.455
.64	.328	1.08	.621	1.52	.604	1.96	.537	2.40	.450
.66	.441	1.10	.621	1.54	.605	1.98	.538	2.42	.443
.68	.511	1.12	.622	1.56	.606	2.00	.531	2.44	.435
.70	.545	1.14	.622	1.58	.607	2.02	.525	2.46	.428
.72	.571	1.16	.623	1.60	.606	2.04	.519	2.48	.423

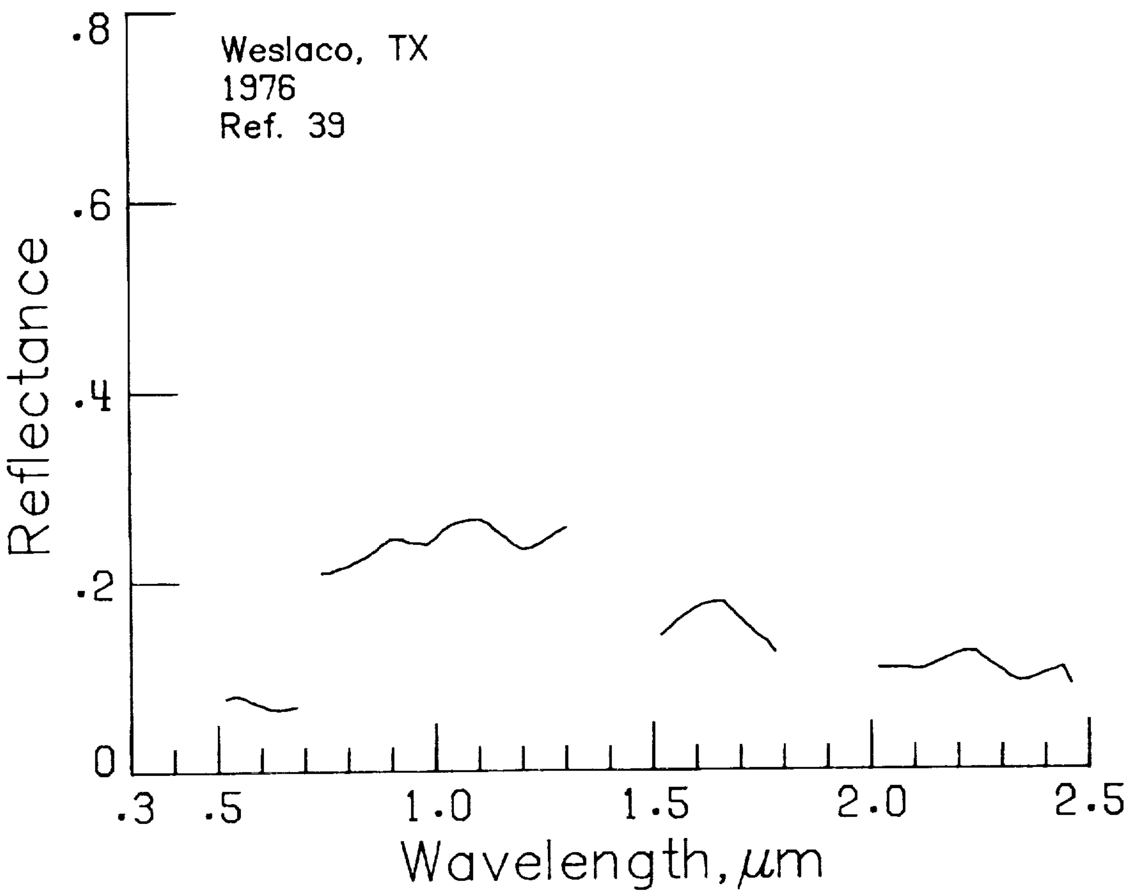
NO.68 - TULIP TREE LEAF



λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.526	1.18	.523	1.62	.401	2.06	.155
.32		.76	.540	1.20	.523	1.64	.418	2.08	.173
.34		.78	.545	1.22	.524	1.66	.416	2.10	.192
.36		.80	.547	1.24	.525	1.68	.411	2.12	.209
.38		.82	.547	1.26	.525	1.70	.401	2.14	.225
.40		.84	.550	1.28	.522	1.72	.388	2.16	.236
.42		.86	.551	1.30	.516	1.74	.377	2.18	.242
.44		.88	.555	1.32	.503	1.76	.367	2.20	.247
.46		.90	.557	1.34	.482	1.78	.366	2.22	.252
.48		.92	.553	1.36	.451	1.80	.366	2.24	.250
.50	.108	.94	.544	1.38	.337	1.82	.351	2.26	.243
.52	.157	.96	.541	1.40	.223	1.84	.331	2.28	.231
.54	.162	.98	.546	1.42	.203	1.86	.307	2.30	.218
.56	.134	1.00	.549	1.44	.210	1.88	.273	2.32	.200
.58	.114	1.02	.551	1.46	.230	1.90	.092	2.34	.185
.60	.097	1.04	.553	1.48	.249	1.92	.069	2.36	.174
.62	.082	1.06	.553	1.50	.277	1.94	.066	2.38	.159
.64	.076	1.08	.553	1.52	.315	1.96	.076	2.40	.144
.66	.072	1.10	.552	1.54	.346	1.98	.096	2.42	.130
.68	.104	1.12	.545	1.56	.361	2.00	.109	2.44	.116
.70	.346	1.14	.535	1.58	.377	2.02	.122	2.46	.105
.72	.465	1.16	.528	1.60	.385	2.04	.138	2.48	.095

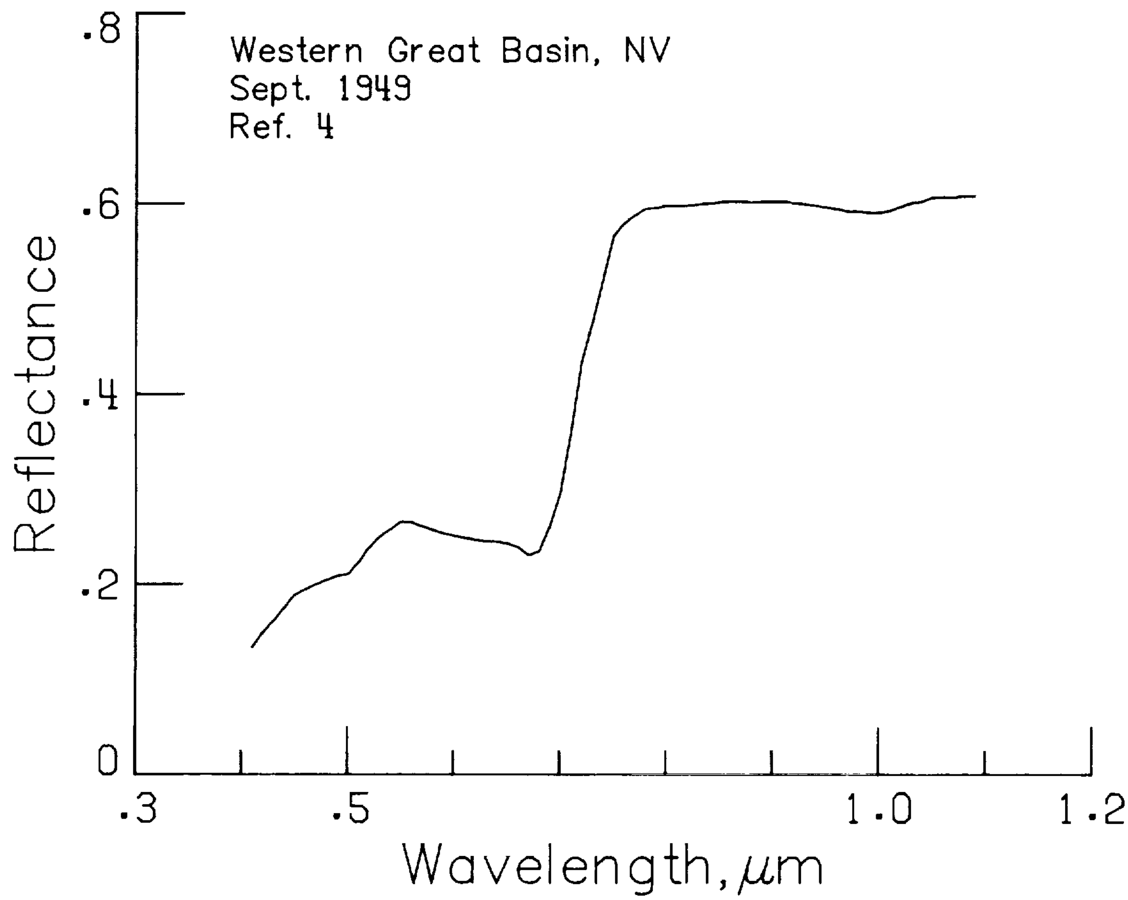
C-2

NO.69 - CENIZO



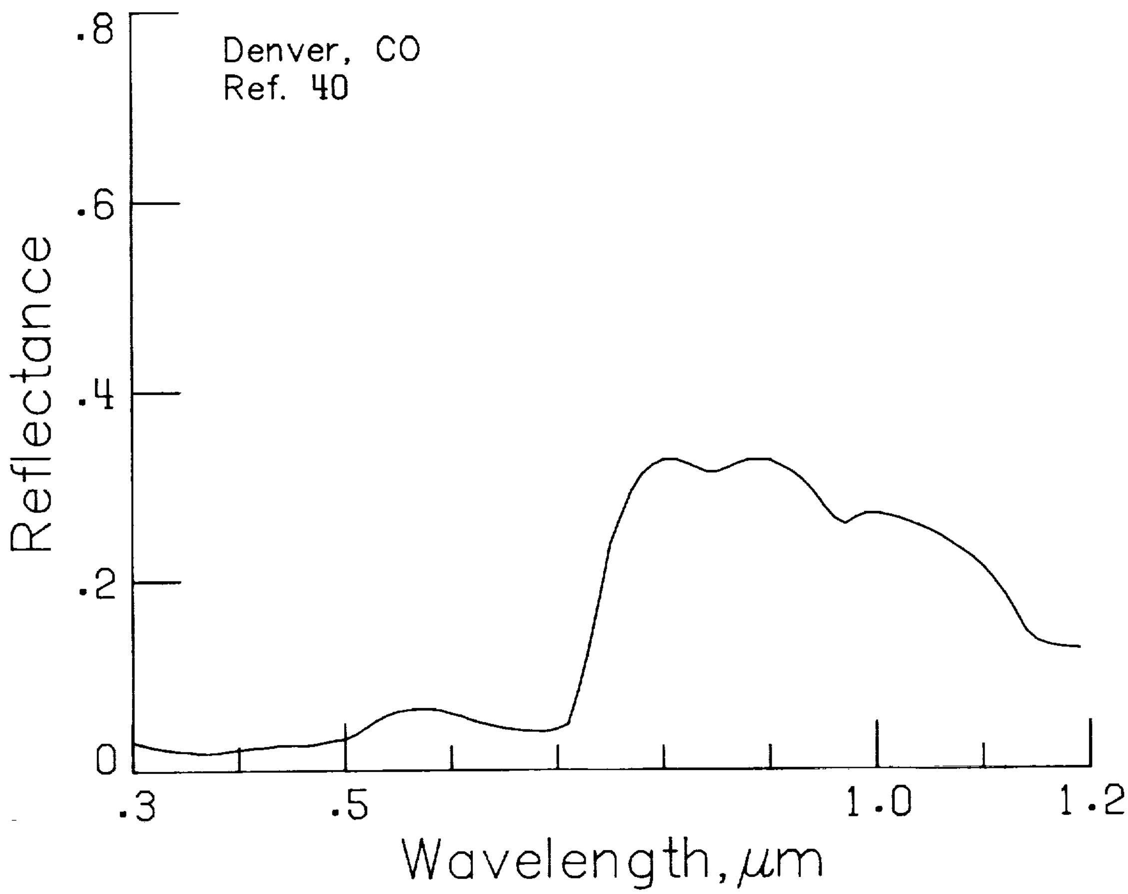
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.210	1.18	.239	1.62	.175	2.06	.107
.32		.76	.210	1.20	.234	1.64	.177	2.08	.107
.34		.78	.215	1.22	.236	1.66	.178	2.10	.105
.36		.80	.217	1.24	.240	1.68	.168	2.12	.106
.38		.82	.222	1.26	.246	1.70	.159	2.14	.110
.40		.84	.226	1.28	.252	1.72	.150	2.16	.114
.42		.86	.232	1.30	.257	1.74	.142	2.18	.118
.44		.88	.240	1.32		1.76	.136	2.20	.122
.46		.90	.245	1.34		1.78	.124	2.22	.124
.48		.92	.245	1.36		1.80		2.24	.123
.50		.94	.241	1.38		1.82		2.26	.115
.52	.078	.96	.241	1.40		1.84		2.28	.109
.54	.081	.98	.239	1.42		1.86		2.30	.104
.56	.078	1.00	.246	1.44		1.88		2.32	.096
.58	.073	1.02	.255	1.46		1.90		2.34	.093
.60	.070	1.04	.260	1.48		1.92		2.36	.093
.62	.066	1.06	.263	1.50		1.94		2.38	.097
.64	.066	1.08	.265	1.52	.143	1.96		2.40	.101
.66	.067	1.10	.265	1.54	.151	1.98		2.42	.104
.68	.069	1.12	.261	1.56	.159	2.00		2.44	.107
.70		1.14	.253	1.58	.165	2.02	.107	2.46	.089
.72		1.16	.247	1.60	.171	2.04	.107	2.48	

NO.70 - AVERAGE DESERT LEAVES



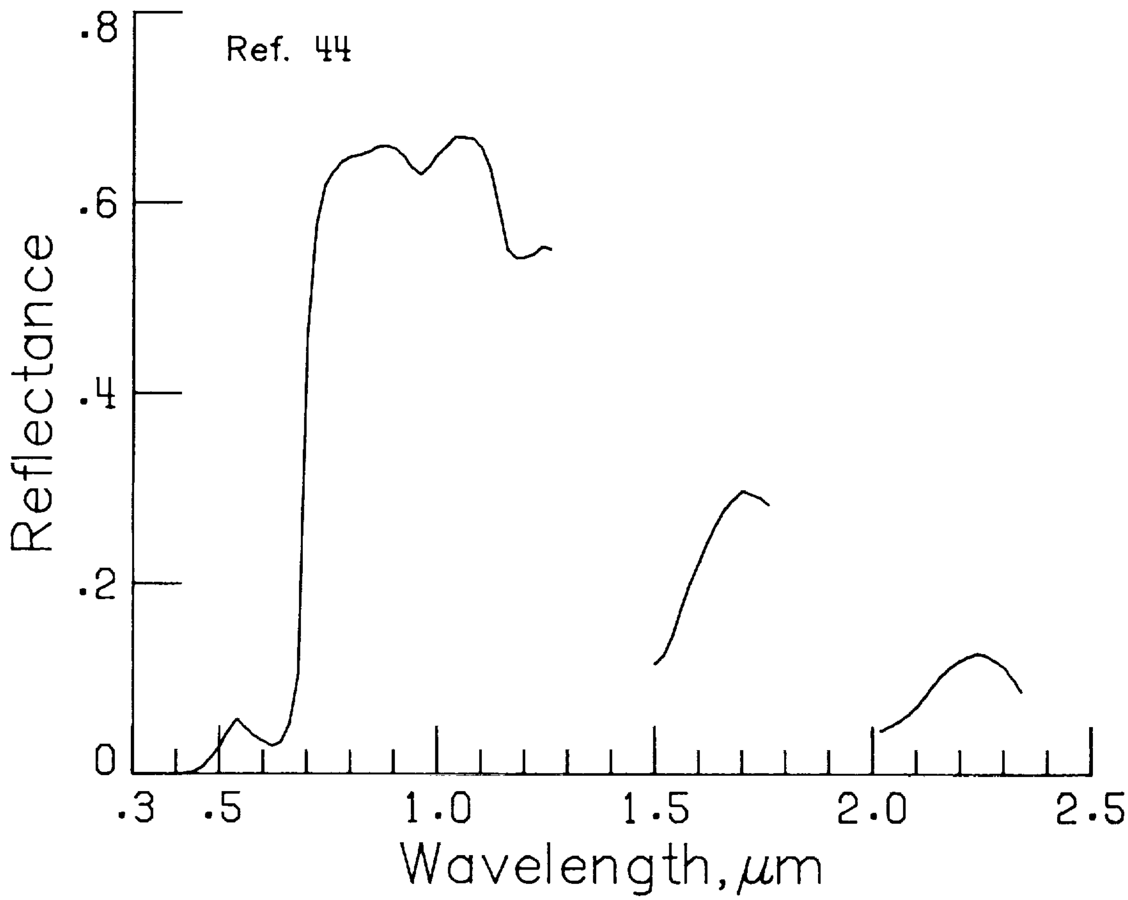
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.205	.66	.239	.84	.600	1.02	.597
.31		.49	.209	.67	.231	.85	.602	1.03	.600
.32		.50	.211	.68	.235	.86	.602	1.04	.602
.33		.51	.223	.69	.261	.87	.602	1.05	.606
.34		.52	.239	.70	.296	.88	.601	1.06	.607
.35		.53	.250	.71	.359	.89	.602	1.07	.607
.36		.54	.258	.72	.435	.90	.602	1.08	.608
.37		.55	.266	.73	.475	.91	.602	1.09	.608
.38		.56	.265	.74	.521	.92	.600	1.10	
.39		.57	.261	.75	.567	.93	.599	1.11	
.40		.58	.257	.76	.580	.94	.598	1.12	
.41	.134	.59	.254	.77	.588	.95	.596	1.13	
.42	.150	.60	.251	.78	.595	.96	.594	1.14	
.43	.162	.61	.249	.79	.596	.97	.592	1.15	
.44	.175	.62	.247	.80	.598	.98	.592	1.16	
.45	.189	.63	.245	.81	.598	.99	.591	1.17	
.46	.195	.64	.245	.82	.598	1.00	.590	1.18	
.47	.200	.65	.243	.83	.599	1.01	.593	1.19	

NO.71 - GRASS



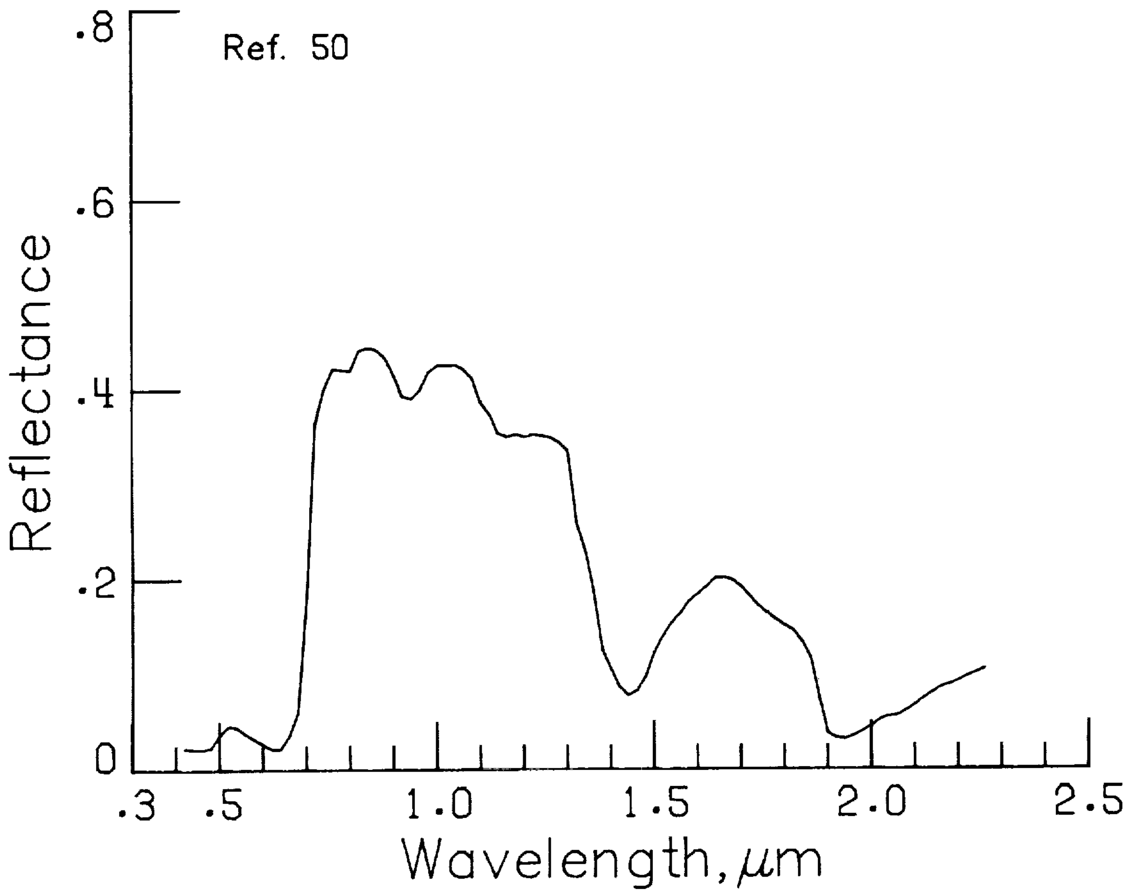
λ	R	λ	R	λ	R	λ	R	λ	R
.30	.031	.48	.030	.66	.042	.84	.314	1.02	.264
.31	.028	.49	.032	.67	.041	.85	.314	1.03	.260
.32	.025	.50	.033	.68	.041	.86	.318	1.04	.256
.33	.023	.51	.038	.69	.041	.87	.323	1.05	.251
.34	.021	.52	.045	.70	.043	.88	.327	1.06	.245
.35	.020	.53	.053	.71	.048	.89	.327	1.07	.237
.36	.019	.54	.058	.72	.084	.90	.326	1.08	.230
.37	.019	.55	.062	.73	.130	.91	.320	1.09	.222
.38	.019	.56	.064	.74	.182	.92	.314	1.10	.211
.39	.021	.57	.065	.75	.239	.93	.305	1.11	.198
.40	.022	.58	.064	.76	.267	.94	.293	1.12	.183
.41	.024	.59	.063	.77	.295	.95	.277	1.13	.165
.42	.025	.60	.059	.78	.312	.96	.264	1.14	.145
.43	.026	.61	.057	.79	.322	.97	.258	1.15	.135
.44	.027	.62	.052	.80	.327	.98	.265	1.16	.131
.45	.027	.63	.049	.81	.327	.99	.269	1.17	.128
.46	.027	.64	.046	.82	.324	1.00	.269	1.18	.127
.47	.028	.65	.044	.83	.319	1.01	.267	1.19	.127

NO.72 - GRASS



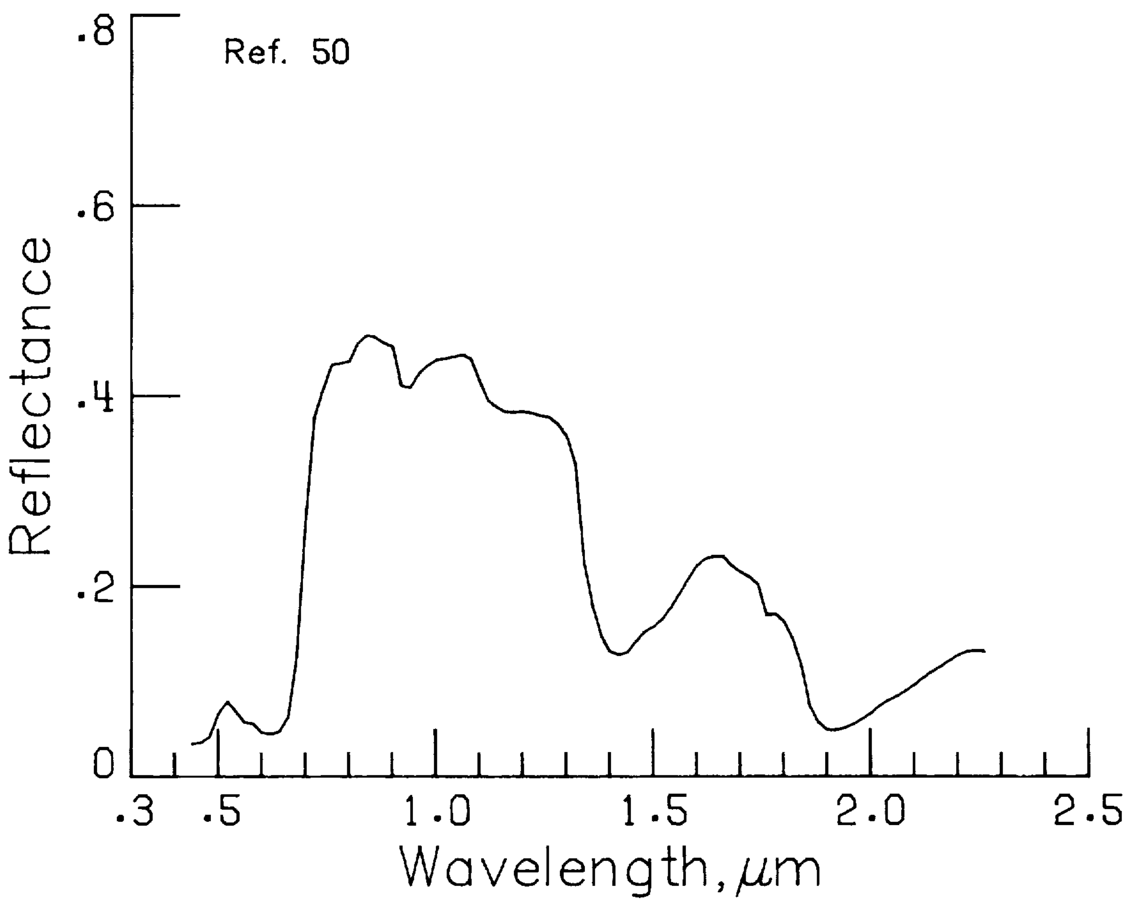
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.619	1.18	.542	1.62	.244	2.06	.055
.32		.76	.634	1.20	.543	1.64	.263	2.08	.062
.34		.78	.644	1.22	.546	1.66	.279	2.10	.070
.36		.80	.649	1.24	.554	1.68	.289	2.12	.082
.38		.82	.651	1.26	.551	1.70	.298	2.14	.094
.40		.84	.654	1.28		1.72	.294	2.16	.105
.42	.001	.86	.659	1.30		1.74	.290	2.18	.113
.44	.002	.88	.660	1.32		1.76	.283	2.20	.119
.46	.007	.90	.657	1.34		1.78		2.22	.124
.48	.017	.92	.650	1.36		1.80		2.24	.127
.50	.029	.94	.636	1.38		1.82		2.26	.124
.52	.045	.96	.630	1.40		1.84		2.28	.119
.54	.058	.98	.638	1.42		1.86		2.30	.113
.56	.048	1.00	.652	1.44		1.88		2.32	.101
.58	.039	1.02	.660	1.46		1.90		2.34	.087
.60	.034	1.04	.670	1.48		1.92		2.36	
.62	.029	1.06	.669	1.50	.116	1.94		2.38	
.64	.033	1.08	.668	1.52	.125	1.96		2.40	
.66	.052	1.10	.658	1.54	.145	1.98		2.42	
.68	.104	1.12	.636	1.56	.175	2.00		2.44	
.70	.460	1.14	.594	1.58	.201	2.02	.045	2.46	
.72	.577	1.16	.550	1.60	.222	2.04	.051	2.48	

NO.73 - KENTUCKY BLUE GRASS



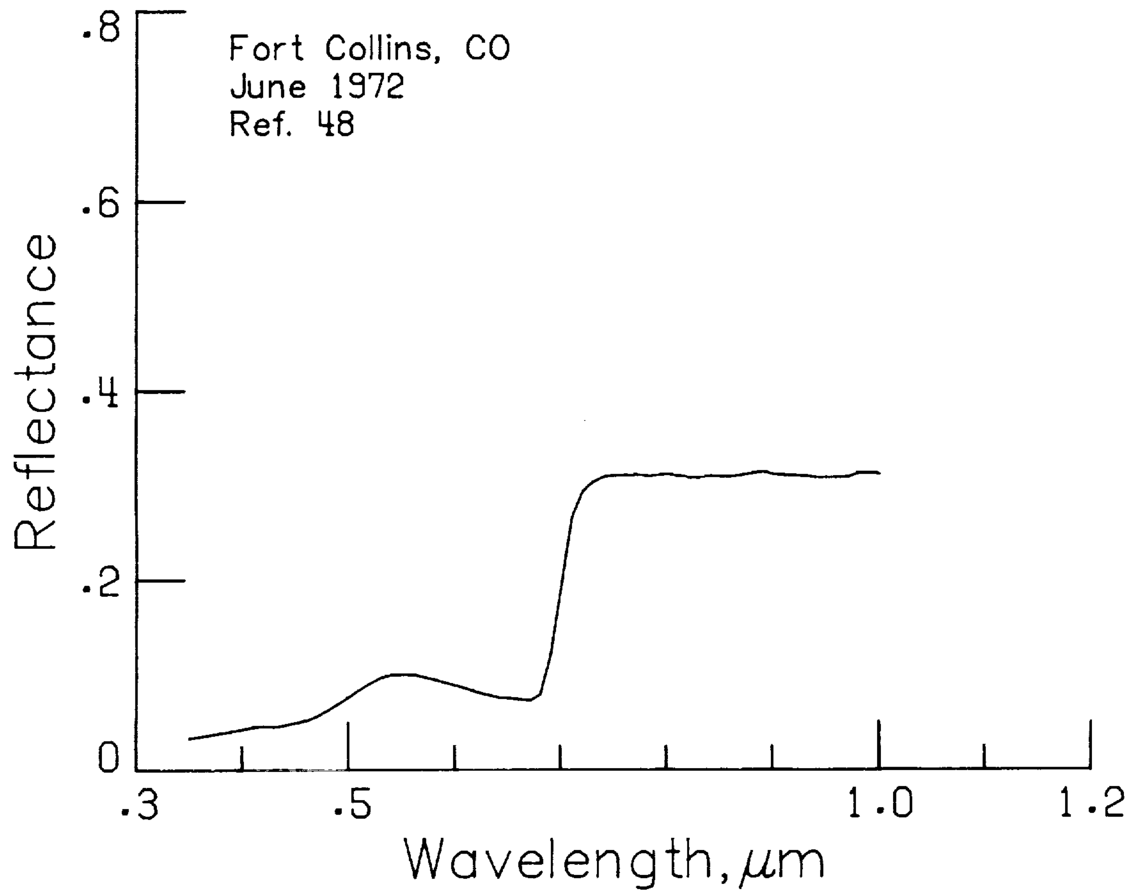
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.402	1.18	.353	1.62	.192	2.06	.056
.32		.76	.422	1.20	.350	1.64	.201	2.08	.061
.34		.78	.421	1.22	.353	1.66	.202	2.10	.067
.36		.80	.420	1.24	.351	1.68	.199	2.12	.074
.38		.82	.442	1.26	.350	1.70	.192	2.14	.080
.40		.84	.444	1.28	.344	1.72	.182	2.16	.086
.42	.023	.86	.442	1.30	.336	1.74	.172	2.18	.089
.44	.022	.88	.434	1.32	.260	1.76	.164	2.20	.093
.46	.022	.90	.416	1.34	.231	1.78	.157	2.22	.097
.48	.024	.92	.393	1.36	.187	1.80	.151	2.24	.101
.50	.037	.94	.390	1.38	.125	1.82	.146	2.26	.105
.52	.046	.96	.400	1.40	.105	1.84	.134	2.28	
.54	.044	.98	.419	1.42	.086	1.86	.117	2.30	
.56	.038	1.00	.425	1.44	.077	1.88	.074	2.32	
.58	.032	1.02	.425	1.46	.083	1.90	.037	2.34	
.60	.027	1.04	.426	1.48	.097	1.92	.032	2.36	
.62	.022	1.06	.422	1.50	.123	1.94	.031	2.38	
.64	.022	1.08	.412	1.52	.140	1.96	.035	2.40	
.66	.036	1.10	.386	1.54	.155	1.98	.040	2.42	
.68	.061	1.12	.374	1.56	.164	2.00	.045	2.44	
.70	.180	1.14	.354	1.58	.177	2.02	.052	2.46	
.72	.365	1.16	.350	1.60	.184	2.04	.055	2.48	

NO.74 - RED FESCUE GRASS



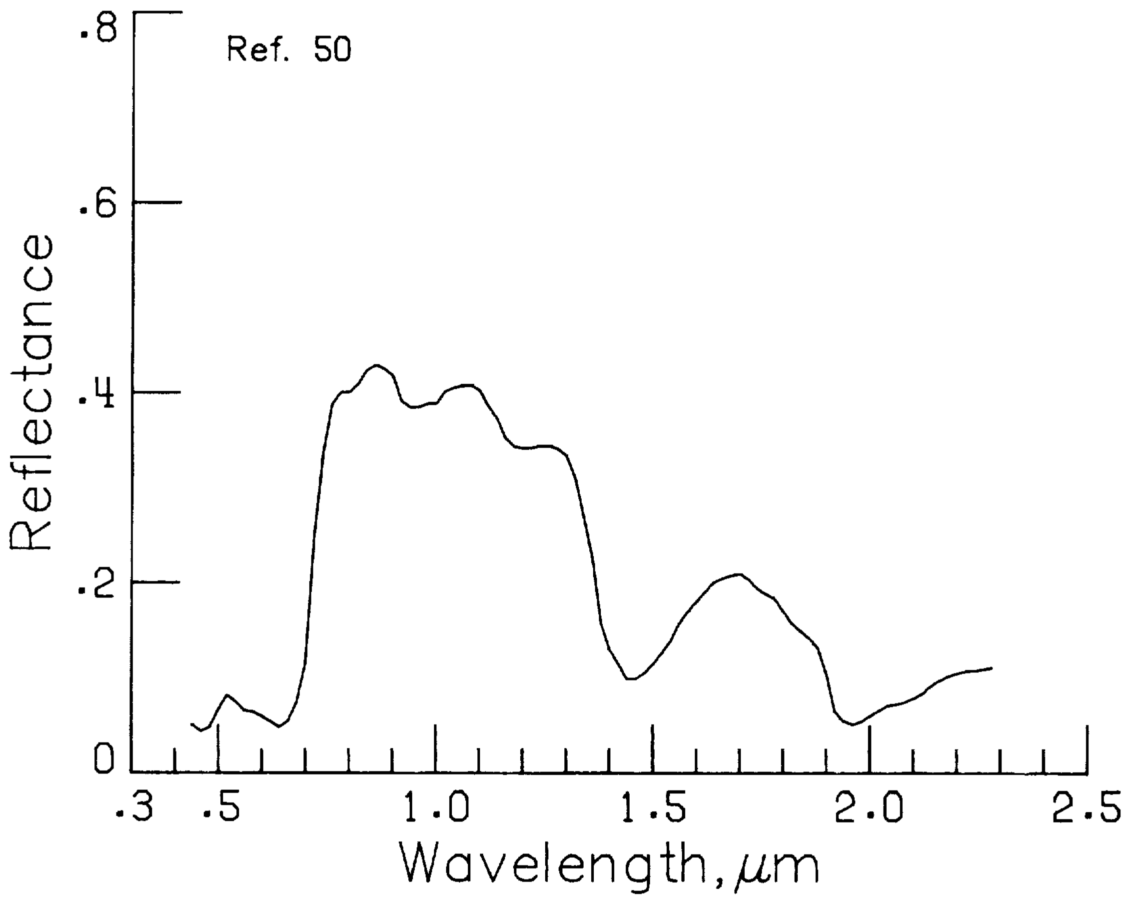
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.407	1.18	.383	1.62	.230	2.06	.085
.32		.76	.433	1.20	.383	1.64	.231	2.08	.091
.34		.78	.434	1.22	.382	1.66	.231	2.10	.097
.36		.80	.437	1.24	.379	1.68	.222	2.12	.104
.38		.82	.456	1.26	.377	1.70	.215	2.14	.111
.40		.84	.464	1.28	.371	1.72	.210	2.16	.116
.42		.86	.461	1.30	.358	1.74	.202	2.18	.122
.44	.035	.88	.455	1.32	.329	1.76	.170	2.20	.128
.46	.036	.90	.451	1.34	.226	1.78	.171	2.22	.131
.48	.042	.92	.410	1.36	.179	1.80	.163	2.24	.132
.50	.067	.94	.409	1.38	.147	1.82	.145	2.26	.131
.52	.079	.96	.424	1.40	.131	1.84	.116	2.28	
.54	.069	.98	.432	1.42	.128	1.86	.074	2.30	
.56	.057	1.00	.438	1.44	.131	1.88	.057	2.32	
.58	.055	1.02	.439	1.46	.142	1.90	.049	2.34	
.60	.046	1.04	.441	1.48	.152	1.92	.049	2.36	
.62	.045	1.06	.443	1.50	.158	1.94	.052	2.38	
.64	.048	1.08	.439	1.52	.166	1.96	.056	2.40	
.66	.063	1.10	.416	1.54	.178	1.98	.061	2.42	
.68	.128	1.12	.394	1.56	.193	2.00	.067	2.44	
.70	.268	1.14	.388	1.58	.209	2.02	.075	2.46	
.72	.379	1.16	.383	1.60	.223	2.04	.081	2.48	

NO.75 - BLUE GRAMA GRASS



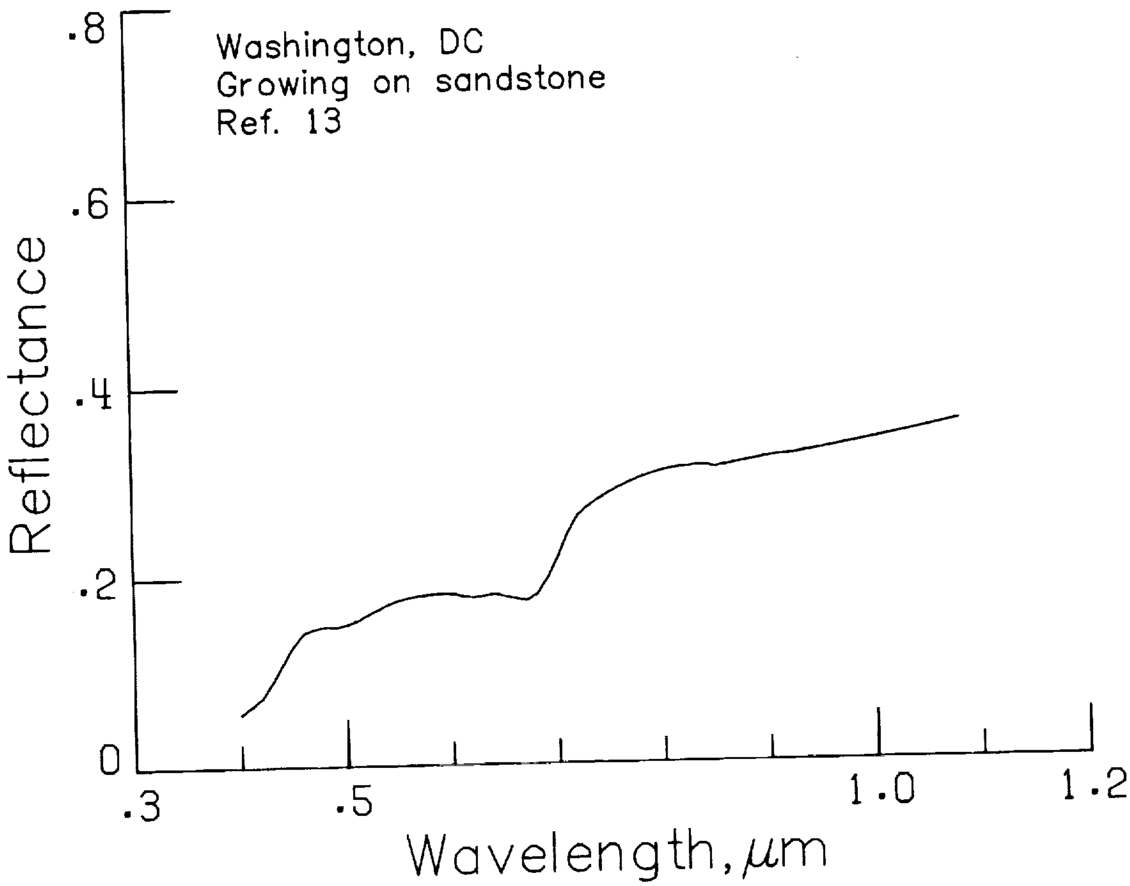
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.063	.66	.074	.84	.309	1.02	
.31		.49	.070	.67	.073	.85	.310	1.03	
.32		.50	.077	.68	.079	.86	.310	1.04	
.33		.51	.085	.69	.121	.87	.311	1.05	
.34		.52	.091	.70	.194	.88	.313	1.06	
.35	.033	.53	.097	.71	.267	.89	.314	1.07	
.36	.035	.54	.100	.72	.294	.90	.311	1.08	
.37	.037	.55	.100	.73	.304	.91	.311	1.09	
.38	.039	.56	.099	.74	.309	.92	.310	1.10	
.39	.041	.57	.097	.75	.311	.93	.309	1.11	
.40	.043	.58	.094	.76	.311	.94	.308	1.12	
.41	.045	.59	.092	.77	.311	.95	.308	1.13	
.42	.046	.60	.089	.78	.310	.96	.308	1.14	
.43	.045	.61	.085	.79	.311	.97	.309	1.15	
.44	.047	.62	.081	.80	.312	.98	.313	1.16	
.45	.050	.63	.079	.81	.310	.99	.313	1.17	
.46	.052	.64	.076	.82	.308	1.00	.312	1.18	
.47	.056	.65	.075	.83	.308	1.01		1.19	

NO.76 - PERENNIAL RYE GRASS



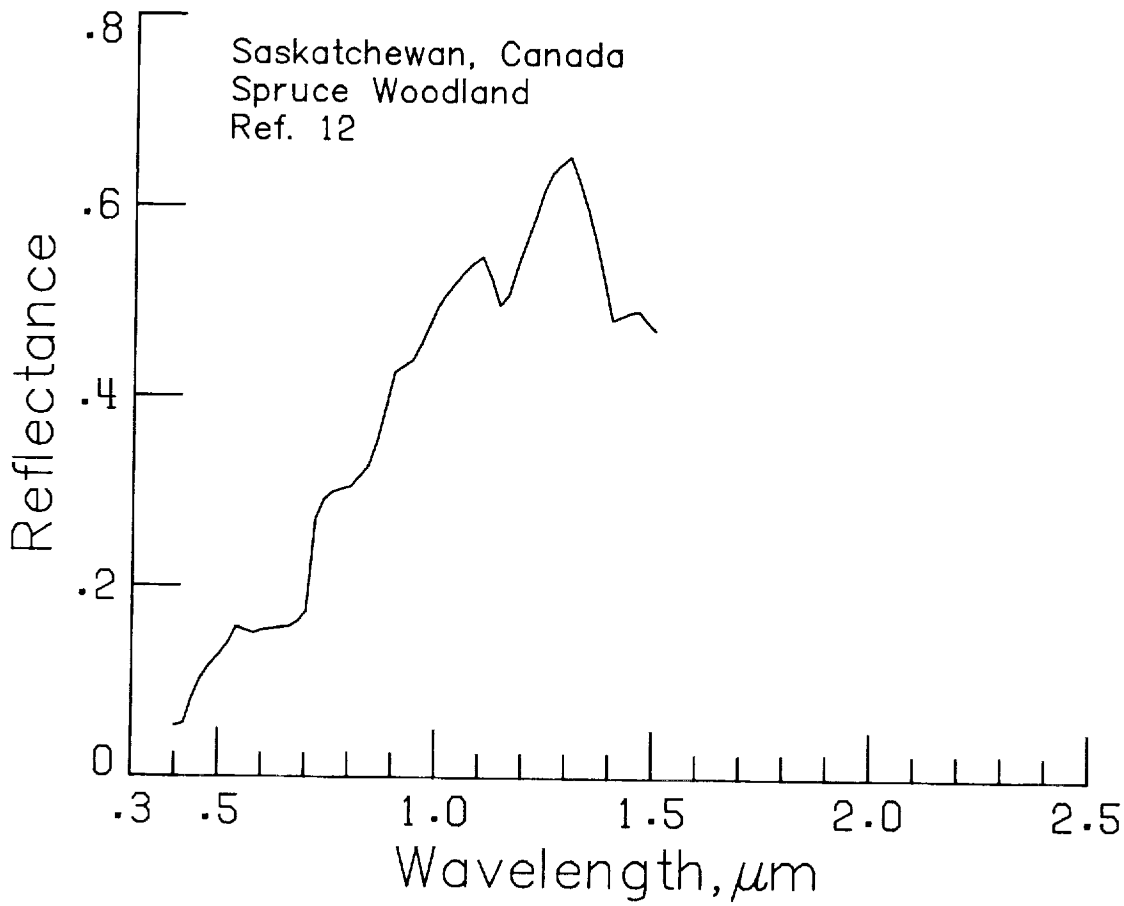
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.338	1.18	.343	1.62	.191	2.06	.072
.32		.76	.388	1.20	.342	1.64	.201	2.08	.075
.34		.78	.401	1.22	.342	1.66	.205	2.10	.079
.36		.80	.401	1.24	.344	1.68	.208	2.12	.083
.38		.82	.410	1.26	.344	1.70	.210	2.14	.092
.40		.84	.425	1.28	.341	1.72	.204	2.16	.098
.42		.86	.430	1.30	.334	1.74	.194	2.18	.102
.44	.050	.88	.425	1.32	.311	1.76	.188	2.20	.105
.46	.044	.90	.418	1.34	.270	1.78	.183	2.22	.107
.48	.048	.92	.391	1.36	.228	1.80	.170	2.24	.108
.50	.067	.94	.384	1.38	.158	1.82	.157	2.26	.109
.52	.082	.96	.385	1.40	.130	1.84	.149	2.28	.111
.54	.075	.98	.389	1.42	.115	1.86	.142	2.30	
.56	.065	1.00	.389	1.44	.099	1.88	.132	2.32	
.58	.064	1.02	.402	1.46	.099	1.90	.105	2.34	
.60	.059	1.04	.406	1.48	.105	1.92	.064	2.36	
.62	.054	1.06	.408	1.50	.115	1.94	.054	2.38	
.64	.048	1.08	.408	1.52	.126	1.96	.051	2.40	
.66	.055	1.10	.402	1.54	.139	1.98	.054	2.42	
.68	.074	1.12	.386	1.56	.158	2.00	.060	2.44	
.70	.116	1.14	.373	1.58	.170	2.02	.065	2.46	
.72	.252	1.16	.352	1.60	.181	2.04	.071	2.48	

NO.77 - DRY LICHEN SAMPLE



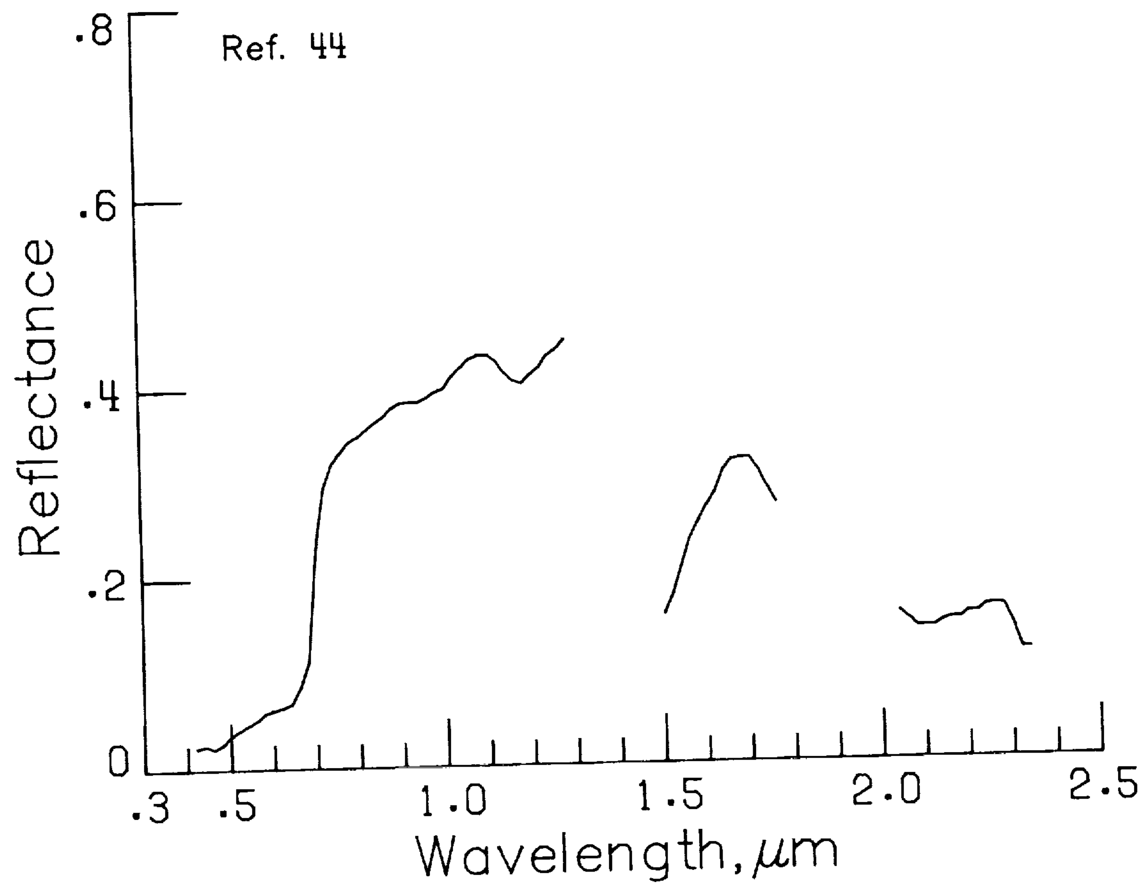
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.148	.66	.175	.84	.312	1.02	.342
.31		.49	.147	.67	.173	.85	.310	1.03	.345
.32		.50	.150	.68	.179	.86	.312	1.04	.347
.33		.51	.154	.69	.195	.87	.314	1.05	.349
.34		.52	.160	.70	.217	.88	.316	1.06	.351
.35		.53	.165	.71	.243	.89	.318	1.07	.354
.36		.54	.171	.72	.261	.90	.320	1.08	.356
.37		.55	.175	.73	.271	.91	.322	1.09	
.38		.56	.177	.74	.278	.92	.322	1.10	
.39		.57	.179	.75	.285	.93	.324	1.11	
.40	.057	.58	.180	.76	.291	.94	.326	1.12	
.41	.065	.59	.181	.77	.296	.95	.328	1.13	
.42	.074	.60	.181	.78	.300	.96	.330	1.14	
.43	.091	.61	.178	.79	.304	.97	.332	1.15	
.44	.110	.62	.177	.80	.307	.98	.334	1.16	
.45	.129	.63	.178	.81	.309	.99	.336	1.17	
.46	.142	.64	.180	.82	.311	1.00	.338	1.18	
.47	.146	.65	.177	.83	.312	1.01	.340	1.19	

NO.78 - LICHEN MAT



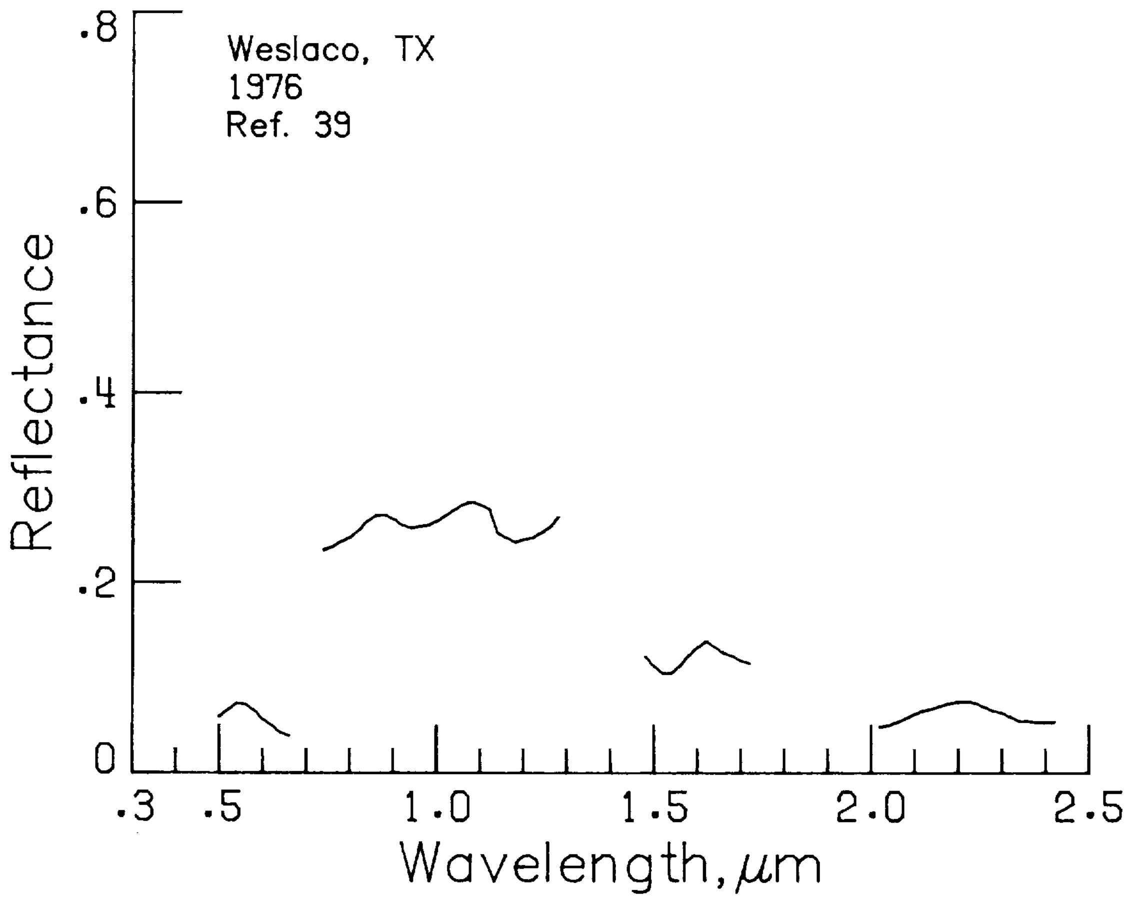
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.293	1.18	.537	1.62		2.06	
.32		.76	.300	1.20	.563	1.64		2.08	
.34		.78	.303	1.22	.588	1.66		2.10	
.36		.80	.306	1.24	.618	1.68		2.12	
.38		.82	.316	1.26	.637	1.70		2.14	
.40	.053	.84	.327	1.28	.646	1.72		2.16	
.42	.055	.86	.352	1.30	.653	1.74		2.18	
.44	.084	.88	.389	1.32	.628	1.76		2.20	
.46	.105	.90	.426	1.34	.600	1.78		2.22	
.48	.118	.92	.433	1.36	.566	1.80		2.24	
.50	.128	.94	.439	1.38	.525	1.82		2.26	
.52	.140	.96	.456	1.40	.481	1.84		2.28	
.54	.158	.98	.477	1.42	.486	1.86		2.30	
.56	.154	1.00	.497	1.44	.490	1.88		2.32	
.58	.151	1.02	.510	1.46	.491	1.90		2.34	
.60	.155	1.04	.522	1.48	.480	1.92		2.36	
.62	.156	1.06	.533	1.50	.471	1.94		2.38	
.64	.157	1.08	.541	1.52		1.96		2.40	
.66	.158	1.10	.547	1.54		1.98		2.42	
.68	.163	1.12	.526	1.56		2.00		2.44	
.70	.174	1.14	.497	1.58		2.02		2.46	
.72	.272	1.16	.508	1.60		2.04		2.48	

NO.79 - MANZANITA



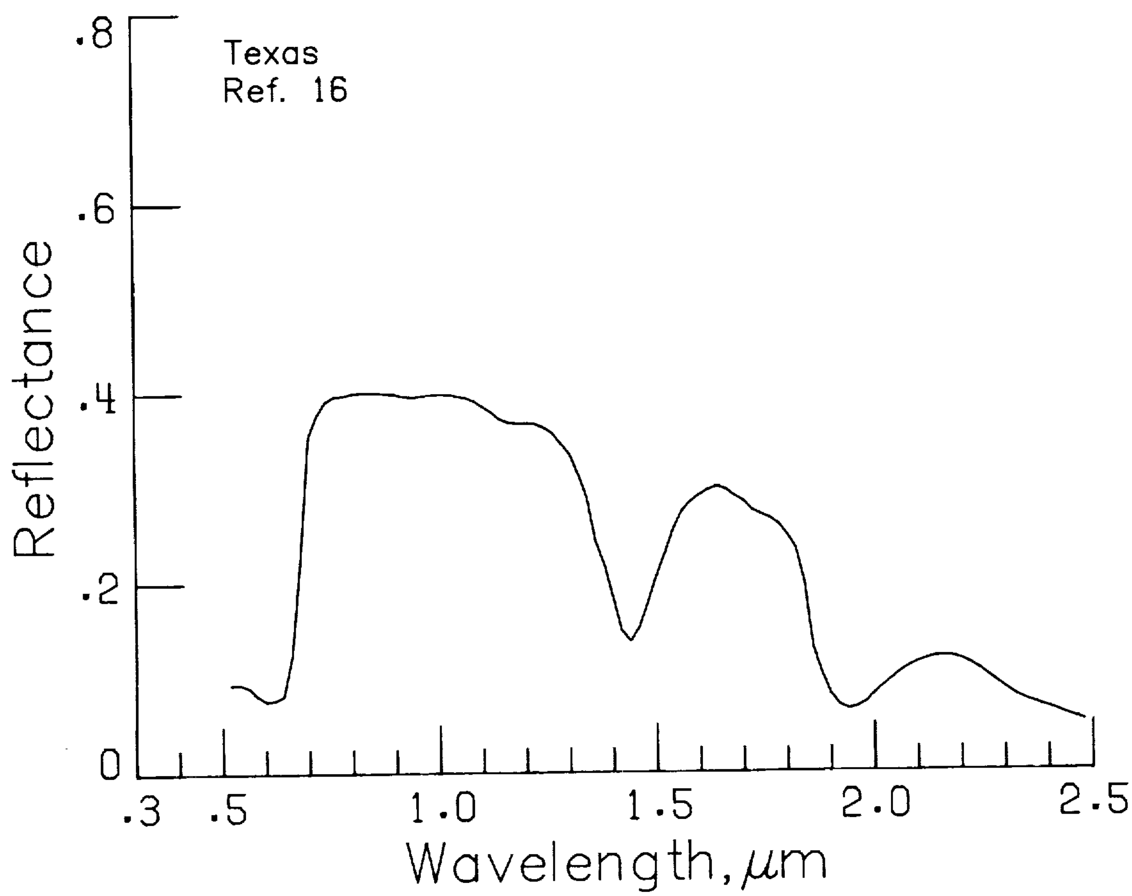
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.322	1.18	.402	1.62	.284	2.06	.147
.32		.76	.333	1.20	.411	1.64	.308	2.08	.138
.34		.78	.344	1.22	.418	1.66	.319	2.10	.139
.36		.80	.349	1.24	.432	1.68	.320	2.12	.139
.38		.82	.356	1.26	.437	1.70	.321	2.14	.144
.40		.84	.364	1.28	.447	1.72	.307	2.16	.147
.42	.024	.86	.370	1.30		1.74	.289	2.18	.147
.44	.026	.88	.379	1.32		1.76	.272	2.20	.153
.46	.022	.90	.384	1.34		1.78		2.22	.153
.48	.027	.92	.385	1.36		1.80		2.24	.160
.50	.037	.94	.385	1.38		1.82		2.26	.161
.52	.042	.96	.389	1.40		1.84		2.28	.159
.54	.047	.98	.395	1.42		1.86		2.30	.140
.56	.052	1.00	.398	1.44		1.88		2.32	.114
.58	.060	1.02	.411	1.46		1.90		2.34	.114
.60	.063	1.04	.420	1.48		1.92		2.36	
.62	.066	1.06	.429	1.50	.156	1.94		2.38	
.64	.069	1.08	.432	1.52	.177	1.96		2.40	
.66	.086	1.10	.433	1.54	.207	1.98		2.42	
.68	.112	1.12	.426	1.56	.236	2.00		2.44	
.70	.233	1.14	.413	1.58	.253	2.02		2.46	
.72	.296	1.16	.405	1.60	.270	2.04	.154	2.48	

NO.80 - MESQUITE



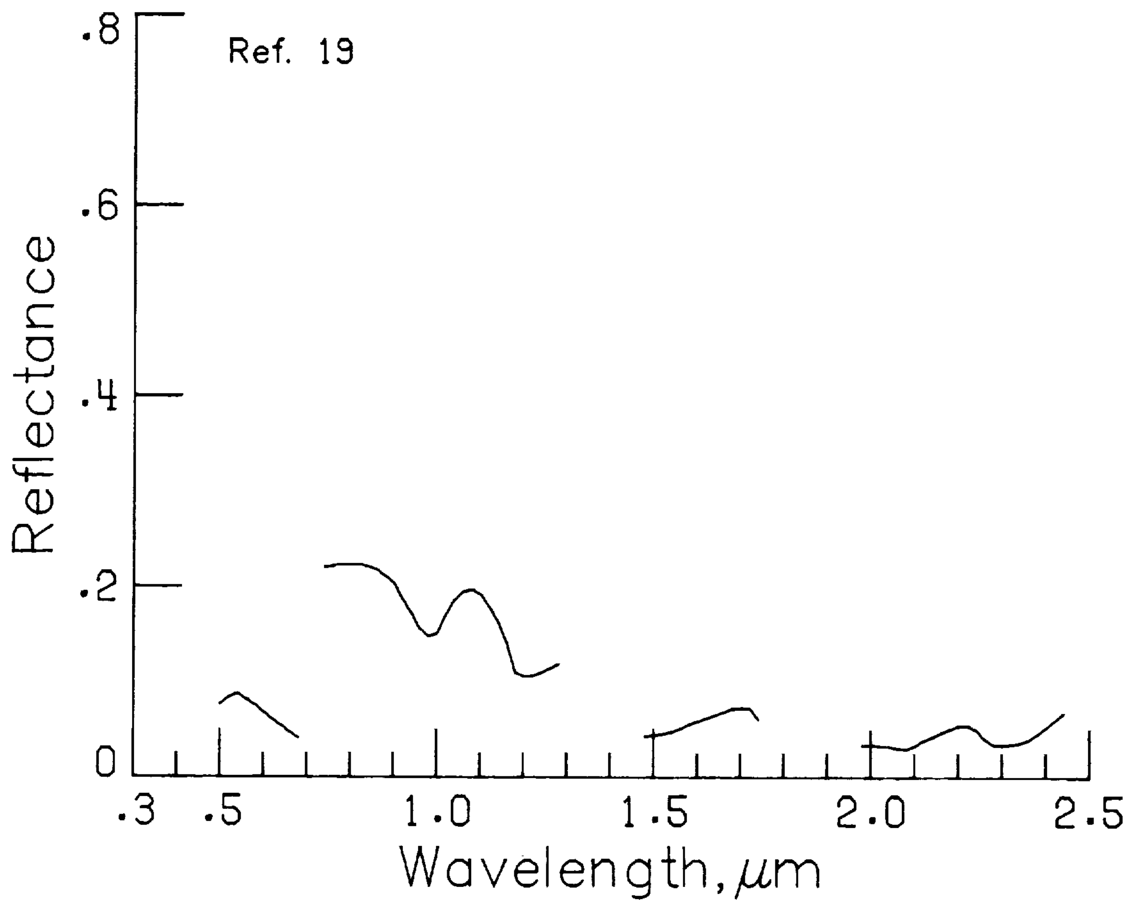
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.235	1.18	.243	1.62	.139	2.06	.053
.32		.76	.238	1.20	.246	1.64	.132	2.08	.058
.34		.78	.244	1.22	.248	1.66	.126	2.10	.062
.36		.80	.248	1.24	.253	1.68	.123	2.12	.066
.38		.82	.256	1.26	.259	1.70	.118	2.14	.068
.40		.84	.265	1.28	.270	1.72	.116	2.16	.071
.42		.86	.271	1.30		1.74		2.18	.074
.44		.88	.272	1.32		1.76		2.20	.075
.46		.90	.267	1.34		1.78		2.22	.076
.48		.92	.261	1.36		1.80		2.24	.074
.50	.059	.94	.258	1.38		1.82		2.26	.069
.52	.067	.96	.260	1.40		1.84		2.28	.065
.54	.073	.98	.261	1.42		1.86		2.30	.063
.56	.072	1.00	.265	1.44		1.88		2.32	.059
.58	.066	1.02	.271	1.46		1.90		2.34	.054
.60	.056	1.04	.277	1.48	.122	1.92		2.36	.055
.62	.050	1.06	.283	1.50	.112	1.94		2.38	.053
.64	.042	1.08	.285	1.52	.105	1.96		2.40	.053
.66	.039	1.10	.282	1.54	.105	1.98		2.42	.053
.68		1.12	.278	1.56	.113	2.00		2.44	
.70		1.14	.252	1.58	.124	2.02	.048	2.46	
.72		1.16	.248	1.60	.133	2.04	.050	2.48	

NO.81 - HONEY MESQUITE



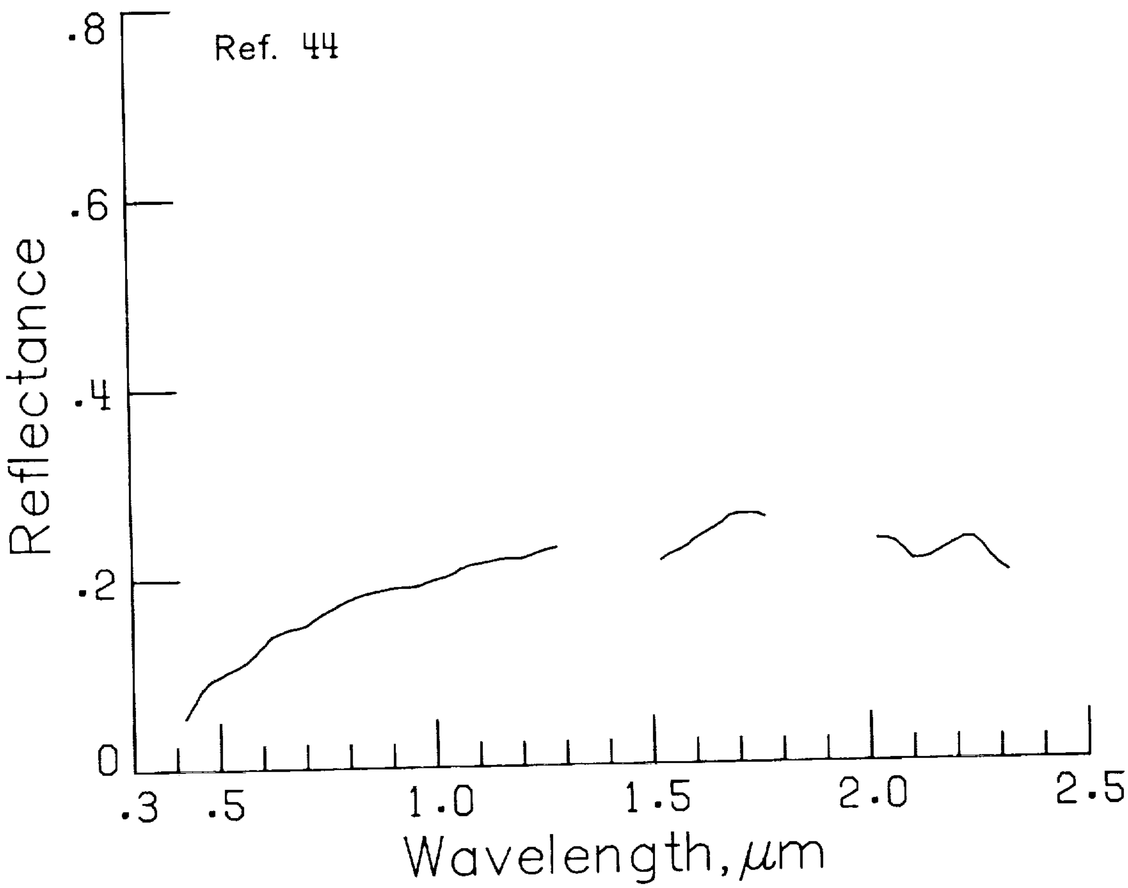
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.392	1.18	.367	1.62	.297	2.06	.104
.32		.76	.397	1.20	.367	1.64	.300	2.08	.110
.34		.78	.397	1.22	.367	1.66	.297	2.10	.114
.36		.80	.399	1.24	.363	1.68	.290	2.12	.117
.38		.82	.400	1.26	.358	1.70	.285	2.14	.119
.40		.84	.400	1.28	.346	1.72	.275	2.16	.120
.42		.86	.400	1.30	.335	1.74	.270	2.18	.119
.44		.88	.399	1.32	.314	1.76	.266	2.20	.116
.46		.90	.398	1.34	.289	1.78	.260	2.22	.112
.48		.92	.396	1.36	.242	1.80	.248	2.24	.106
.50		.94	.395	1.38	.218	1.82	.234	2.26	.099
.52	.093	.96	.397	1.40	.183	1.84	.198	2.28	.092
.54	.094	.98	.397	1.42	.148	1.86	.129	2.30	.085
.56	.090	1.00	.398	1.44	.137	1.88	.101	2.32	.079
.58	.081	1.02	.398	1.46	.151	1.90	.080	2.34	.074
.60	.076	1.04	.396	1.48	.177	1.92	.068	2.36	.071
.62	.077	1.06	.395	1.50	.206	1.94	.065	2.38	.067
.64	.082	1.08	.391	1.52	.230	1.96	.067	2.40	.065
.66	.126	1.10	.385	1.54	.256	1.98	.072	2.42	.061
.68	.229	1.12	.380	1.56	.275	2.00	.081	2.44	.057
.70	.355	1.14	.372	1.58	.285	2.02	.089	2.46	.054
.72	.378	1.16	.368	1.60	.291	2.04	.097	2.48	.051

NO.82 - PRICKLY PEAR



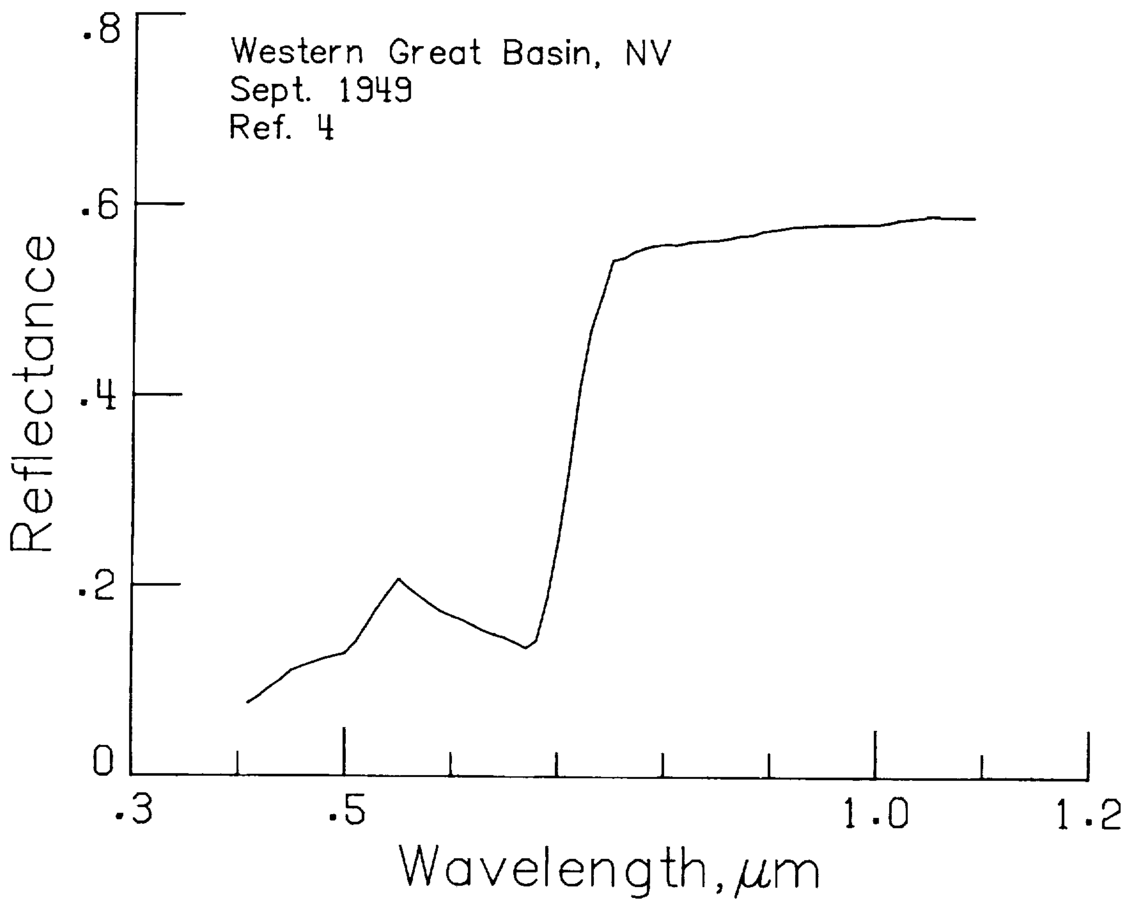
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.221	1.18	.110	1.62	.063	2.06	.031
.32		.76	.222	1.20	.106	1.64	.066	2.08	.030
.34		.78	.223	1.22	.107	1.66	.069	2.10	.034
.36		.80	.223	1.24	.110	1.68	.073	2.12	.039
.38		.82	.223	1.26	.115	1.70	.073	2.14	.043
.40		.84	.222	1.28	.119	1.72	.073	2.16	.047
.42		.86	.218	1.30		1.74	.061	2.18	.051
.44		.88	.211	1.32		1.76		2.20	.055
.46		.90	.204	1.34		1.78		2.22	.055
.48		.92	.187	1.36		1.80		2.24	.051
.50	.077	.94	.173	1.38		1.82		2.26	.041
.52	.084	.96	.156	1.40		1.84		2.28	.035
.54	.088	.98	.148	1.42		1.86		2.30	.035
.56	.082	1.00	.151	1.44		1.88		2.32	.035
.58	.076	1.02	.171	1.46		1.90		2.34	.037
.60	.068	1.04	.186	1.48	.043	1.92		2.36	.040
.62	.061	1.06	.195	1.50	.045	1.94		2.38	.046
.64	.054	1.08	.197	1.52	.046	1.96		2.40	.053
.66	.047	1.10	.192	1.54	.048	1.98	.034	2.42	.060
.68	.041	1.12	.179	1.56	.052	2.00	.035	2.44	.067
.70		1.14	.163	1.58	.056	2.02	.033	2.46	
.72		1.16	.141	1.60	.059	2.04	.033	2.48	

NO.83 - DRY SAGE



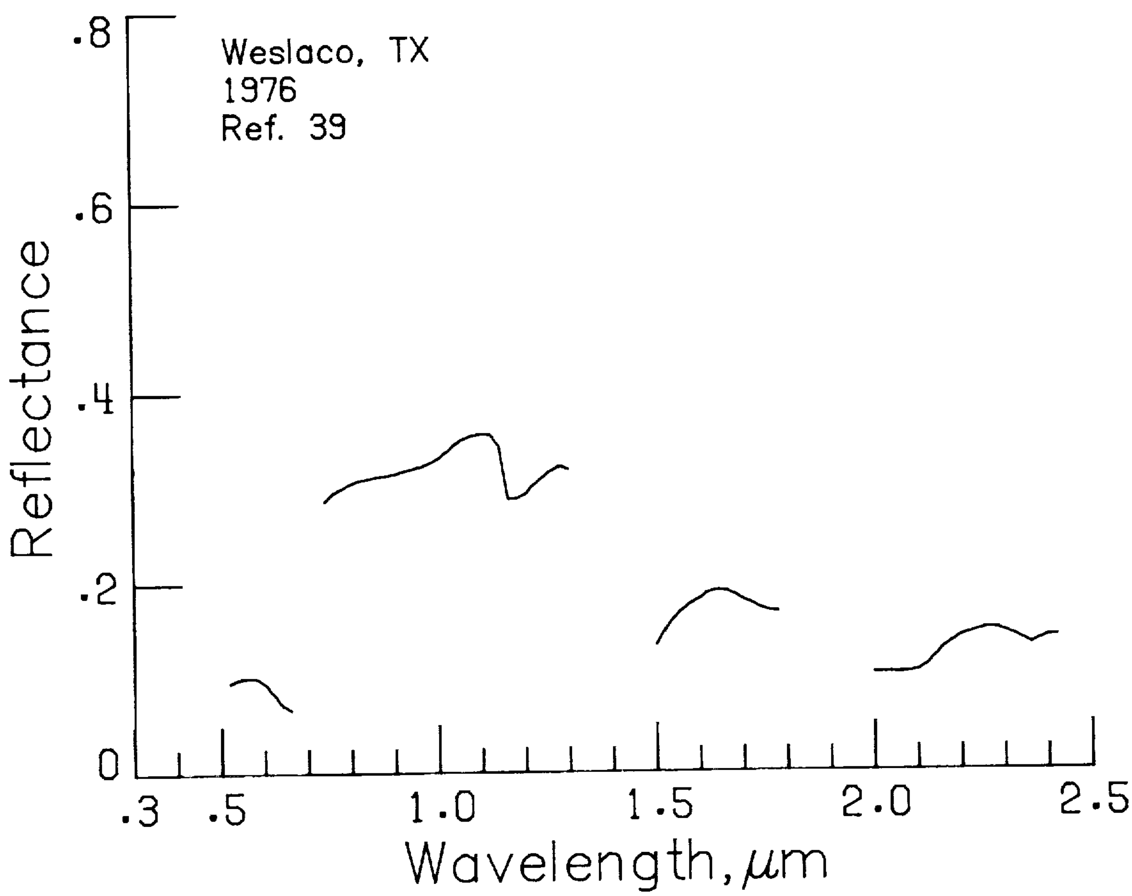
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.163	1.18	.219	1.62	.242	2.06	.230
.32		.76	.168	1.20	.219	1.64	.247	2.08	.222
.34		.78	.173	1.22	.222	1.66	.253	2.10	.212
.36		.80	.177	1.24	.225	1.68	.260	2.12	.212
.38		.82	.181	1.26	.228	1.70	.262	2.14	.214
.40		.84	.184	1.28	.230	1.72	.262	2.16	.219
.42	.055	.86	.185	1.30		1.74	.262	2.18	.224
.44	.070	.88	.187	1.32		1.76	.259	2.20	.229
.46	.086	.90	.189	1.34		1.78		2.22	.234
.48	.094	.92	.190	1.36		1.80		2.24	.234
.50	.098	.94	.190	1.38		1.82		2.26	.226
.52	.104	.96	.191	1.40		1.84		2.28	.213
.54	.108	.98	.195	1.42		1.86		2.30	.204
.56	.113	1.00	.198	1.44		1.88		2.32	.198
.58	.121	1.02	.200	1.46		1.90		2.34	
.60	.130	1.04	.204	1.48		1.92		2.36	
.62	.140	1.06	.209	1.50		1.94		2.38	
.64	.143	1.08	.212	1.52	.214	1.96		2.40	
.66	.147	1.10	.214	1.54	.221	1.98		2.42	
.68	.149	1.12	.215	1.56	.224	2.00		2.44	
.70	.151	1.14	.217	1.58	.229	2.02	.234	2.46	
.72	.158	1.16	.219	1.60	.237	2.04	.233	2.48	

NO.84 - AVERAGE SUBALPINE SLOPE LEAVES



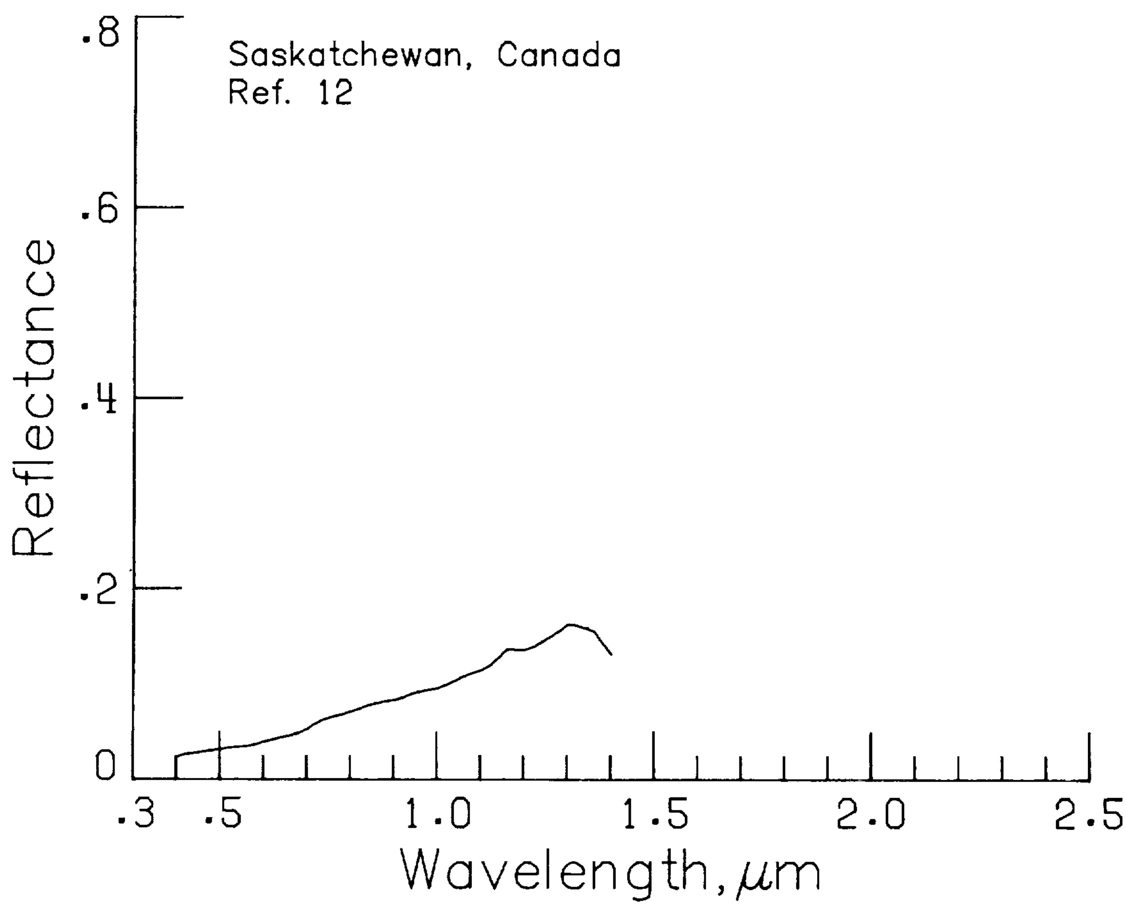
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.124	.66	.141	.84	.564	1.02	.586
.31		.49	.127	.67	.136	.85	.565	1.03	.588
.32		.50	.130	.68	.143	.86	.567	1.04	.589
.33		.51	.141	.69	.187	.87	.570	1.05	.590
.34		.52	.159	.70	.248	.88	.570	1.06	.589
.35		.53	.177	.71	.323	.89	.574	1.07	.589
.36		.54	.193	.72	.411	.90	.576	1.08	.589
.37		.55	.207	.73	.471	.91	.577	1.09	.589
.38		.56	.197	.74	.505	.92	.579	1.10	
.39		.57	.189	.75	.543	.93	.579	1.11	
.40		.58	.181	.76	.546	.94	.580	1.12	
.41	.077	.59	.174	.77	.553	.95	.581	1.13	
.42	.084	.60	.169	.78	.556	.96	.581	1.14	
.43	.094	.61	.165	.79	.559	.97	.581	1.15	
.44	.101	.62	.159	.80	.561	.98	.582	1.16	
.45	.111	.63	.154	.81	.560	.99	.582	1.17	
.46	.116	.64	.149	.82	.562	1.00	.582	1.18	
.47	.120	.65	.146	.83	.564	1.01	.584	1.19	

NO.85 - SILVERLEAF SUNFLOWER



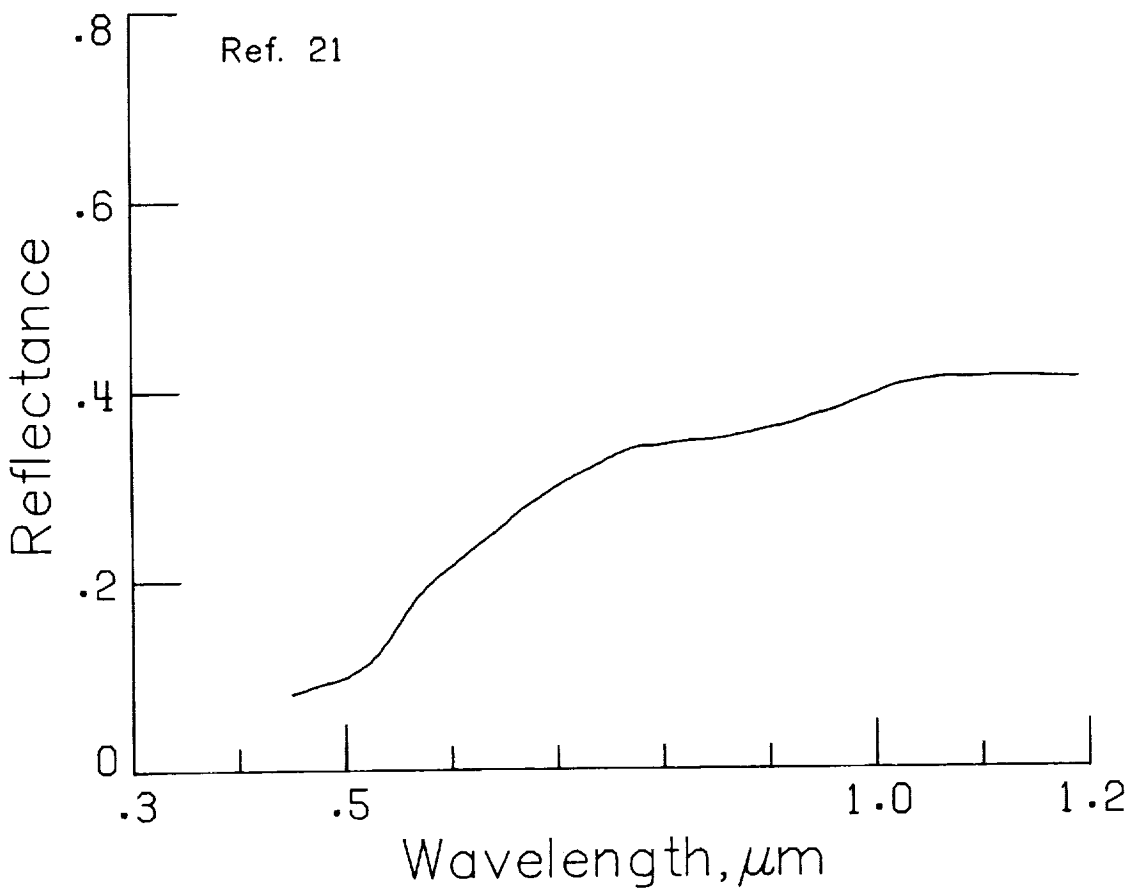
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.287	1.18	.288	1.62	.189	2.06	.103
.32		.76	.295	1.20	.293	1.64	.191	2.08	.103
.34		.78	.300	1.22	.303	1.66	.190	2.10	.105
.36		.80	.305	1.24	.311	1.68	.186	2.12	.110
.38		.82	.309	1.26	.318	1.70	.180	2.14	.120
.40		.84	.310	1.28	.322	1.72	.177	2.16	.130
.42		.86	.312	1.30	.319	1.74	.172	2.18	.135
.44		.88	.313	1.32		1.76	.169	2.20	.141
.46		.90	.315	1.34		1.78	.168	2.22	.144
.48		.92	.318	1.36		1.80		2.24	.147
.50		.94	.320	1.38		1.82		2.26	.149
.52	.096	.96	.322	1.40		1.84		2.28	.149
.54	.100	.98	.326	1.42		1.86		2.30	.145
.56	.101	1.00	.331	1.44		1.88		2.32	.142
.58	.101	1.02	.338	1.46		1.90		2.34	.137
.60	.095	1.04	.346	1.48		1.92		2.36	.132
.62	.084	1.06	.352	1.50	.134	1.94		2.38	.137
.64	.072	1.08	.355	1.52	.149	1.96		2.40	.140
.66	.067	1.10	.357	1.54	.161	1.98		2.42	.141
.68		1.12	.356	1.56	.170	2.00	.103	2.44	
.70		1.14	.344	1.58	.177	2.02	.103	2.46	
.72		1.16	.288	1.60	.182	2.04	.103	2.48	

NO.86 - BURNED FOREST SURFACE



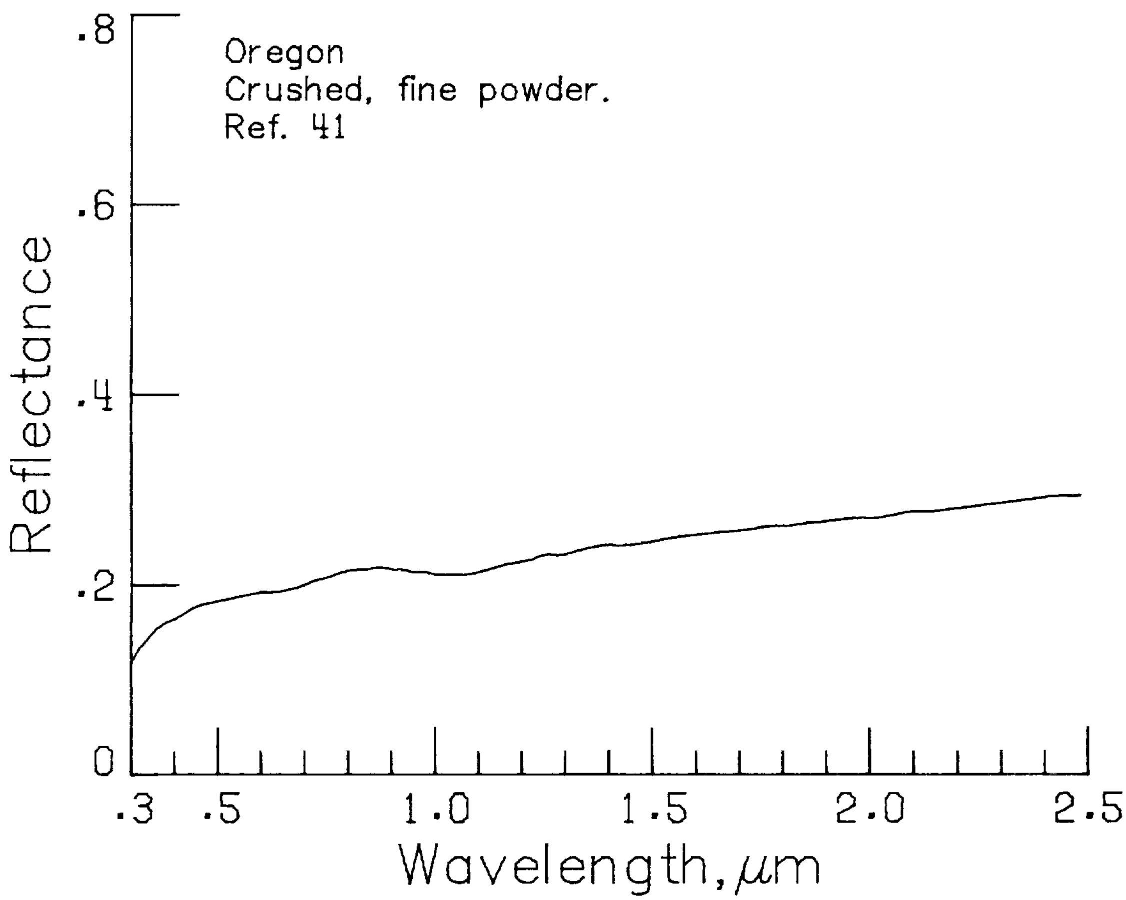
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.063	1.18	.137	1.62		2.06	
.32		.76	.066	1.20	.136	1.64		2.08	
.34		.78	.068	1.22	.140	1.66		2.10	
.36		.80	.071	1.24	.145	1.68		2.12	
.38		.82	.074	1.26	.150	1.70		2.14	
.40	.023	.84	.078	1.28	.156	1.72		2.16	
.42	.026	.86	.080	1.30	.163	1.74		2.18	
.44	.028	.88	.082	1.32	.162	1.76		2.20	
.46	.029	.90	.083	1.34	.159	1.78		2.22	
.48	.030	.92	.086	1.36	.156	1.80		2.24	
.50	.032	.94	.090	1.38	.143	1.82		2.26	
.52	.033	.96	.092	1.40	.132	1.84		2.28	
.54	.034	.98	.094	1.42		1.86		2.30	
.56	.035	1.00	.096	1.44		1.88		2.32	
.58	.037	1.02	.100	1.46		1.90		2.34	
.60	.040	1.04	.104	1.48		1.92		2.36	
.62	.042	1.06	.109	1.50		1.94		2.38	
.64	.044	1.08	.112	1.52		1.96		2.40	
.66	.046	1.10	.115	1.54		1.98		2.42	
.68	.049	1.12	.120	1.56		2.00		2.44	
.70	.053	1.14	.128	1.58		2.02		2.46	
.72	.059	1.16	.137	1.60		2.04		2.48	

NO.87 - ARKOSE



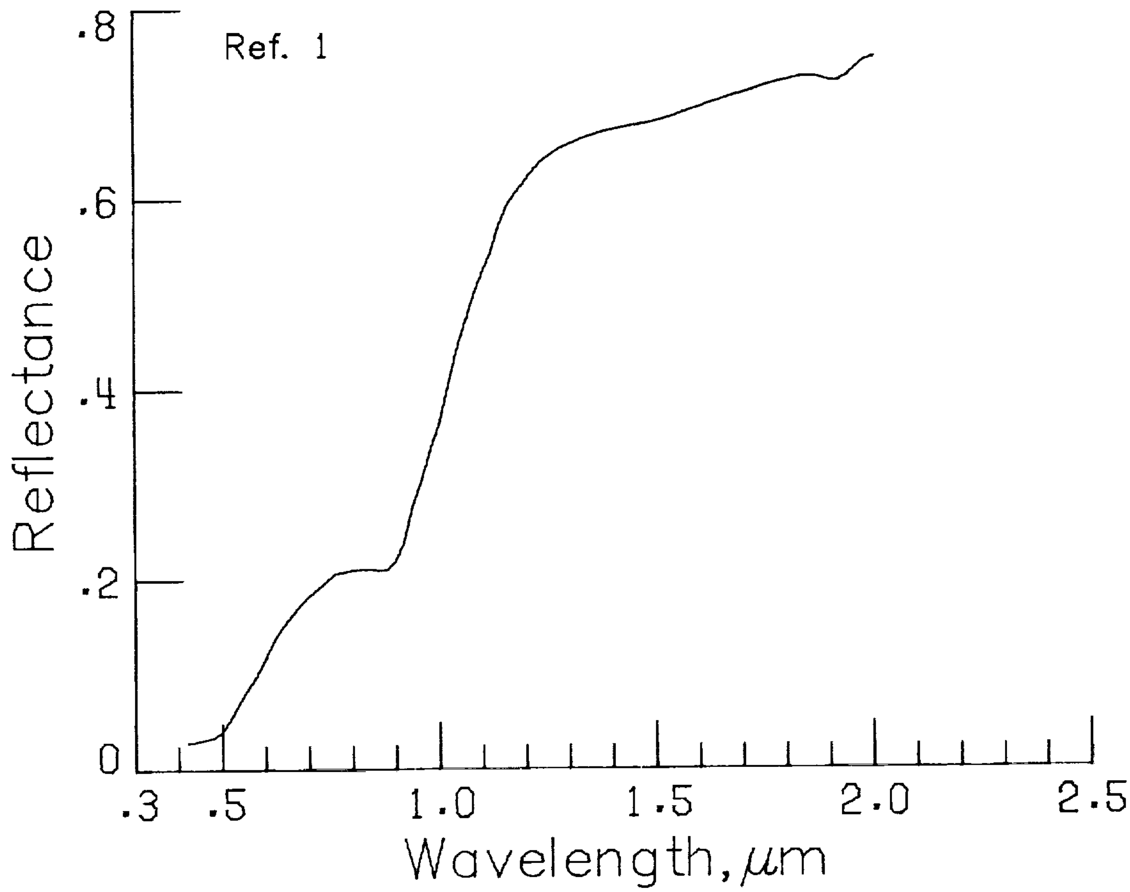
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.092	.66	.269	.84	.347	1.02	.404
.31		.49	.095	.67	.278	.85	.348	1.03	.406
.32		.50	.098	.68	.285	.86	.350	1.04	.408
.33		.51	.105	.69	.292	.87	.352	1.05	.409
.34		.52	.112	.70	.299	.88	.354	1.06	.411
.35		.53	.122	.71	.306	.89	.357	1.07	.411
.36		.54	.136	.72	.312	.90	.360	1.08	.410
.37		.55	.153	.73	.317	.91	.361	1.09	.411
.38		.56	.171	.74	.323	.92	.364	1.10	.411
.39		.57	.186	.75	.329	.93	.368	1.11	.412
.40		.58	.197	.76	.334	.94	.372	1.12	.412
.41		.59	.207	.77	.338	.95	.375	1.13	.412
.42		.60	.215	.78	.341	.96	.378	1.14	.412
.43		.61	.224	.79	.341	.97	.382	1.15	.412
.44		.62	.233	.80	.342	.98	.387	1.16	.411
.45	.082	.63	.242	.81	.344	.99	.391	1.17	.411
.46	.085	.64	.249	.82	.346	1.00	.395	1.18	.410
.47	.089	.65	.259	.83	.347	1.01	.400	1.19	.411

NO.88 - BASALT SAMPLE



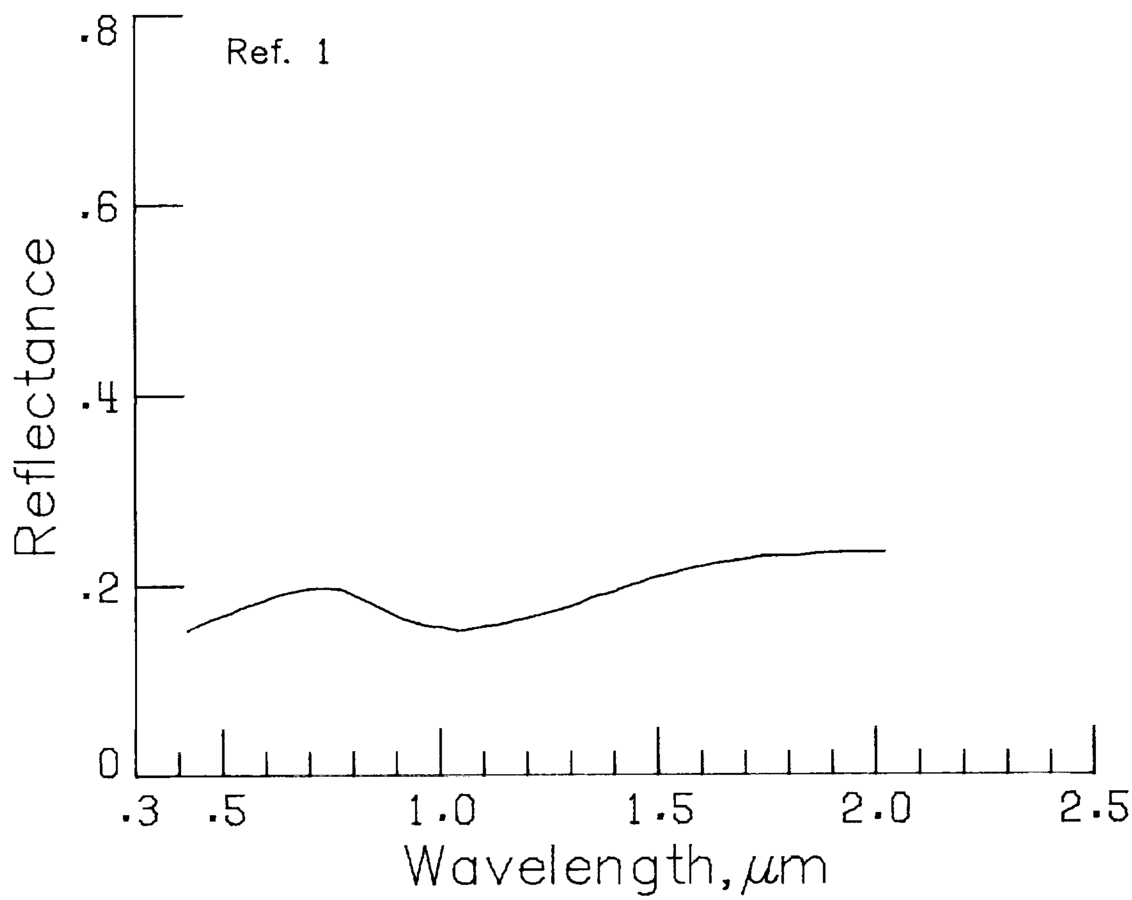
λ	R	λ	R	λ	R	λ	R	λ	R
.30	.119	.74	.207	1.18	.223	1.62	.254	2.06	.274
.32	.133	.76	.210	1.20	.225	1.64	.255	2.08	.276
.34	.145	.78	.213	1.22	.227	1.66	.255	2.10	.277
.36	.155	.80	.215	1.24	.231	1.68	.256	2.12	.276
.38	.161	.82	.216	1.26	.232	1.70	.257	2.14	.277
.40	.165	.84	.216	1.28	.231	1.72	.258	2.16	.278
.42	.170	.86	.218	1.30	.232	1.74	.259	2.18	.279
.44	.176	.88	.218	1.32	.235	1.76	.260	2.20	.280
.46	.180	.90	.216	1.34	.238	1.78	.261	2.22	.281
.48	.182	.92	.216	1.36	.240	1.80	.261	2.24	.283
.50	.184	.94	.214	1.38	.241	1.82	.262	2.26	.284
.52	.185	.96	.213	1.40	.242	1.84	.263	2.28	.285
.54	.187	.98	.213	1.42	.241	1.86	.264	2.30	.286
.56	.189	1.00	.211	1.44	.242	1.88	.266	2.32	.287
.58	.191	1.02	.211	1.46	.243	1.90	.267	2.34	.288
.60	.193	1.04	.211	1.48	.244	1.92	.268	2.36	.289
.62	.192	1.06	.211	1.50	.245	1.94	.269	2.38	.291
.64	.193	1.08	.212	1.52	.248	1.96	.270	2.40	.292
.66	.196	1.10	.214	1.54	.249	1.98	.270	2.42	.293
.68	.198	1.12	.216	1.56	.250	2.00	.270	2.44	.293
.70	.201	1.14	.219	1.58	.251	2.02	.271	2.46	.293
.72	.205	1.16	.222	1.60	.252	2.04	.272	2.48	.293

NO.89 - RED CINDER BASALT SAMPLE



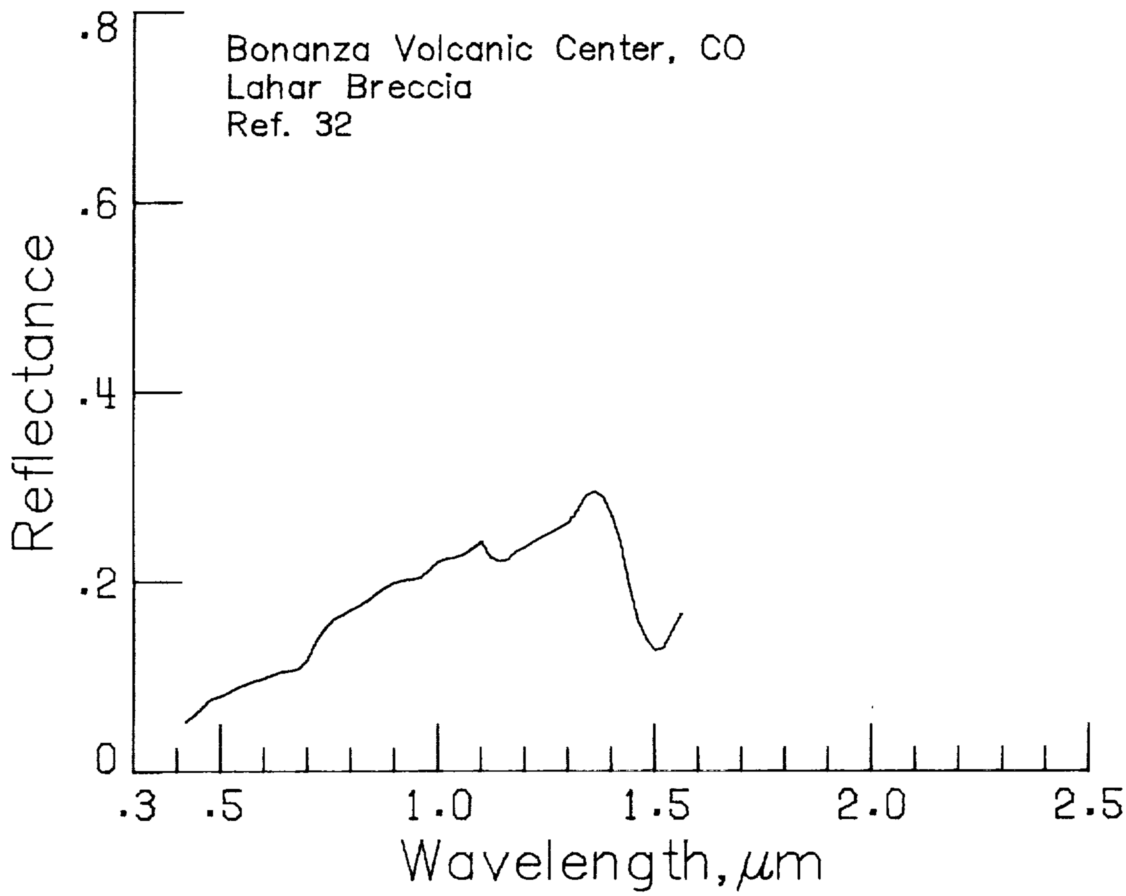
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.199	1.18	.608	1.62	.700	2.06	
.32		.76	.207	1.20	.620	1.64	.703	2.08	
.34		.78	.208	1.22	.632	1.66	.706	2.10	
.36		.80	.210	1.24	.641	1.68	.708	2.12	
.38		.82	.211	1.26	.647	1.70	.711	2.14	
.40		.84	.211	1.28	.653	1.72	.714	2.16	
.42	.029	.86	.210	1.30	.658	1.74	.717	2.18	
.44	.031	.88	.211	1.32	.662	1.76	.719	2.20	
.46	.033	.90	.220	1.34	.665	1.78	.722	2.22	
.48	.035	.92	.240	1.36	.668	1.80	.724	2.24	
.50	.041	.94	.279	1.38	.671	1.82	.726	2.26	
.52	.055	.96	.304	1.40	.673	1.84	.727	2.28	
.54	.072	.98	.337	1.42	.675	1.86	.728	2.30	
.56	.087	1.00	.364	1.44	.676	1.88	.725	2.32	
.58	.100	1.02	.401	1.46	.678	1.90	.723	2.34	
.60	.118	1.04	.439	1.48	.680	1.92	.723	2.36	
.62	.137	1.06	.470	1.50	.682	1.94	.729	2.38	
.64	.151	1.08	.498	1.52	.684	1.96	.737	2.40	
.66	.163	1.10	.523	1.54	.687	1.98	.745	2.42	
.68	.174	1.12	.544	1.56	.690	2.00	.747	2.44	
.70	.183	1.14	.573	1.58	.693	2.02		2.46	
.72	.191	1.16	.596	1.60	.696	2.04		2.48	

NO.90 - GRAY BASALT SAMPLE



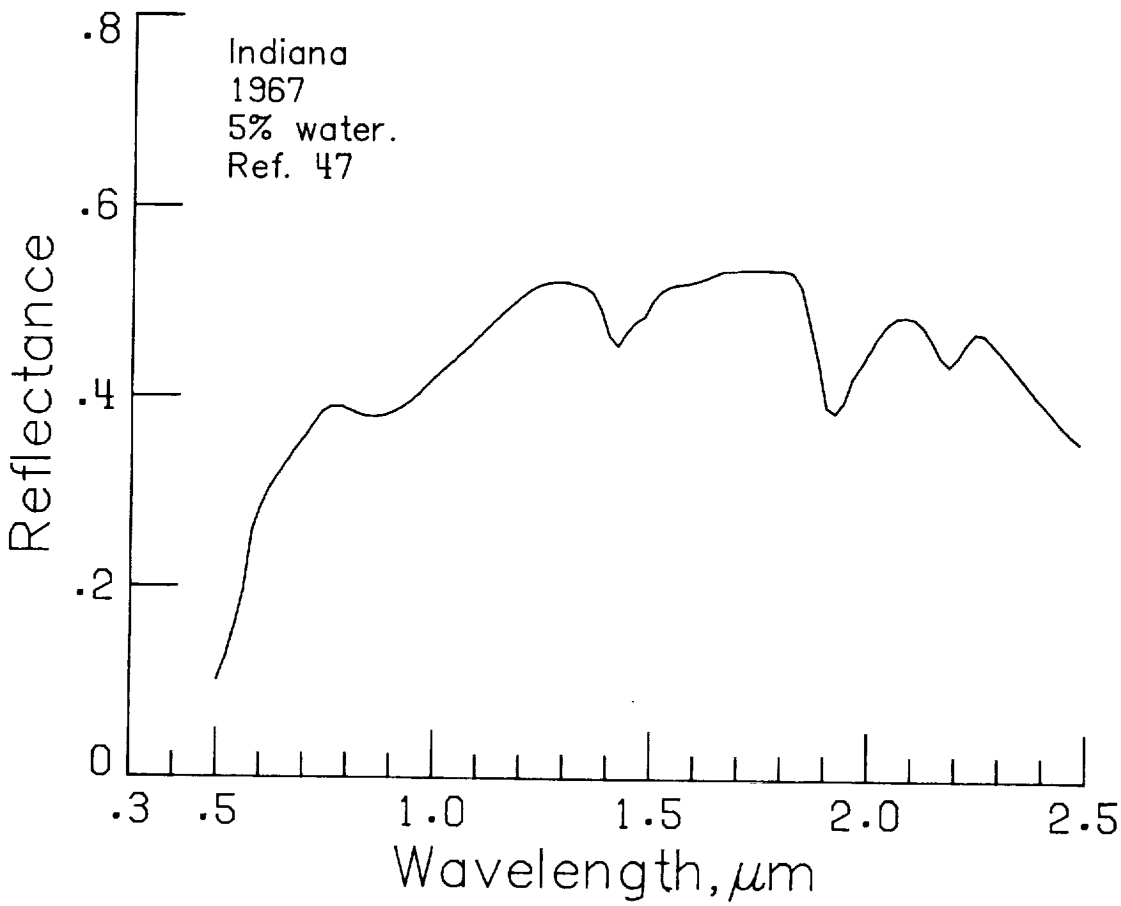
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.198	1.18	.164	1.62	.222	2.06	
.32		.76	.197	1.20	.167	1.64	.224	2.08	
.34		.78	.195	1.22	.169	1.66	.225	2.10	
.36		.80	.190	1.24	.172	1.68	.226	2.12	
.38		.82	.186	1.26	.174	1.70	.228	2.14	
.40		.84	.182	1.28	.176	1.72	.230	2.16	
.42	.153	.86	.177	1.30	.179	1.74	.231	2.18	
.44	.158	.88	.173	1.32	.182	1.76	.231	2.20	
.46	.162	.90	.168	1.34	.187	1.78	.231	2.22	
.48	.166	.92	.164	1.36	.190	1.80	.231	2.24	
.50	.169	.94	.161	1.38	.192	1.82	.231	2.26	
.52	.172	.96	.158	1.40	.195	1.84	.232	2.28	
.54	.177	.98	.157	1.42	.199	1.86	.233	2.30	
.56	.180	1.00	.157	1.44	.201	1.88	.234	2.32	
.58	.182	1.02	.155	1.46	.204	1.90	.234	2.34	
.60	.186	1.04	.153	1.48	.208	1.92	.235	2.36	
.62	.190	1.06	.154	1.50	.210	1.94	.234	2.38	
.64	.192	1.08	.156	1.52	.212	1.96	.234	2.40	
.66	.194	1.10	.157	1.54	.214	1.98	.234	2.42	
.68	.196	1.12	.158	1.56	.217	2.00	.234	2.44	
.70	.197	1.14	.160	1.58	.219	2.02	.234	2.46	
.72	.198	1.16	.162	1.60	.221	2.04		2.48	

NO.91 - BRECCIA



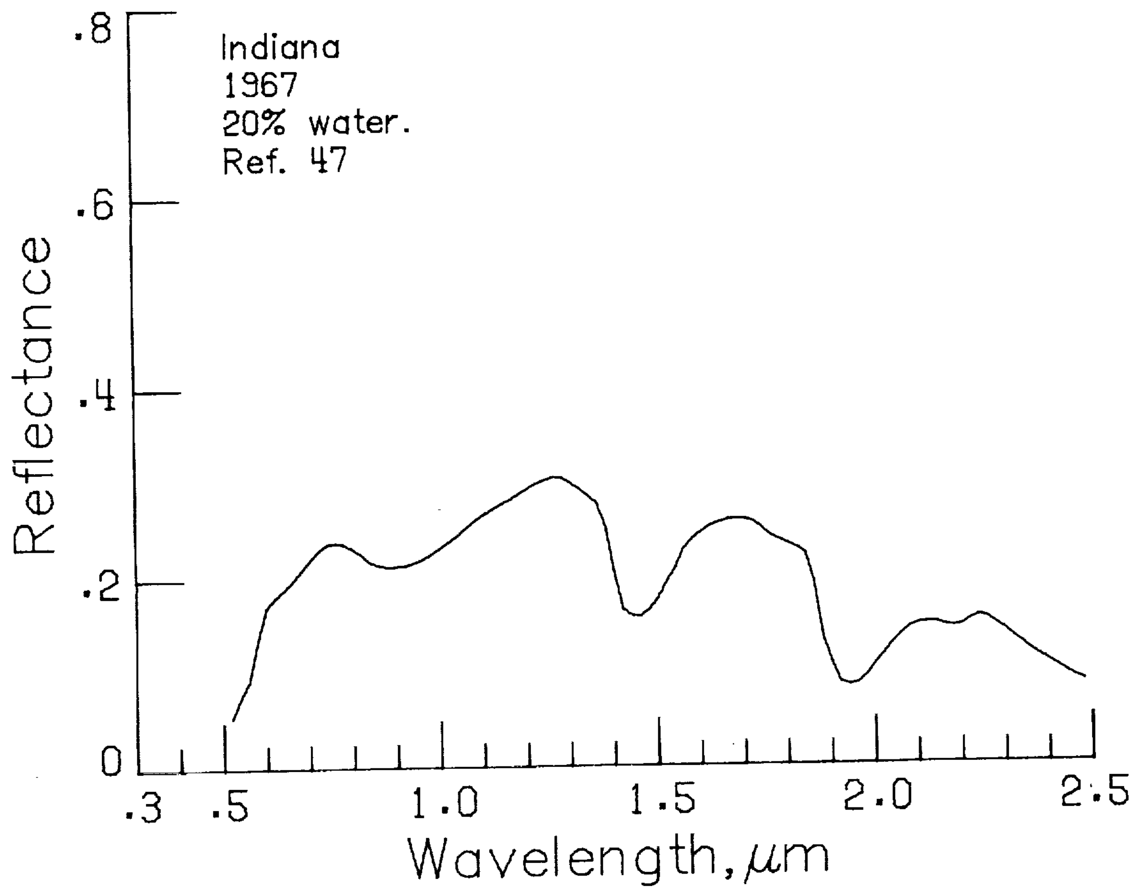
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.151	1.18	.232	1.62		2.06	
.32		.76	.160	1.20	.236	1.64		2.08	
.34		.78	.166	1.22	.242	1.66		2.10	
.36		.80	.171	1.24	.248	1.68		2.12	
.38		.82	.175	1.26	.252	1.70		2.14	
.40		.84	.181	1.28	.257	1.72		2.16	
.42	.053	.86	.188	1.30	.262	1.74		2.18	
.44	.059	.88	.195	1.32	.276	1.76		2.20	
.46	.069	.90	.199	1.34	.291	1.78		2.22	
.48	.077	.92	.202	1.36	.296	1.80		2.24	
.50	.080	.94	.202	1.38	.289	1.82		2.26	
.52	.084	.96	.205	1.40	.268	1.84		2.28	
.54	.088	.98	.212	1.42	.241	1.86		2.30	
.56	.092	1.00	.221	1.44	.196	1.88		2.32	
.58	.096	1.02	.224	1.46	.159	1.90		2.34	
.60	.098	1.04	.226	1.48	.139	1.92		2.36	
.62	.102	1.06	.229	1.50	.128	1.94		2.38	
.64	.105	1.08	.235	1.52	.131	1.96		2.40	
.66	.106	1.10	.242	1.54	.149	1.98		2.42	
.68	.109	1.12	.226	1.56	.166	2.00		2.44	
.70	.118	1.14	.221	1.58		2.02		2.46	
.72	.138	1.16	.223	1.60		2.04		2.48	

NO.92 - DRY RED CLAY SAMPLE



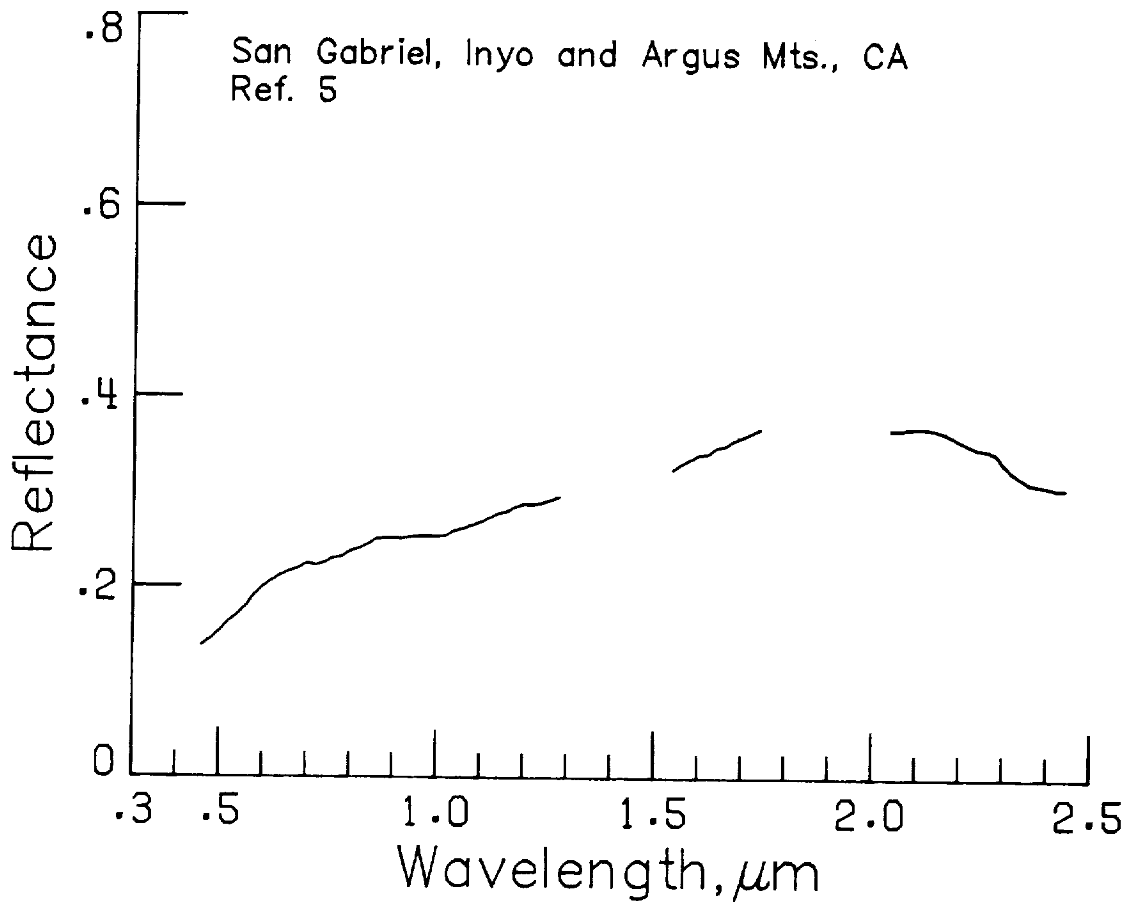
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.385	1.18	.500	1.62	.527	2.06	.487
.32		.76	.390	1.20	.508	1.64	.531	2.08	.488
.34		.78	.390	1.22	.515	1.66	.535	2.10	.485
.36		.80	.387	1.24	.519	1.68	.535	2.12	.478
.38		.82	.383	1.26	.522	1.70	.535	2.14	.463
.40		.84	.380	1.28	.523	1.72	.536	2.16	.445
.42		.86	.380	1.30	.522	1.74	.536	2.18	.436
.44		.88	.381	1.32	.520	1.76	.536	2.20	.446
.46		.90	.384	1.34	.518	1.78	.535	2.22	.461
.48		.92	.389	1.36	.511	1.80	.536	2.24	.471
.50	.102	.94	.396	1.38	.494	1.82	.533	2.26	.469
.52	.126	.96	.403	1.40	.465	1.84	.518	2.28	.459
.54	.159	.98	.413	1.42	.456	1.86	.482	2.30	.449
.56	.196	1.00	.423	1.44	.471	1.88	.442	2.32	.438
.58	.261	1.02	.431	1.46	.481	1.90	.392	2.34	.427
.60	.286	1.04	.439	1.48	.487	1.92	.386	2.36	.415
.62	.306	1.06	.448	1.50	.504	1.94	.397	2.38	.404
.64	.320	1.08	.455	1.52	.514	1.96	.423	2.40	.394
.66	.334	1.10	.465	1.54	.519	1.98	.437	2.42	.383
.68	.347	1.12	.475	1.56	.521	2.00	.453	2.44	.372
.70	.359	1.14	.483	1.58	.522	2.02	.468	2.46	.364
.72	.372	1.16	.492	1.60	.524	2.04	.480	2.48	.356

NO. 93 - WET RED CLAY SAMPLE



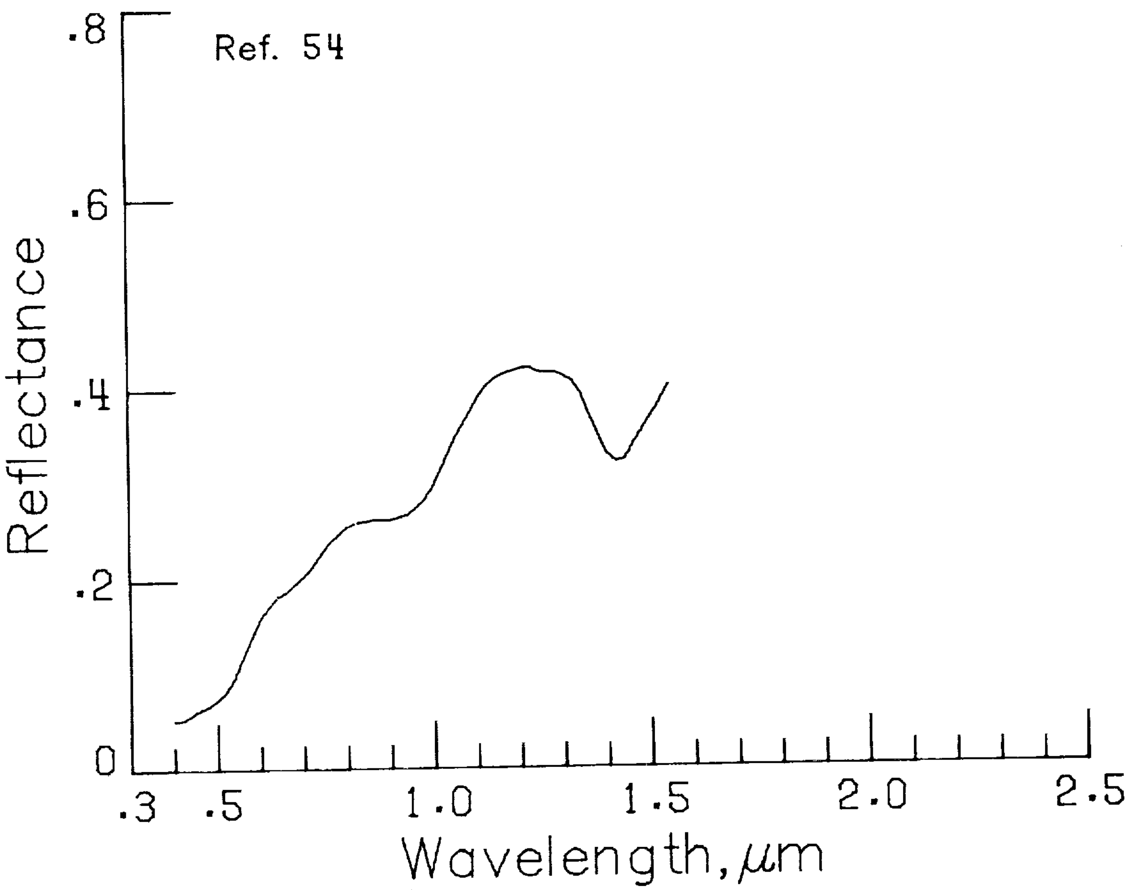
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.237	1.18	.288	1.62	.252	2.06	.137
.32		.76	.238	1.20	.293	1.64	.256	2.08	.145
.34		.78	.236	1.22	.299	1.66	.258	2.10	.148
.36		.80	.231	1.24	.302	1.68	.259	2.12	.149
.38		.82	.225	1.26	.305	1.70	.258	2.14	.149
.40		.84	.217	1.28	.304	1.72	.256	2.16	.145
.42		.86	.214	1.30	.299	1.74	.248	2.18	.144
.44		.88	.212	1.32	.292	1.76	.240	2.20	.146
.46		.90	.213	1.34	.285	1.78	.236	2.22	.152
.48		.92	.214	1.36	.277	1.80	.232	2.24	.156
.50		.94	.217	1.38	.252	1.82	.228	2.26	.153
.52	.055	.96	.221	1.40	.206	1.84	.222	2.28	.146
.54	.077	.98	.226	1.42	.165	1.86	.192	2.30	.140
.56	.094	1.00	.232	1.44	.158	1.88	.133	2.32	.132
.58	.138	1.02	.238	1.46	.158	1.90	.106	2.34	.125
.60	.171	1.04	.244	1.48	.166	1.92	.086	2.36	.118
.62	.182	1.06	.253	1.50	.177	1.94	.084	2.38	.112
.64	.190	1.08	.260	1.52	.195	1.96	.086	2.40	.106
.66	.199	1.10	.266	1.54	.210	1.98	.094	2.42	.100
.68	.210	1.12	.272	1.56	.230	2.00	.106	2.44	.095
.70	.220	1.14	.277	1.58	.240	2.02	.117	2.46	.089
.72	.230	1.16	.282	1.60	.246	2.04	.128	2.48	.085

NO.94 - QUARTZ DIORITE



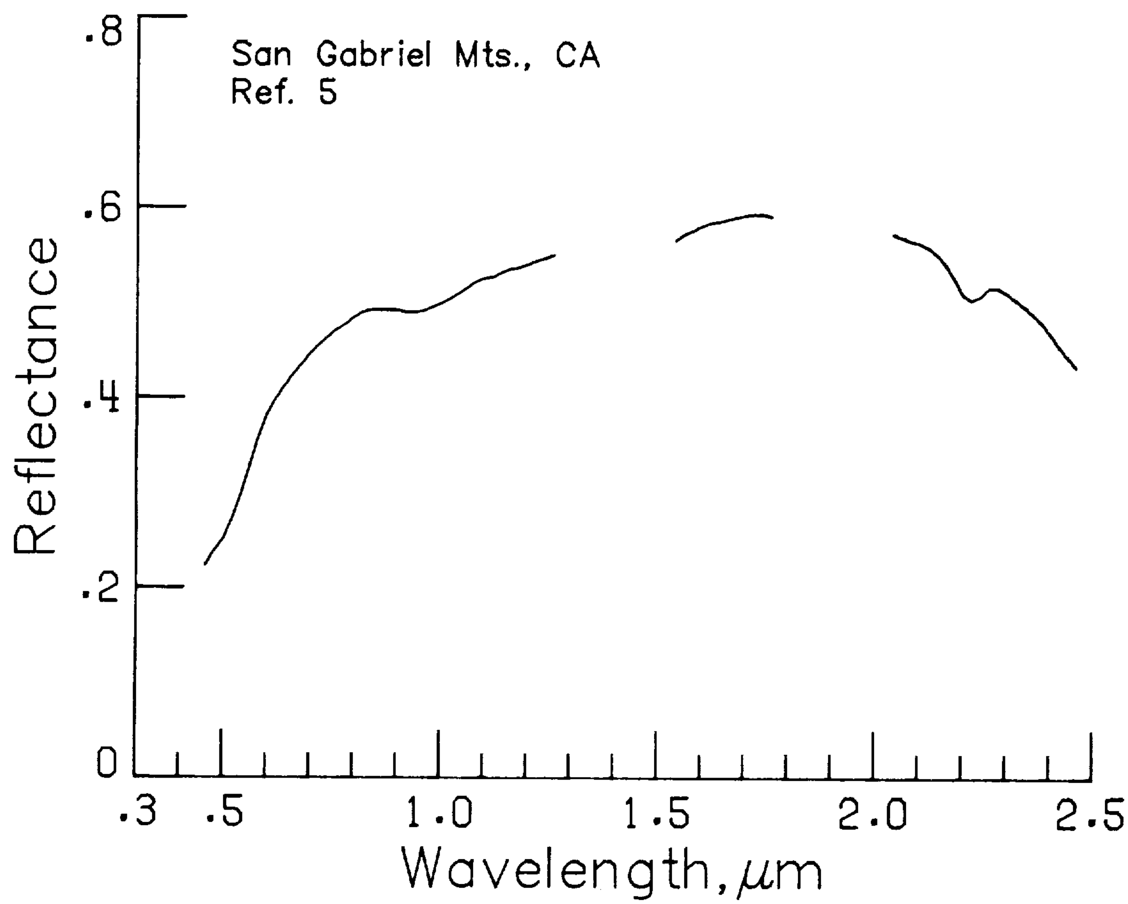
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.226	1.18	.286	1.62	.341	2.06	.367
.32		.76	.231	1.20	.288	1.64	.348	2.08	.368
.34		.78	.233	1.22	.288	1.66	.350	2.10	.369
.36		.80	.238	1.24	.290	1.68	.356	2.12	.369
.38		.82	.241	1.26	.293	1.70	.359	2.14	.367
.40		.84	.246	1.28	.296	1.72	.363	2.16	.364
.42		.86	.251	1.30		1.74	.367	2.18	.360
.44		.88	.252	1.32		1.76		2.20	.355
.46	.139	.90	.252	1.34		1.78		2.22	.351
.48	.145	.92	.252	1.36		1.80		2.24	.347
.50	.154	.94	.254	1.38		1.82		2.26	.346
.52	.164	.96	.254	1.40		1.84		2.28	.343
.54	.171	.98	.254	1.42		1.86		2.30	.331
.56	.180	1.00	.254	1.44		1.88		2.32	.323
.58	.192	1.02	.255	1.46		1.90		2.34	.317
.60	.200	1.04	.260	1.48		1.92		2.36	.311
.62	.207	1.06	.263	1.50		1.94		2.38	.310
.64	.213	1.08	.266	1.52		1.96		2.40	.308
.66	.217	1.10	.270	1.54	.325	1.98		2.42	.306
.68	.220	1.12	.274	1.56	.331	2.00		2.44	.306
.70	.225	1.14	.278	1.58	.336	2.02		2.46	
.72	.223	1.16	.281	1.60	.341	2.04	.366	2.48	

NO.95 - GRANITE



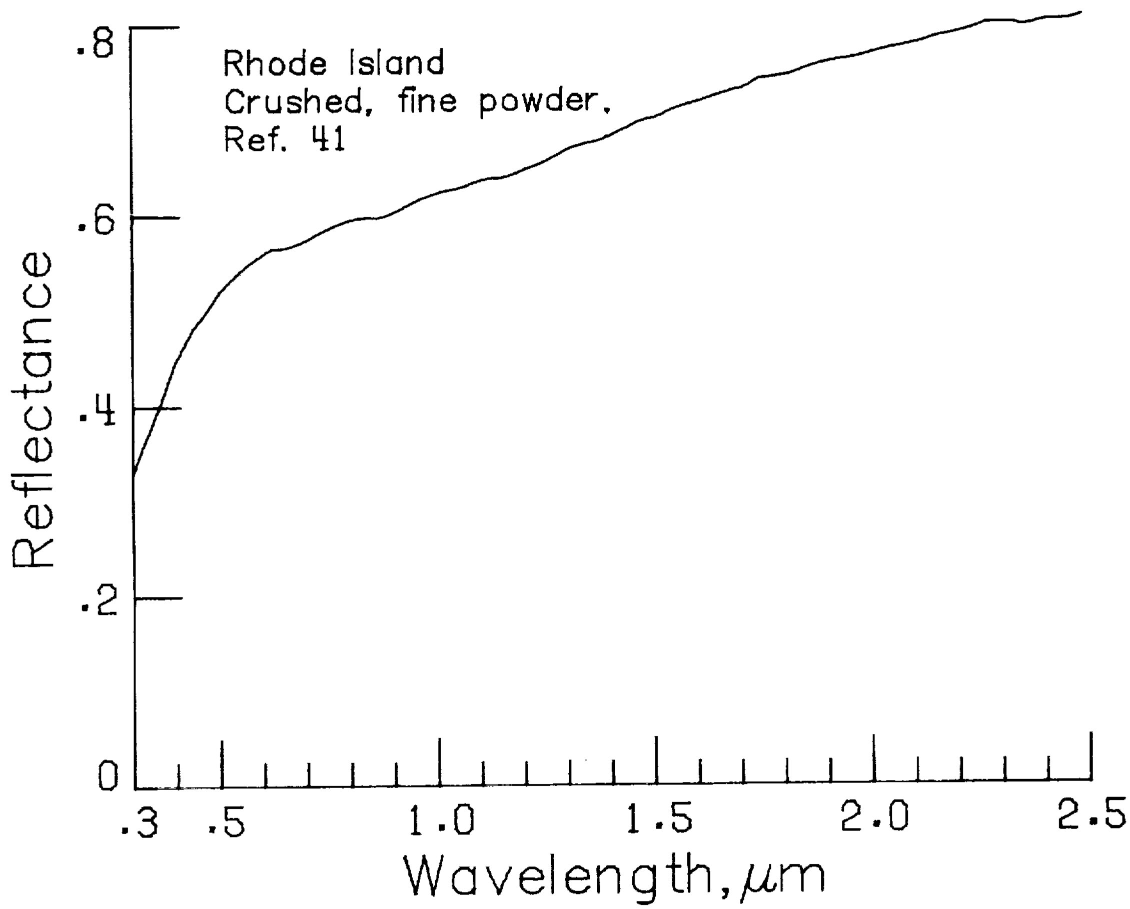
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.226	1.18	.418	1.62		2.06	
.32		.76	.238	1.20	.421	1.64		2.08	
.34		.78	.247	1.22	.422	1.66		2.10	
.36		.80	.255	1.24	.418	1.68		2.12	
.38		.82	.259	1.26	.417	1.70		2.14	
.40	.053	.84	.260	1.28	.417	1.72		2.16	
.42	.054	.86	.262	1.30	.412	1.74		2.18	
.44	.059	.88	.262	1.32	.407	1.76		2.20	
.46	.065	.90	.262	1.34	.394	1.78		2.22	
.48	.069	.92	.264	1.36	.371	1.80		2.24	
.50	.075	.94	.268	1.38	.349	1.82		2.26	
.52	.084	.96	.275	1.40	.331	1.84		2.28	
.54	.098	.98	.284	1.42	.323	1.86		2.30	
.56	.120	1.00	.293	1.44	.325	1.88		2.32	
.58	.141	1.02	.318	1.46	.340	1.90		2.34	
.60	.160	1.04	.338	1.48	.355	1.92		2.36	
.62	.173	1.06	.356	1.50	.370	1.94		2.38	
.64	.184	1.08	.372	1.52	.384	1.96		2.40	
.66	.188	1.10	.389	1.54	.401	1.98		2.42	
.68	.196	1.12	.401	1.56		2.00		2.44	
.70	.204	1.14	.410	1.58		2.02		2.46	
.72	.214	1.16	.415	1.60		2.04		2.48	

NO.96 - GRANITE



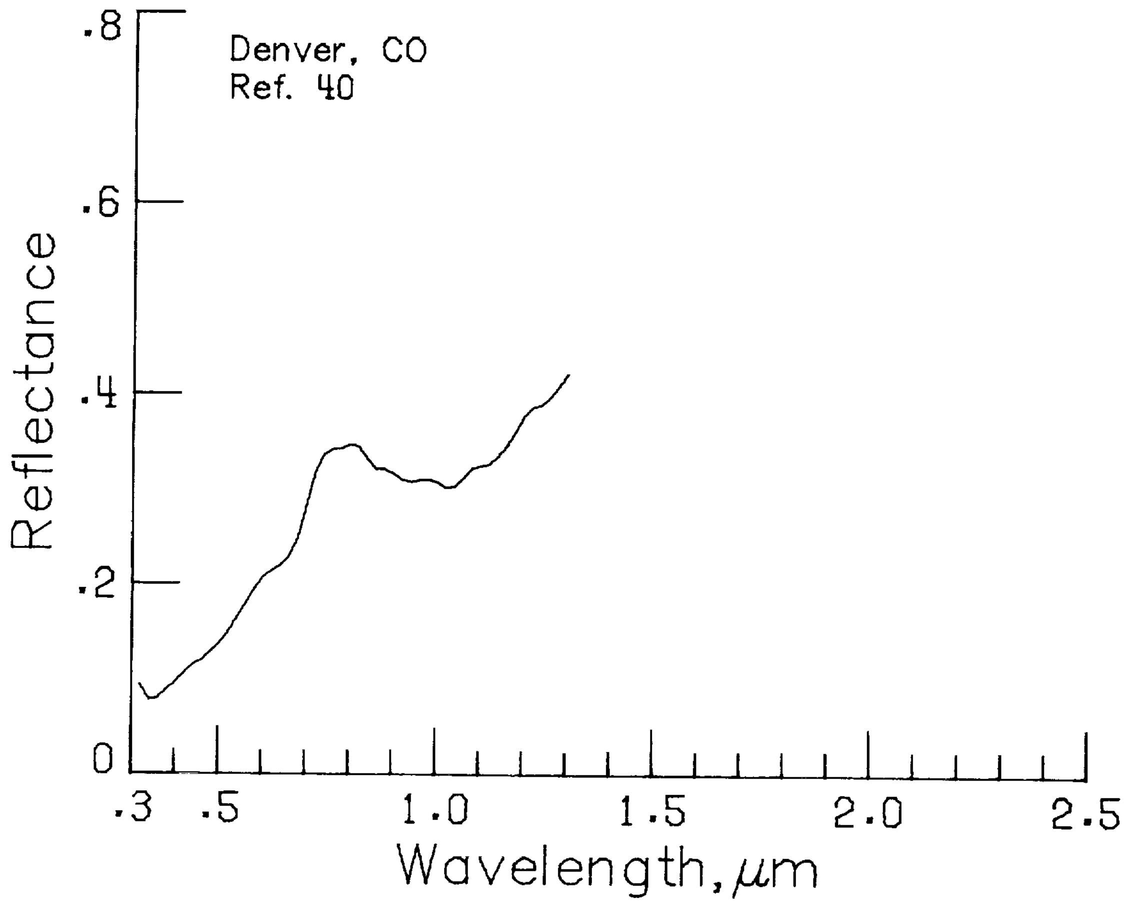
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.465	1.18	.538	1.62	.585	2.06	.569
.32		.76	.473	1.20	.541	1.64	.586	2.08	.566
.34		.78	.478	1.22	.545	1.66	.588	2.10	.563
.36		.80	.485	1.24	.548	1.68	.591	2.12	.559
.38		.82	.491	1.26	.551	1.70	.592	2.14	.552
.40		.84	.493	1.28		1.72	.593	2.16	.541
.42		.86	.493	1.30		1.74	.593	2.18	.526
.44		.88	.493	1.32		1.76	.591	2.20	.509
.46	.225	.90	.492	1.34		1.78		2.22	.504
.48	.240	.92	.491	1.36		1.80		2.24	.508
.50	.252	.94	.491	1.38		1.82		2.26	.517
.52	.272	.96	.492	1.40		1.84		2.28	.517
.54	.297	.98	.496	1.42		1.86		2.30	.512
.56	.327	1.00	.500	1.44		1.88		2.32	.504
.58	.358	1.02	.505	1.46		1.90		2.34	.497
.60	.383	1.04	.511	1.48		1.92		2.36	.489
.62	.400	1.06	.517	1.50		1.94		2.38	.480
.64	.413	1.08	.523	1.52		1.96		2.40	.468
.66	.426	1.10	.527	1.54	.567	1.98		2.42	.455
.68	.436	1.12	.528	1.56	.573	2.00		2.44	.443
.70	.448	1.14	.533	1.58	.577	2.02		2.46	.433
.72	.457	1.16	.536	1.60	.582	2.04	.573	2.48	

NO.97 - BIOTITE GRANITE SAMPLE



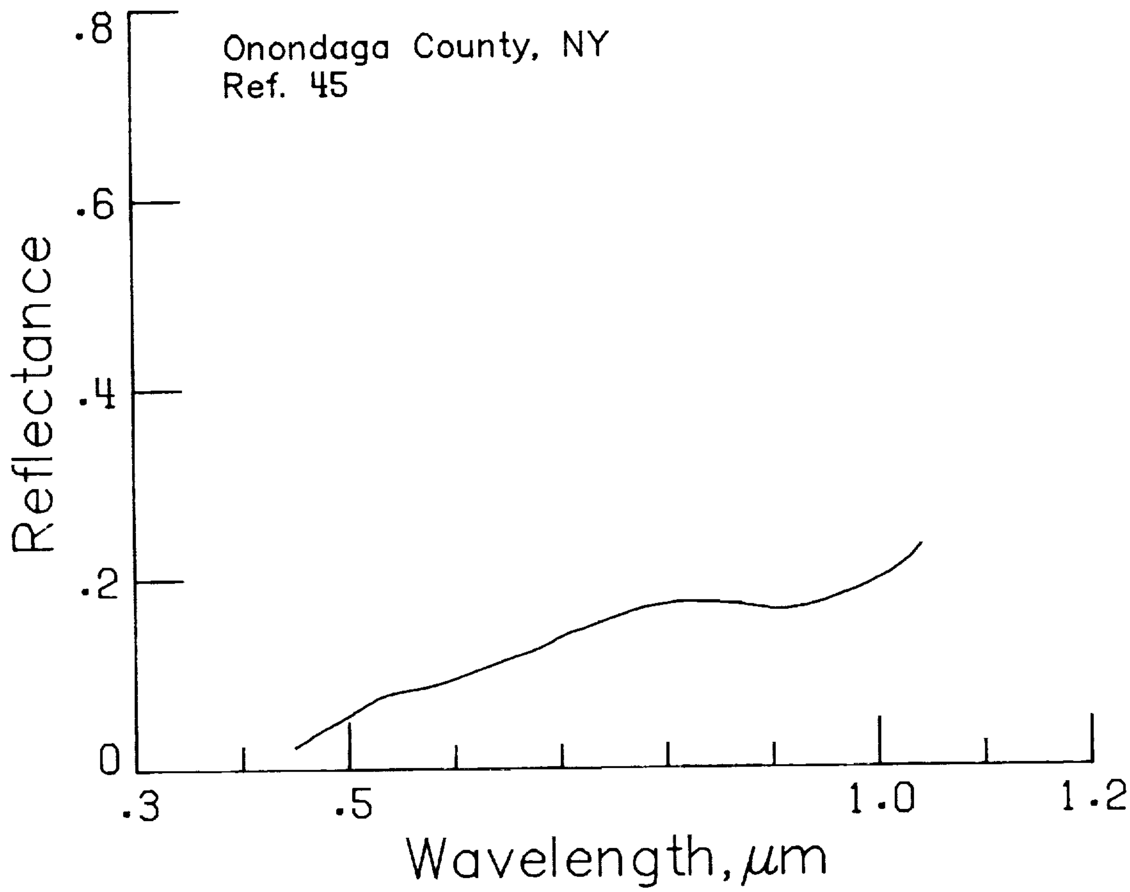
λ	R	λ	R	λ	R	λ	R	λ	R
.30	.329	.74	.585	1.18	.644	1.62	.722	2.06	.775
.32	.354	.76	.589	1.20	.647	1.64	.725	2.08	.777
.34	.377	.78	.593	1.22	.650	1.66	.728	2.10	.779
.36	.398	.80	.596	1.24	.654	1.68	.731	2.12	.782
.38	.423	.82	.597	1.26	.659	1.70	.732	2.14	.785
.40	.448	.84	.598	1.28	.664	1.72	.737	2.16	.787
.42	.465	.86	.598	1.30	.669	1.74	.743	2.18	.789
.44	.482	.88	.599	1.32	.672	1.76	.743	2.20	.791
.46	.494	.90	.603	1.34	.675	1.78	.745	2.22	.793
.48	.506	.92	.608	1.36	.677	1.80	.746	2.24	.796
.50	.520	.94	.613	1.38	.680	1.82	.749	2.26	.800
.52	.530	.96	.617	1.40	.683	1.84	.752	2.28	.800
.54	.539	.98	.620	1.42	.688	1.86	.755	2.30	.800
.56	.547	1.00	.624	1.44	.692	1.88	.758	2.32	.800
.58	.554	1.02	.626	1.46	.697	1.90	.760	2.34	.797
.60	.560	1.04	.627	1.48	.700	1.92	.762	2.36	.798
.62	.565	1.06	.630	1.50	.702	1.94	.763	2.38	.801
.64	.565	1.08	.633	1.52	.705	1.96	.764	2.40	.802
.66	.567	1.10	.636	1.54	.710	1.98	.766	2.42	.802
.68	.571	1.12	.638	1.56	.714	2.00	.769	2.44	.803
.70	.575	1.14	.639	1.58	.716	2.02	.771	2.46	.804
.72	.580	1.16	.640	1.60	.719	2.04	.774	2.48	.807

NO.98 - GRAVEL



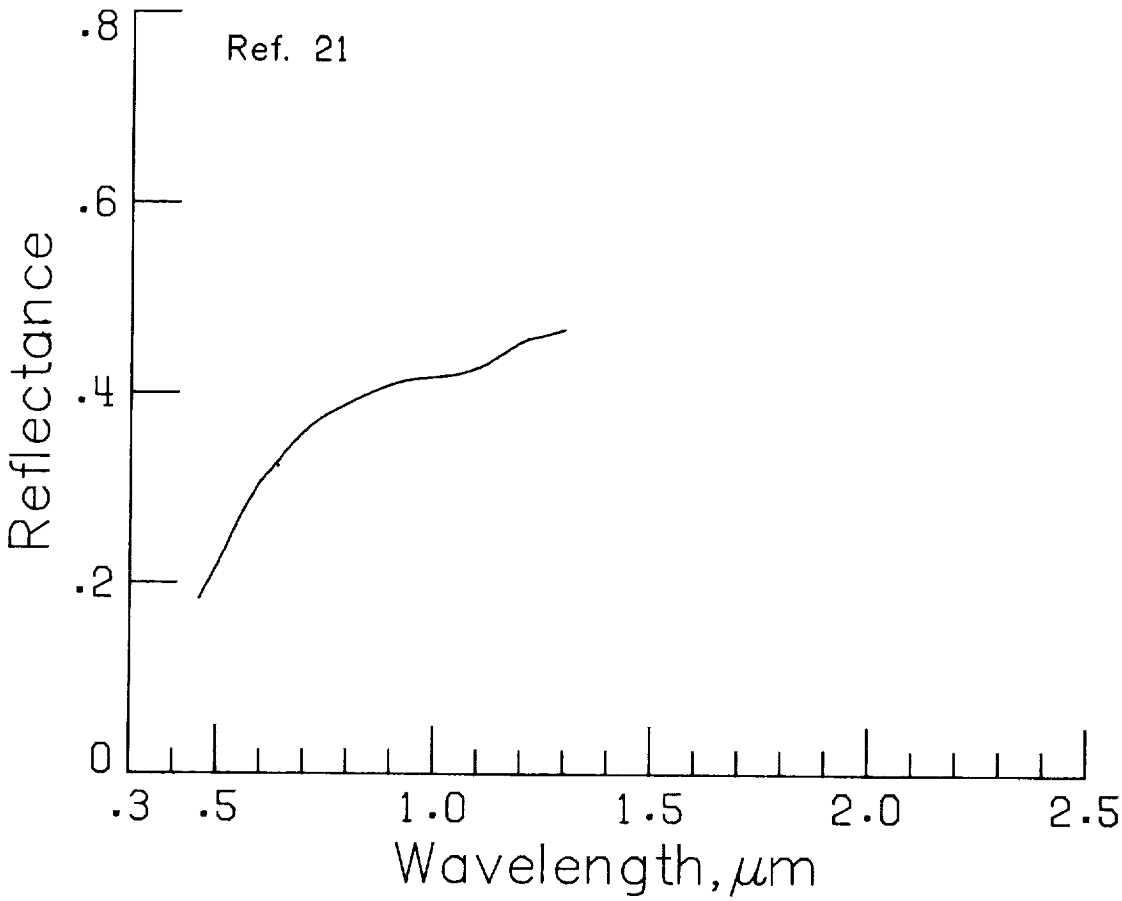
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.337	1.18	.361	1.62		2.06	
.32	.094	.76	.343	1.20	.378	1.64		2.08	
.34	.078	.78	.344	1.22	.388	1.66		2.10	
.36	.080	.80	.347	1.24	.390	1.68		2.12	
.38	.089	.82	.345	1.26	.398	1.70		2.14	
.40	.097	.84	.332	1.28	.409	1.72		2.16	
.42	.106	.86	.322	1.30	.422	1.74		2.18	
.44	.116	.88	.321	1.32		1.76		2.20	
.46	.121	.90	.316	1.34		1.78		2.22	
.48	.129	.92	.310	1.36		1.80		2.24	
.50	.138	.94	.308	1.38		1.82		2.26	
.52	.149	.96	.310	1.40		1.84		2.28	
.54	.165	.98	.311	1.42		1.86		2.30	
.56	.180	1.00	.308	1.44		1.88		2.32	
.58	.194	1.02	.302	1.46		1.90		2.34	
.60	.207	1.04	.303	1.48		1.92		2.36	
.62	.215	1.06	.312	1.50		1.94		2.38	
.64	.220	1.08	.322	1.52		1.96		2.40	
.66	.229	1.10	.326	1.54		1.98		2.42	
.68	.248	1.12	.328	1.56		2.00		2.44	
.70	.283	1.14	.335	1.58		2.02		2.46	
.72	.317	1.16	.346	1.60		2.04		2.48	

NO.99 - GLACIOFLUVIAL SAND AND GRAVEL



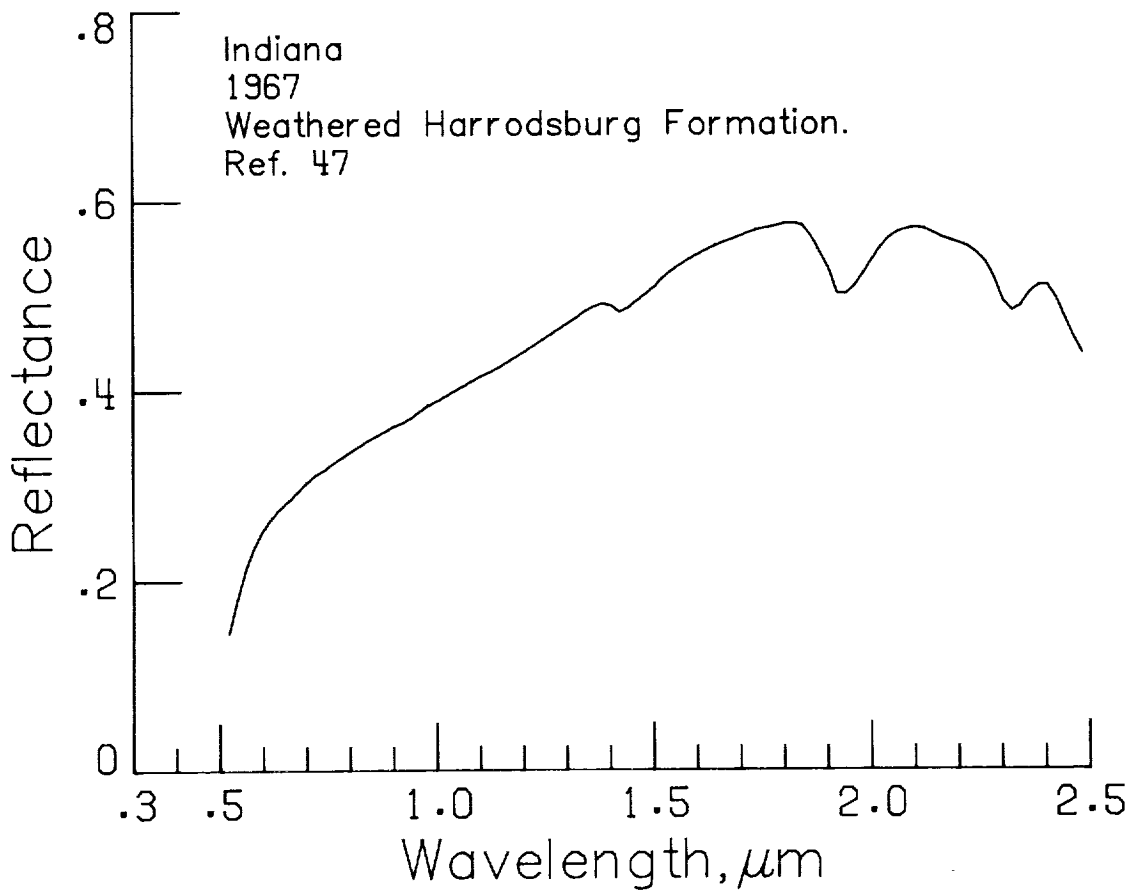
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.044	.66	.119	.84	.174	1.02	.211
.31		.49	.050	.67	.122	.85	.173	1.03	.219
.32		.50	.056	.68	.126	.86	.172	1.04	.232
.33		.51	.063	.69	.132	.87	.171	1.05	
.34		.52	.070	.70	.138	.88	.169	1.06	
.35		.53	.076	.71	.143	.89	.168	1.07	
.36		.54	.079	.72	.146	.90	.166	1.08	
.37		.55	.081	.73	.150	.91	.166	1.09	
.38		.56	.083	.74	.155	.92	.167	1.10	
.39		.57	.085	.75	.159	.93	.169	1.11	
.40		.58	.087	.76	.162	.94	.172	1.12	
.41		.59	.091	.77	.166	.95	.175	1.13	
.42		.60	.094	.78	.169	.96	.179	1.14	
.43		.61	.099	.79	.171	.97	.183	1.15	
.44		.62	.103	.80	.173	.98	.187	1.16	
.45	.024	.63	.107	.81	.174	.99	.192	1.17	
.46	.030	.64	.111	.82	.175	1.00	.198	1.18	
.47	.038	.65	.115	.83	.174	1.01	.203	1.19	

NO.100 - LIMESTONE



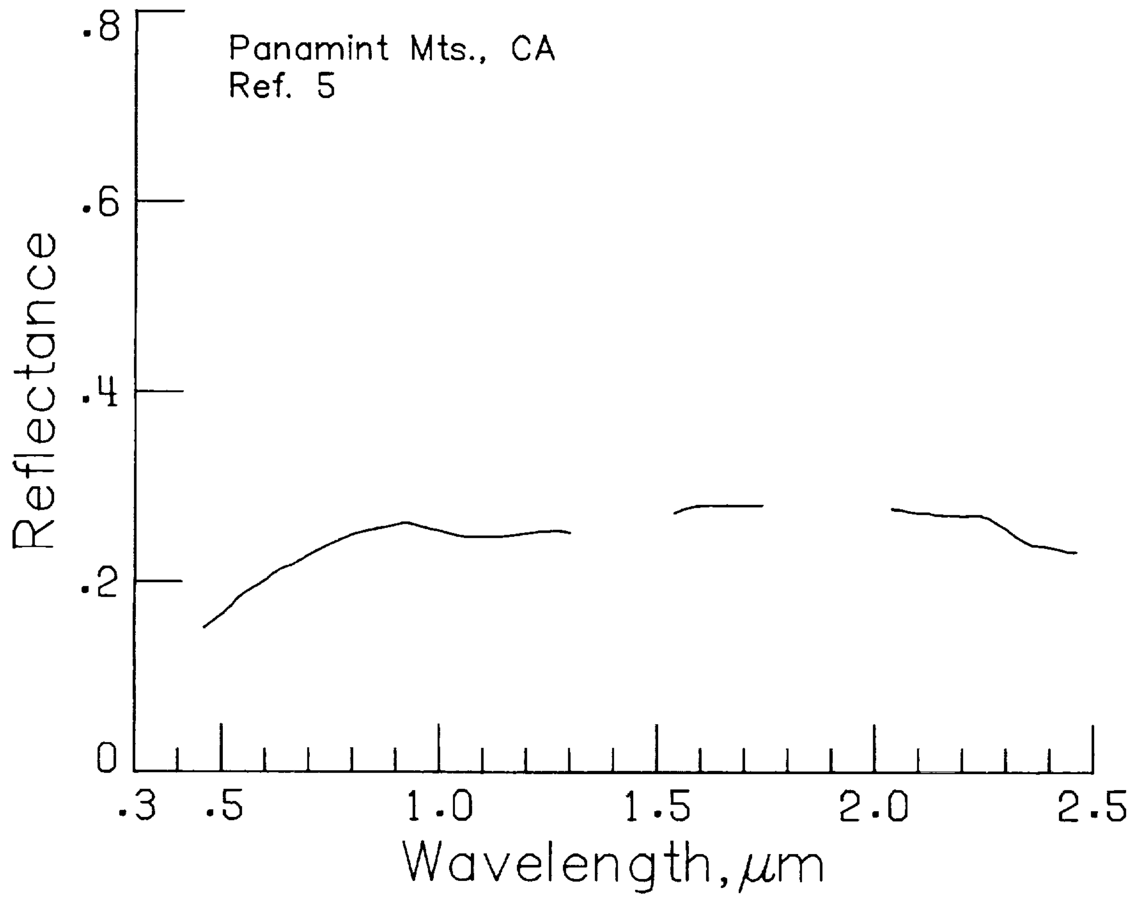
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.374	1.18	.449	1.62		2.06	
.32		.76	.380	1.20	.454	1.64		2.08	
.34		.78	.384	1.22	.458	1.66		2.10	
.36		.80	.389	1.24	.460	1.68		2.12	
.38		.82	.394	1.26	.462	1.70		2.14	
.40		.84	.398	1.28	.465	1.72		2.16	
.42		.86	.402	1.30	.468	1.74		2.18	
.44		.88	.406	1.32		1.76		2.20	
.46	.184	.90	.410	1.34		1.78		2.22	
.48	.202	.92	.412	1.36		1.80		2.24	
.50	.218	.94	.414	1.38		1.82		2.26	
.52	.236	.96	.416	1.40		1.84		2.28	
.54	.257	.98	.417	1.42		1.86		2.30	
.56	.276	1.00	.417	1.44		1.88		2.32	
.58	.292	1.02	.418	1.46		1.90		2.34	
.60	.308	1.04	.419	1.48		1.92		2.36	
.62	.318	1.06	.421	1.50		1.94		2.38	
.64	.328	1.08	.424	1.52		1.96		2.40	
.66	.340	1.10	.427	1.54		1.98		2.42	
.68	.350	1.12	.431	1.56		2.00		2.44	
.70	.360	1.14	.437	1.58		2.02		2.46	
.72	.368	1.16	.443	1.60		2.04		2.48	

NO.101 - LIMESTONE SAMPLE



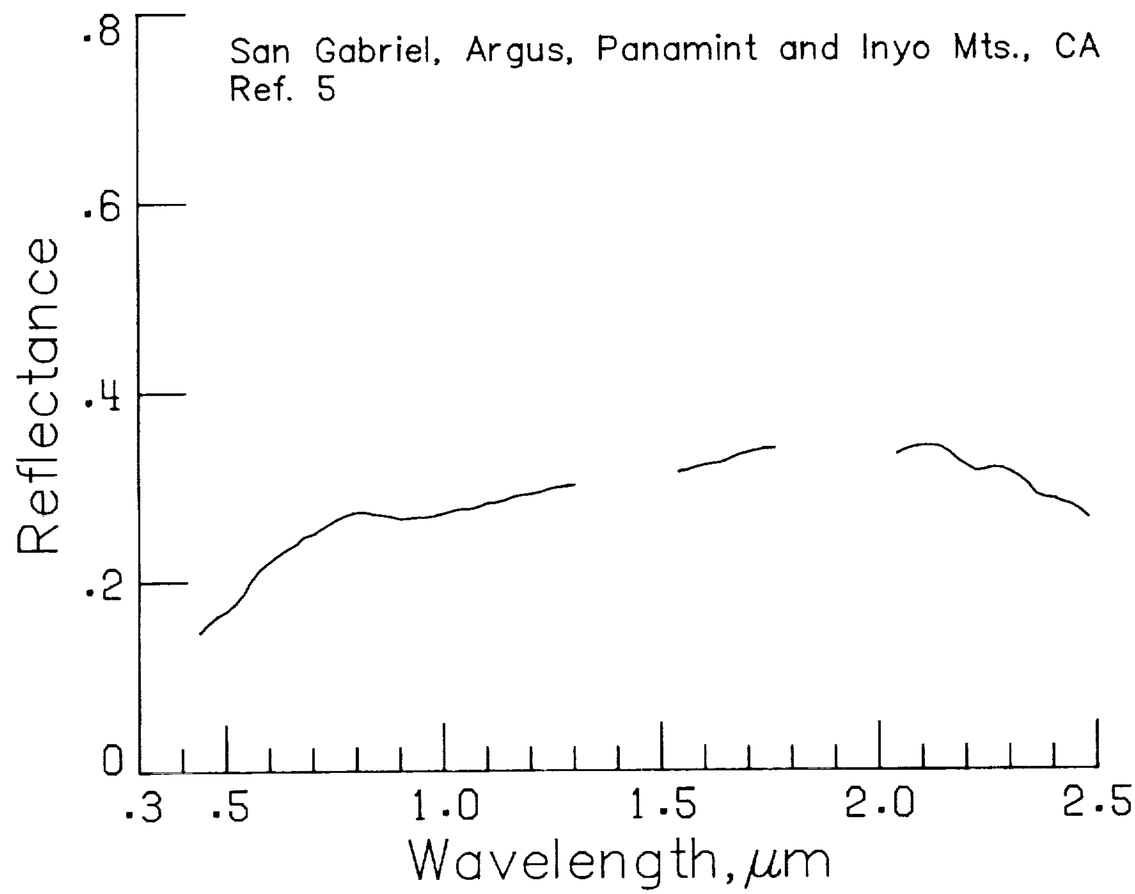
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.317	1.18	.435	1.62	.548	2.06	.567
.32		.76	.324	1.20	.441	1.64	.552	2.08	.570
.34		.78	.330	1.22	.447	1.66	.556	2.10	.571
.36		.80	.336	1.24	.453	1.68	.559	2.12	.569
.38		.82	.342	1.26	.459	1.70	.563	2.14	.565
.40		.84	.348	1.28	.465	1.72	.567	2.16	.561
.42		.86	.353	1.30	.471	1.74	.569	2.18	.557
.44		.88	.358	1.32	.477	1.76	.571	2.20	.554
.46		.90	.363	1.34	.484	1.78	.573	2.22	.551
.48		.92	.367	1.36	.488	1.80	.575	2.24	.544
.50		.94	.372	1.38	.492	1.82	.576	2.26	.535
.52	.145	.96	.379	1.40	.490	1.84	.573	2.28	.517
.54	.182	.98	.385	1.42	.483	1.86	.562	2.30	.493
.56	.215	1.00	.390	1.44	.487	1.88	.545	2.32	.484
.58	.237	1.02	.395	1.46	.495	1.90	.528	2.34	.489
.60	.255	1.04	.400	1.48	.502	1.92	.502	2.36	.503
.62	.267	1.06	.405	1.50	.509	1.94	.502	2.38	.510
.64	.277	1.08	.410	1.52	.519	1.96	.510	2.40	.511
.66	.285	1.10	.415	1.54	.526	1.98	.523	2.42	.497
.68	.295	1.12	.419	1.56	.532	2.00	.538	2.44	.476
.70	.304	1.14	.424	1.58	.538	2.02	.551	2.46	.456
.72	.312	1.16	.430	1.60	.543	2.04	.561	2.48	.438

NO.102 - MONZONITE



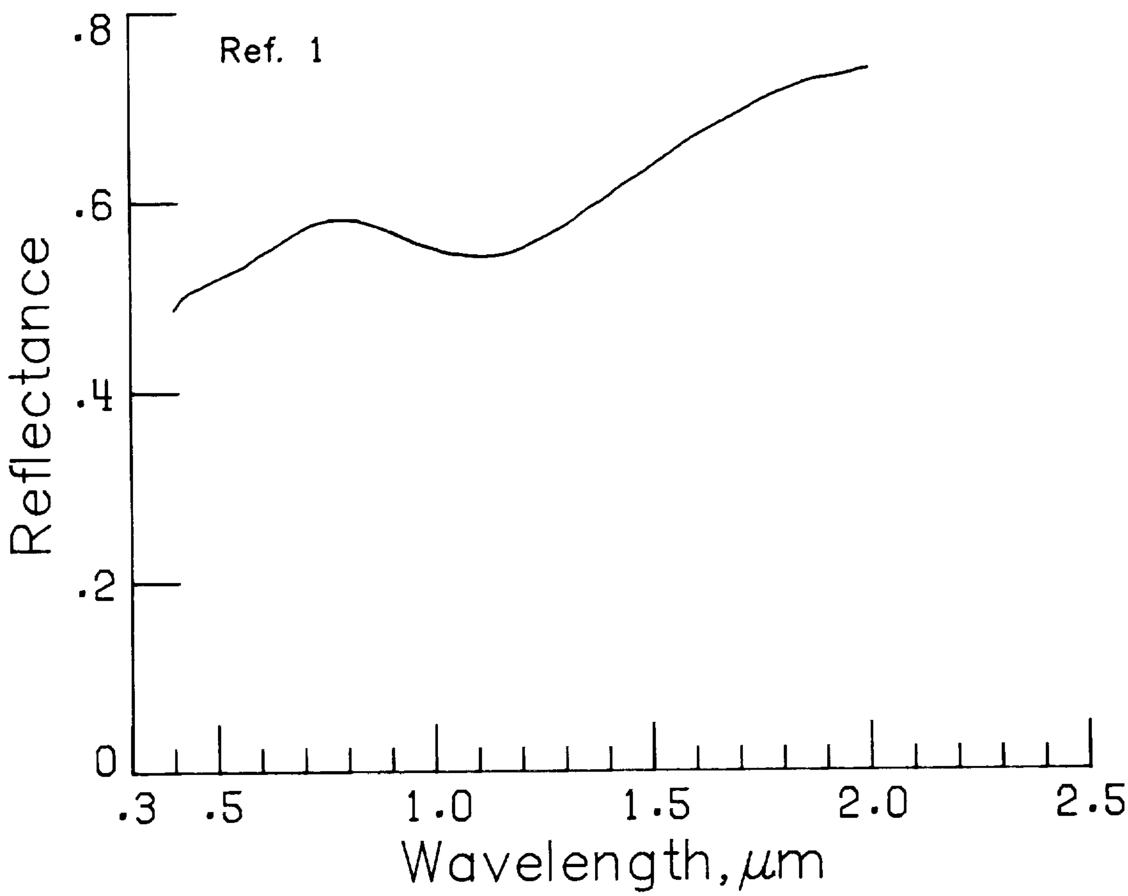
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.238	1.18	.250	1.62	.281	2.06	.276
.32		.76	.242	1.20	.251	1.64	.281	2.08	.274
.34		.78	.246	1.22	.252	1.66	.281	2.10	.272
.36		.80	.250	1.24	.254	1.68	.281	2.12	.272
.38		.82	.252	1.26	.254	1.70	.281	2.14	.271
.40		.84	.255	1.28	.254	1.72	.281	2.16	.270
.42		.86	.256	1.30	.252	1.74	.281	2.18	.270
.44		.88	.258	1.32		1.76		2.20	.269
.46	.152	.90	.260	1.34		1.78		2.22	.270
.48	.159	.92	.262	1.36		1.80		2.24	.270
.50	.166	.94	.261	1.38		1.82		2.26	.267
.52	.174	.96	.258	1.40		1.84		2.28	.261
.54	.184	.98	.256	1.42		1.86		2.30	.256
.56	.191	1.00	.254	1.44		1.88		2.32	.249
.58	.196	1.02	.251	1.46		1.90		2.34	.243
.60	.202	1.04	.249	1.48		1.92		2.36	.239
.62	.209	1.06	.248	1.50		1.94		2.38	.238
.64	.215	1.08	.247	1.52		1.96		2.40	.236
.66	.218	1.10	.247	1.54	.273	1.98		2.42	.235
.68	.223	1.12	.247	1.56	.277	2.00		2.44	.232
.70	.228	1.14	.248	1.58	.279	2.02		2.46	.232
.72	.233	1.16	.249	1.60	.280	2.04	.277	2.48	

NO.103 - QUARTZ MONZONITE



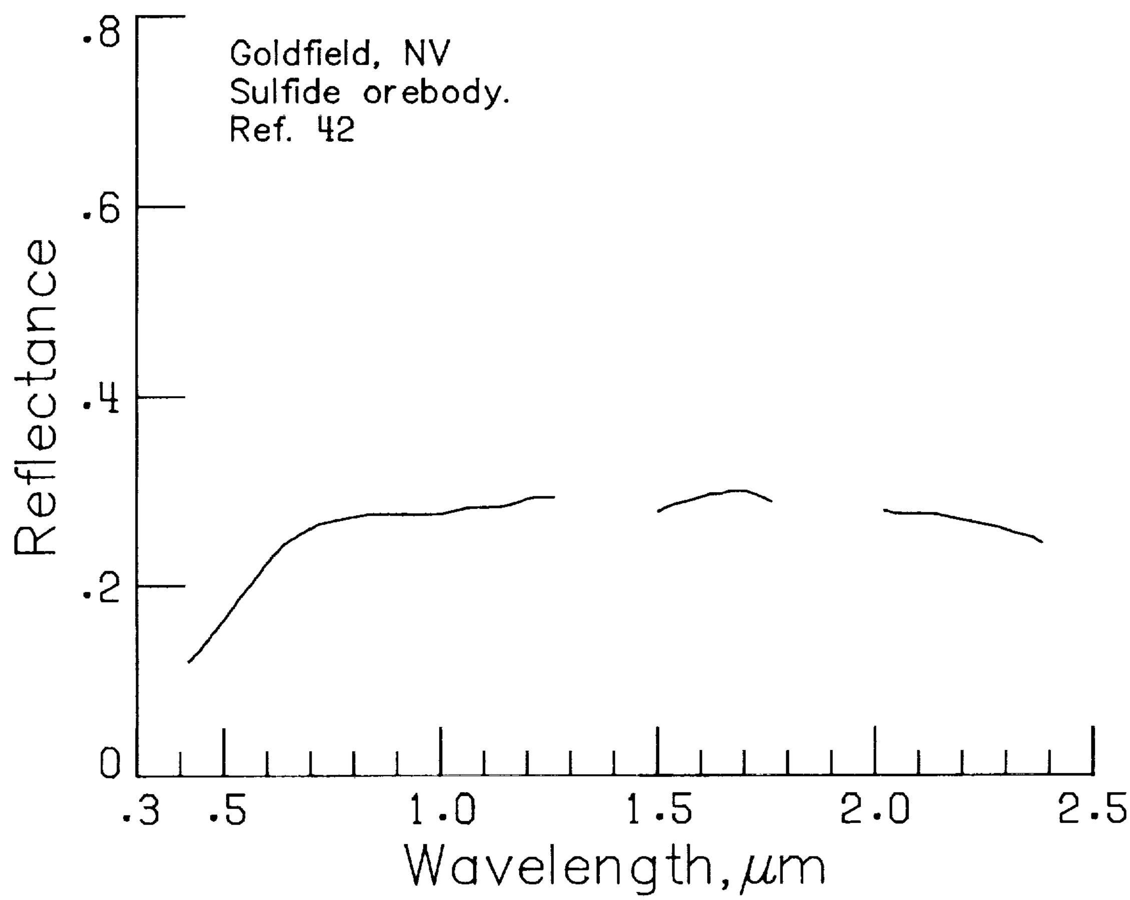
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.262	1.18	.291	1.62	.324	2.06	.338
.32		.76	.267	1.20	.293	1.64	.326	2.08	.341
.34		.78	.271	1.22	.294	1.66	.330	2.10	.342
.36		.80	.274	1.24	.297	1.68	.333	2.12	.342
.38		.82	.274	1.26	.299	1.70	.335	2.14	.340
.40		.84	.271	1.28	.301	1.72	.338	2.16	.335
.42		.86	.270	1.30	.302	1.74	.340	2.18	.326
.44	.147	.88	.269	1.32		1.76	.340	2.20	.321
.46	.156	.90	.267	1.34		1.78		2.22	.315
.48	.164	.92	.267	1.36		1.80		2.24	.316
.50	.169	.94	.268	1.38		1.82		2.26	.319
.52	.176	.96	.268	1.40		1.84		2.28	.318
.54	.187	.98	.270	1.42		1.86		2.30	.314
.56	.203	1.00	.272	1.44		1.88		2.32	.309
.58	.214	1.02	.275	1.46		1.90		2.34	.301
.60	.221	1.04	.277	1.48		1.92		2.36	.290
.62	.228	1.06	.277	1.50		1.94		2.38	.287
.64	.235	1.08	.279	1.52		1.96		2.40	.286
.66	.240	1.10	.283	1.54	.315	1.98		2.42	.282
.68	.248	1.12	.284	1.56	.317	2.00		2.44	.280
.70	.250	1.14	.286	1.58	.320	2.02		2.46	.274
.72	.256	1.16	.290	1.60	.323	2.04	.333	2.48	.266

NO.104 - OBSIDIAN SAMPLE



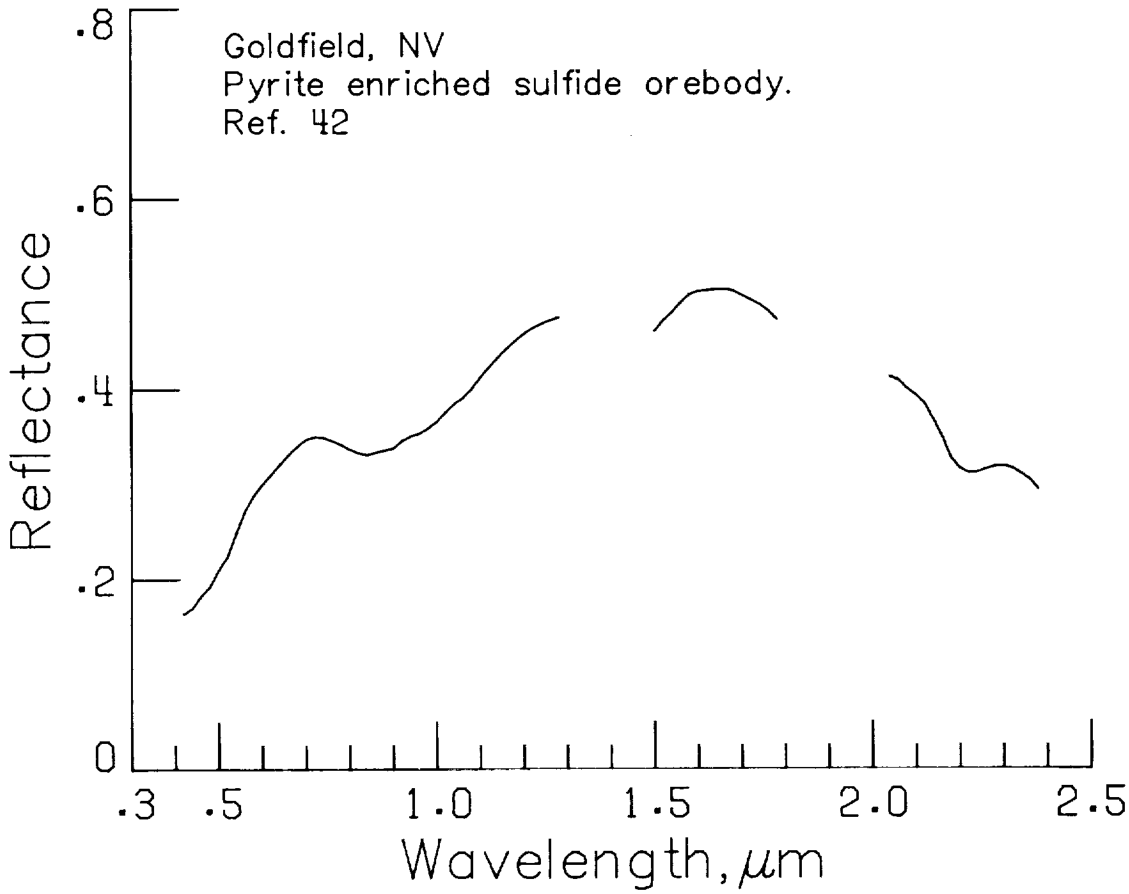
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.579	1.18	.547	1.62	.673	2.06	
.32		.76	.581	1.20	.550	1.64	.678	2.08	
.34		.78	.581	1.22	.555	1.66	.683	2.10	
.36		.80	.581	1.24	.560	1.68	.687	2.12	
.38		.82	.580	1.26	.564	1.70	.692	2.14	
.40	.488	.84	.578	1.28	.569	1.72	.697	2.16	
.42	.501	.86	.575	1.30	.574	1.74	.703	2.18	
.44	.507	.88	.572	1.32	.580	1.76	.707	2.20	
.46	.511	.90	.568	1.34	.588	1.78	.712	2.22	
.48	.516	.92	.564	1.36	.594	1.80	.715	2.24	
.50	.520	.94	.560	1.38	.599	1.82	.719	2.26	
.52	.524	.96	.556	1.40	.605	1.84	.722	2.28	
.54	.528	.98	.553	1.42	.613	1.86	.726	2.30	
.56	.532	1.00	.550	1.44	.619	1.88	.728	2.32	
.58	.539	1.02	.547	1.46	.624	1.90	.729	2.34	
.60	.545	1.04	.545	1.48	.630	1.92	.730	2.36	
.62	.550	1.06	.545	1.50	.636	1.94	.732	2.38	
.64	.555	1.08	.543	1.52	.643	1.96	.734	2.40	
.66	.561	1.10	.542	1.54	.650	1.98	.737	2.42	
.68	.567	1.12	.542	1.56	.656	2.00	.738	2.44	
.70	.572	1.14	.543	1.58	.663	2.02		2.46	
.72	.577	1.16	.545	1.60	.668	2.04		2.48	

NO.105 - UNALTERED ROCKS



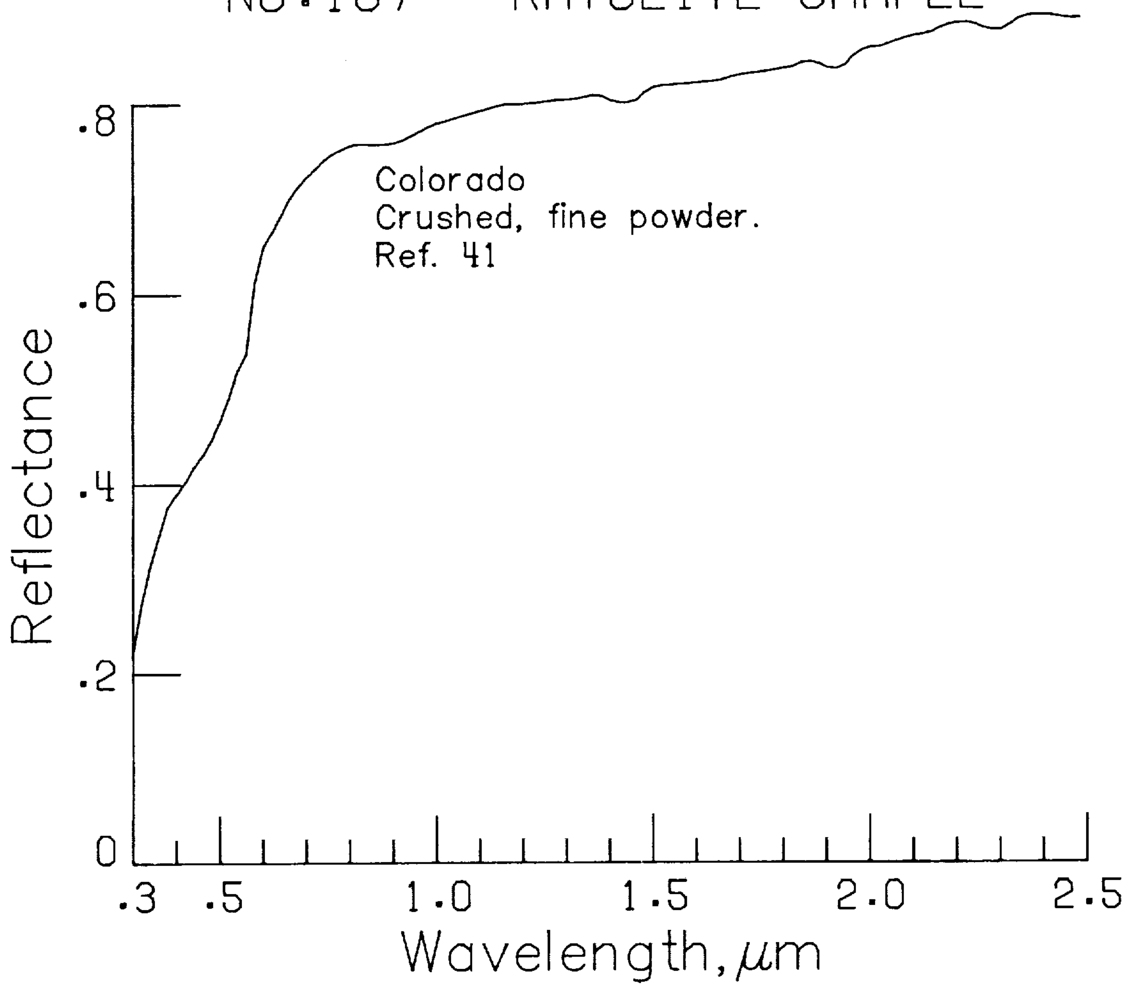
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.267	1.18	.289	1.62	.297	2.06	.276
.32		.76	.269	1.20	.292	1.64	.297	2.08	.276
.34		.78	.271	1.22	.293	1.66	.300	2.10	.276
.36		.80	.273	1.24	.293	1.68	.300	2.12	.276
.38		.82	.275	1.26	.293	1.70	.300	2.14	.275
.40		.84	.276	1.28		1.72	.297	2.16	.273
.42	.122	.86	.276	1.30		1.74	.293	2.18	.271
.44	.130	.88	.276	1.32		1.76	.289	2.20	.269
.46	.142	.90	.276	1.34		1.78		2.22	.267
.48	.153	.92	.276	1.36		1.80		2.24	.265
.50	.164	.94	.276	1.38		1.82		2.26	.264
.52	.176	.96	.276	1.40		1.84		2.28	.262
.54	.189	.98	.276	1.42		1.86		2.30	.258
.56	.200	1.00	.276	1.44		1.88		2.32	.255
.58	.212	1.02	.278	1.46		1.90		2.34	.253
.60	.224	1.04	.280	1.48		1.92		2.36	.251
.62	.235	1.06	.282	1.50	.279	1.94		2.38	.245
.64	.244	1.08	.283	1.52	.283	1.96		2.40	
.66	.250	1.10	.283	1.54	.287	1.98		2.42	
.68	.256	1.12	.283	1.56	.289	2.00		2.44	
.70	.261	1.14	.284	1.58	.291	2.02	.279	2.46	
.72	.266	1.16	.286	1.60	.294	2.04	.276	2.48	

NO.106 - ALTERED ROCKS



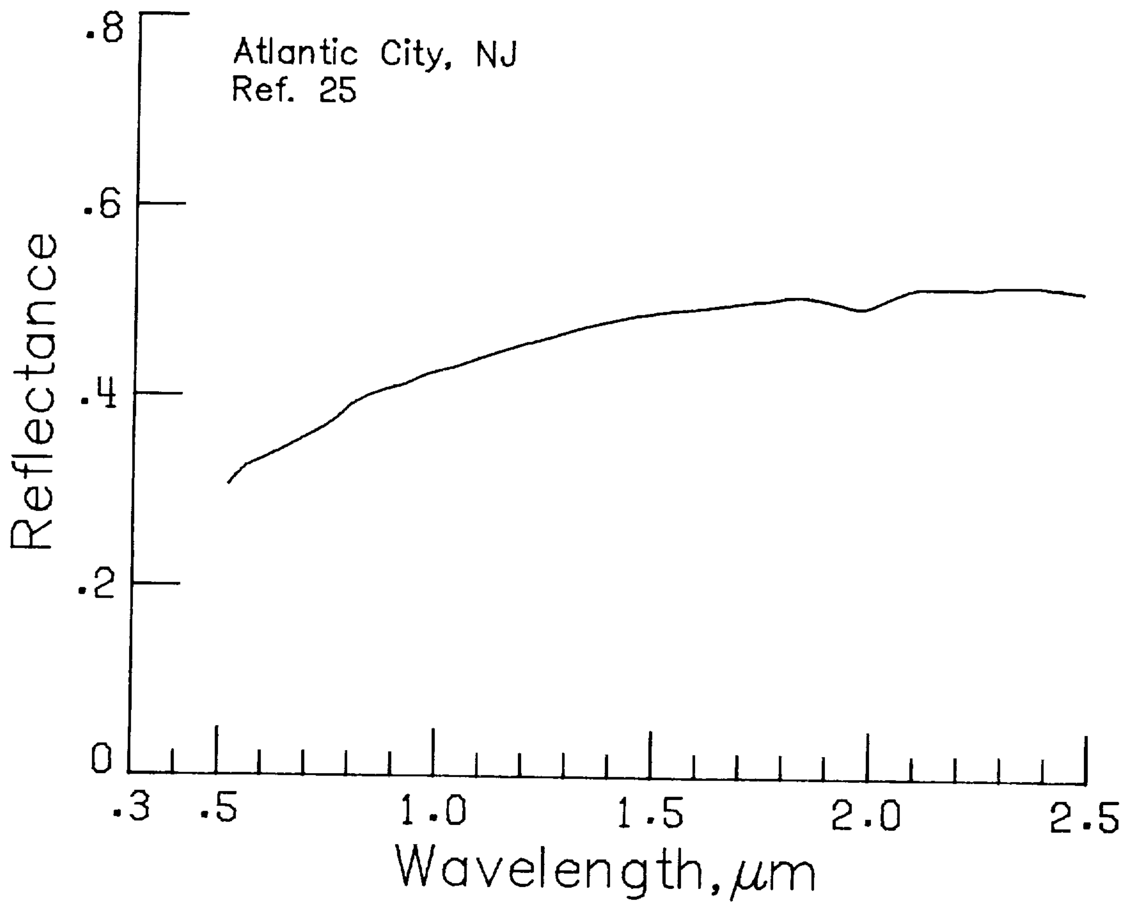
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.349	1.18	.451	1.62	.504	2.06	.409
.32		.76	.346	1.20	.458	1.64	.504	2.08	.399
.34		.78	.341	1.22	.464	1.66	.505	2.10	.393
.36		.80	.337	1.24	.469	1.68	.503	2.12	.384
.38		.82	.333	1.26	.472	1.70	.498	2.14	.367
.40		.84	.331	1.28	.475	1.72	.493	2.16	.349
.42	.164	.86	.334	1.30		1.74	.489	2.18	.326
.44	.170	.88	.336	1.32		1.76	.482	2.20	.315
.46	.183	.90	.338	1.34		1.78	.473	2.22	.311
.48	.193	.92	.345	1.36		1.80		2.24	.311
.50	.210	.94	.351	1.38		1.82		2.26	.315
.52	.224	.96	.353	1.40		1.84		2.28	.317
.54	.249	.98	.359	1.42		1.86		2.30	.318
.56	.272	1.00	.366	1.44		1.88		2.32	.316
.58	.288	1.02	.376	1.46		1.90		2.34	.310
.60	.300	1.04	.384	1.48		1.92		2.36	.304
.62	.310	1.06	.391	1.50	.461	1.94		2.38	.294
.64	.321	1.08	.400	1.52	.472	1.96		2.40	
.66	.331	1.10	.412	1.54	.481	1.98		2.42	
.68	.340	1.12	.423	1.56	.491	2.00		2.44	
.70	.347	1.14	.433	1.58	.499	2.02		2.46	
.72	.350	1.16	.442	1.60	.503	2.04	.412	2.48	

NO.107 - RHYOLITE SAMPLE



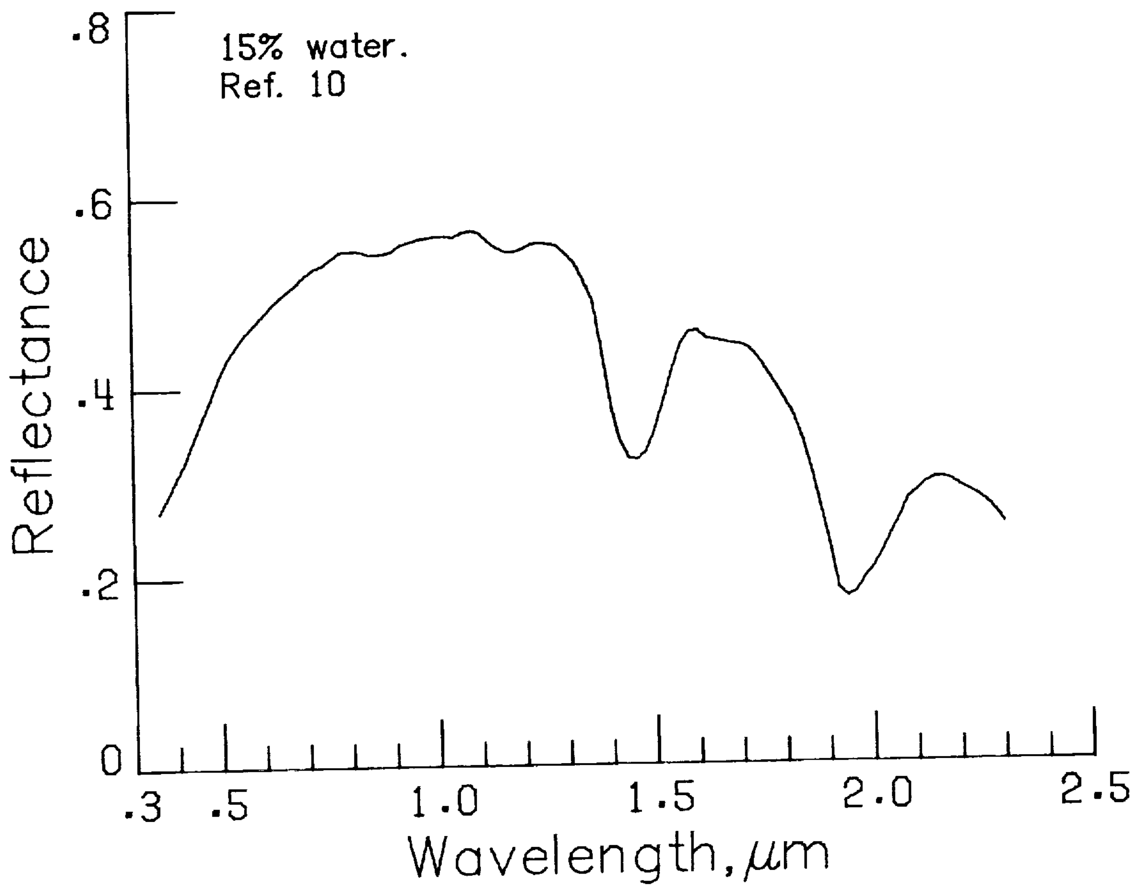
λ	R	λ	R	λ	R	λ	R	λ	R
.30	.219	.74	.742	1.18	.800	1.62	.823	2.06	.866
.32	.273	.76	.748	1.20	.800	1.64	.824	2.08	.869
.34	.314	.78	.753	1.22	.801	1.66	.825	2.10	.871
.36	.345	.80	.757	1.24	.802	1.68	.828	2.12	.873
.38	.376	.82	.758	1.26	.803	1.70	.830	2.14	.875
.40	.390	.84	.758	1.28	.804	1.72	.832	2.16	.880
.42	.402	.86	.758	1.30	.804	1.74	.833	2.18	.883
.44	.418	.88	.758	1.32	.805	1.76	.834	2.20	.885
.46	.431	.90	.759	1.34	.807	1.78	.836	2.22	.885
.48	.446	.92	.762	1.36	.809	1.80	.837	2.24	.883
.50	.467	.94	.767	1.38	.808	1.82	.839	2.26	.879
.52	.490	.96	.772	1.40	.803	1.84	.843	2.28	.877
.54	.519	.98	.777	1.42	.801	1.86	.844	2.30	.878
.56	.536	1.00	.780	1.44	.801	1.88	.842	2.32	.883
.58	.613	1.02	.782	1.46	.804	1.90	.837	2.34	.889
.60	.650	1.04	.785	1.48	.812	1.92	.837	2.36	.892
.62	.665	1.06	.788	1.50	.817	1.94	.840	2.38	.893
.64	.682	1.08	.790	1.52	.819	1.96	.850	2.40	.893
.66	.701	1.10	.793	1.54	.820	1.98	.856	2.42	.892
.68	.714	1.12	.796	1.56	.821	2.00	.859	2.44	.890
.70	.724	1.14	.798	1.58	.821	2.02	.860	2.46	.890
.72	.733	1.16	.800	1.60	.822	2.04	.863	2.48	.890

NO.108 - BEACH SAND SAMPLE



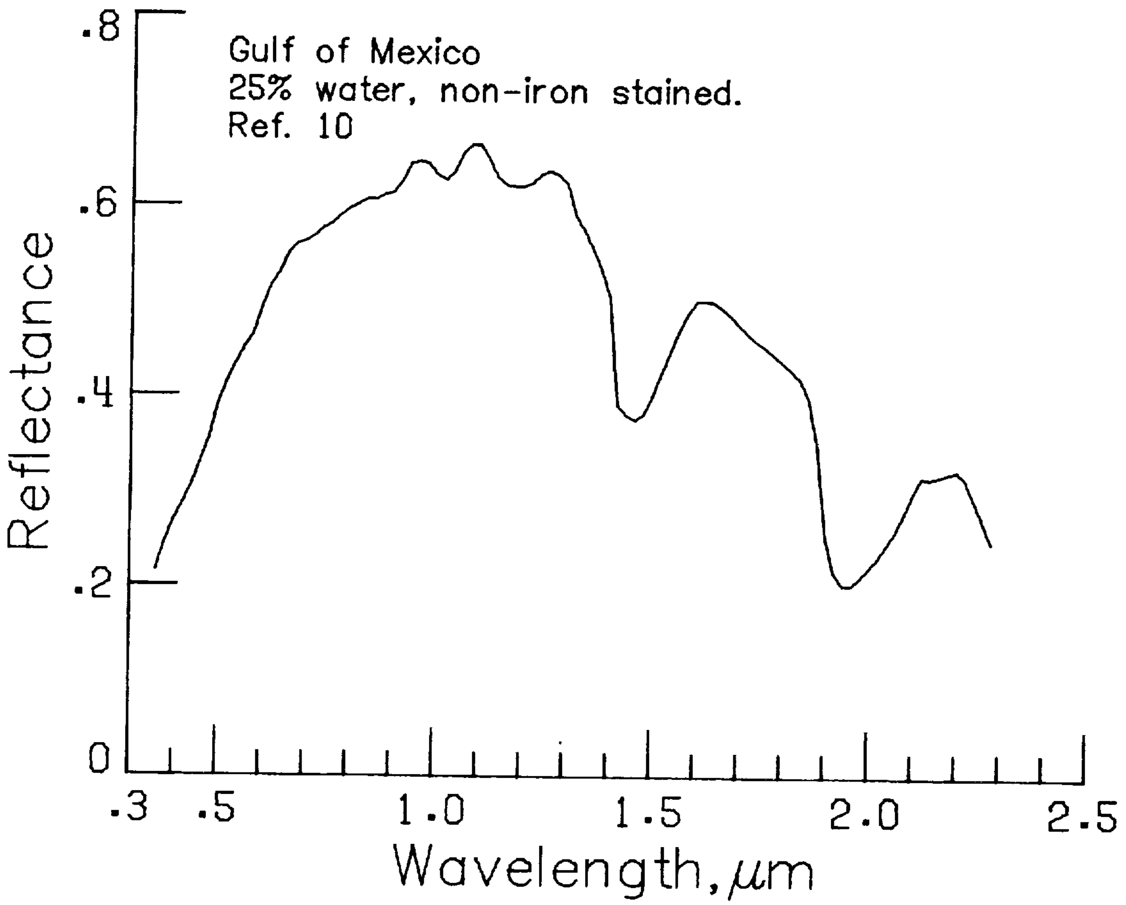
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.369	1.18	.454	1.62	.496	2.06	.511
.32		.76	.376	1.20	.457	1.64	.497	2.08	.515
.34		.78	.383	1.22	.459	1.66	.498	2.10	.517
.36		.80	.393	1.24	.462	1.68	.500	2.12	.517
.38		.82	.397	1.26	.464	1.70	.501	2.14	.517
.40		.84	.402	1.28	.467	1.72	.502	2.16	.517
.42		.86	.405	1.30	.470	1.74	.503	2.18	.517
.44		.88	.408	1.32	.472	1.76	.504	2.20	.517
.46		.90	.411	1.34	.475	1.78	.505	2.22	.517
.48		.92	.413	1.36	.478	1.80	.507	2.24	.517
.50		.94	.417	1.38	.480	1.82	.507	2.26	.518
.52	.307	.96	.422	1.40	.482	1.84	.507	2.28	.519
.54	.318	.98	.425	1.42	.484	1.86	.506	2.30	.520
.56	.328	1.00	.428	1.44	.486	1.88	.504	2.32	.520
.58	.332	1.02	.430	1.46	.487	1.90	.502	2.34	.520
.60	.336	1.04	.433	1.48	.489	1.92	.500	2.36	.520
.62	.340	1.06	.436	1.50	.490	1.94	.498	2.38	.519
.64	.344	1.08	.439	1.52	.491	1.96	.496	2.40	.518
.66	.349	1.10	.442	1.54	.492	1.98	.496	2.42	.517
.68	.354	1.12	.445	1.56	.493	2.00	.499	2.44	.516
.70	.359	1.14	.448	1.58	.494	2.02	.503	2.46	.515
.72	.364	1.16	.451	1.60	.495	2.04	.508	2.48	.514

NO.109 - CARBONATE BEACH SAND SAMPLE



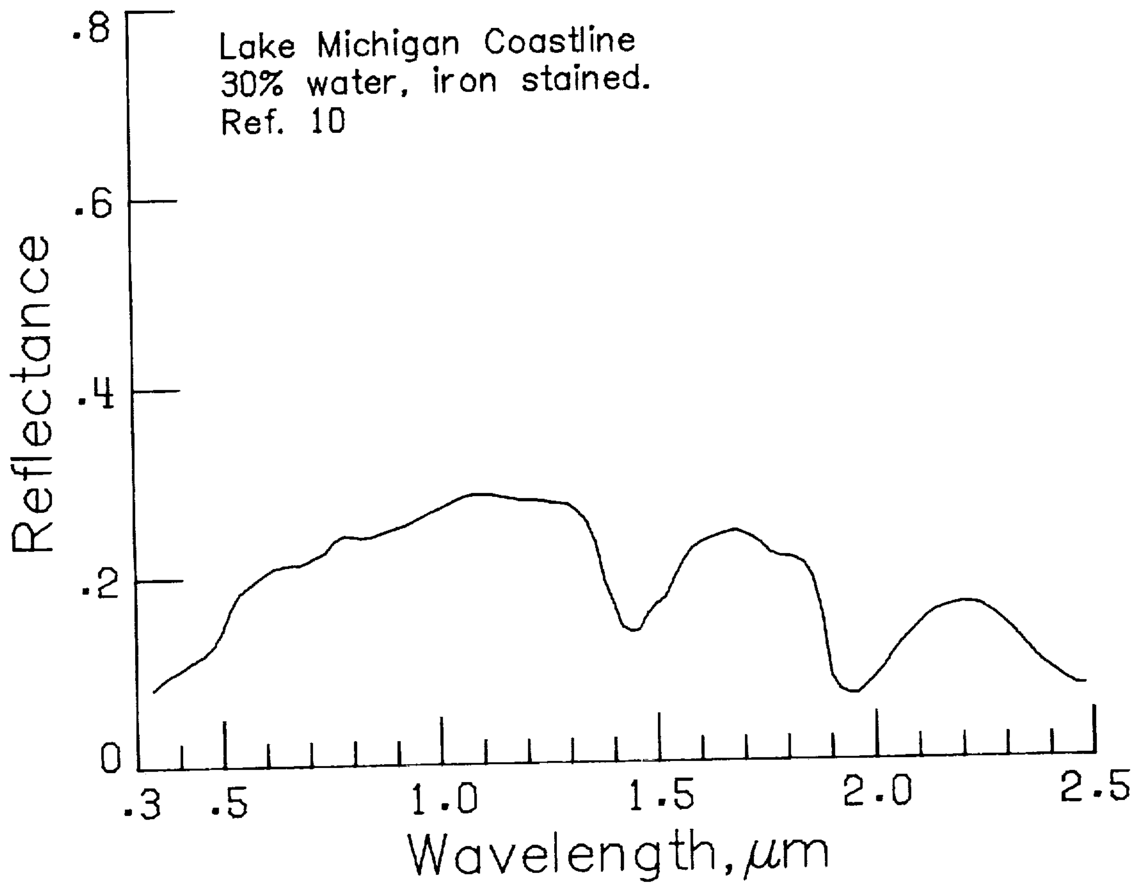
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.530	1.18	.541	1.62	.448	2.06	.258
.32		.76	.536	1.20	.544	1.64	.446	2.08	.276
.34		.78	.543	1.22	.549	1.66	.443	2.10	.285
.36	.271	.80	.543	1.24	.550	1.68	.442	2.12	.294
.38	.288	.82	.543	1.26	.549	1.70	.441	2.14	.298
.40	.305	.84	.541	1.28	.547	1.72	.436	2.16	.298
.42	.324	.86	.540	1.30	.538	1.74	.426	2.18	.296
.44	.347	.88	.541	1.32	.528	1.76	.412	2.20	.289
.46	.369	.90	.543	1.34	.509	1.78	.397	2.22	.284
.48	.390	.92	.550	1.36	.489	1.80	.383	2.24	.279
.50	.413	.94	.553	1.38	.435	1.82	.365	2.26	.272
.52	.433	.96	.555	1.40	.376	1.84	.340	2.28	.262
.54	.445	.98	.557	1.42	.341	1.86	.308	2.30	.250
.56	.457	1.00	.558	1.44	.323	1.88	.267	2.32	
.58	.467	1.02	.559	1.46	.322	1.90	.229	2.34	
.60	.477	1.04	.557	1.48	.330	1.92	.183	2.36	
.62	.487	1.06	.562	1.50	.352	1.94	.175	2.38	
.64	.496	1.08	.564	1.52	.383	1.96	.179	2.40	
.66	.503	1.10	.561	1.54	.414	1.98	.195	2.42	
.68	.511	1.12	.552	1.56	.441	2.00	.205	2.44	
.70	.519	1.14	.545	1.58	.455	2.02	.221	2.46	
.72	.525	1.16	.541	1.60	.456	2.04	.240	2.48	

NO.110 - QUARTZ BEACH SAND SAMPLE



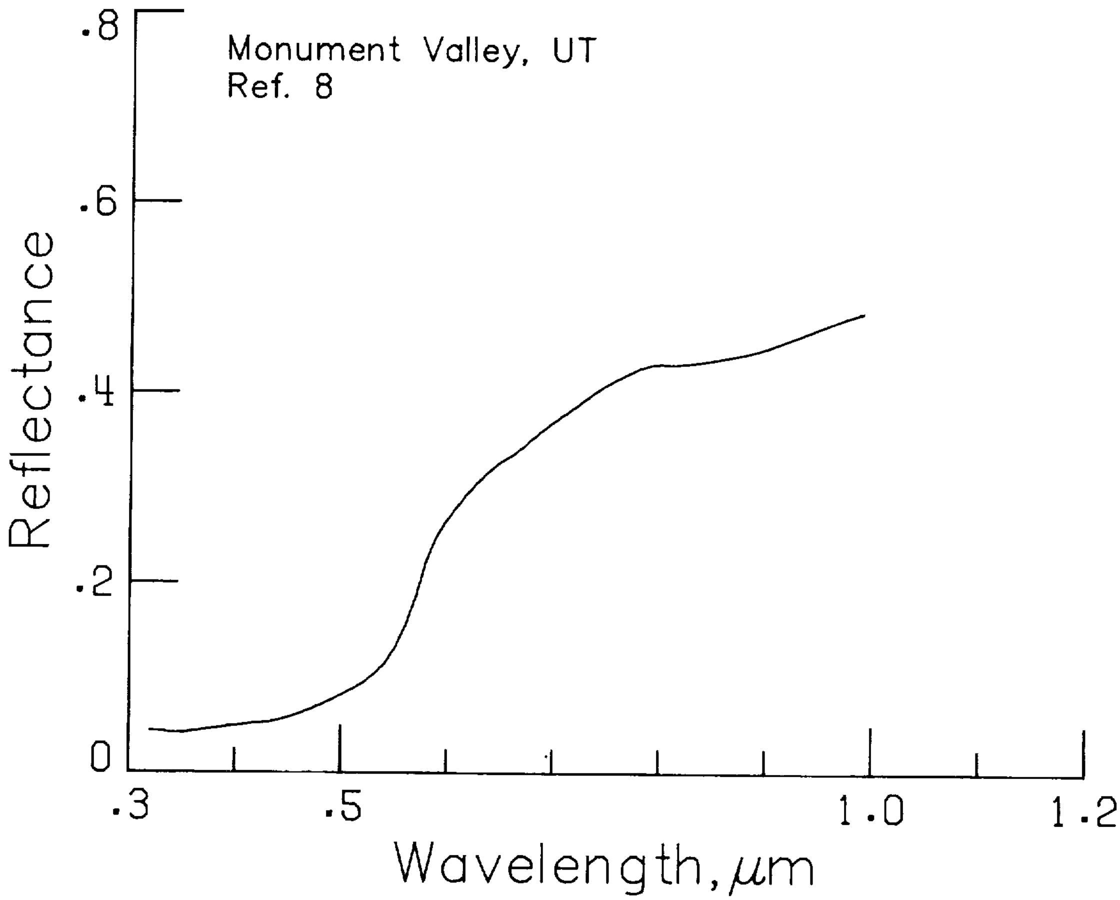
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.577	1.18	.621	1.62	.501	2.06	.259
.32		.76	.582	1.20	.621	1.64	.499	2.08	.277
.34		.78	.591	1.22	.625	1.66	.492	2.10	.299
.36	.216	.80	.598	1.24	.634	1.68	.484	2.12	.316
.38	.245	.82	.602	1.26	.637	1.70	.474	2.14	.315
.40	.268	.84	.607	1.28	.633	1.72	.465	2.16	.318
.42	.286	.86	.607	1.30	.624	1.74	.457	2.18	.321
.44	.306	.88	.612	1.32	.590	1.76	.451	2.20	.324
.46	.330	.90	.615	1.34	.575	1.78	.443	2.22	.315
.48	.355	.92	.627	1.36	.556	1.80	.436	2.24	.293
.50	.390	.94	.644	1.38	.534	1.82	.427	2.26	.272
.52	.415	.96	.647	1.40	.504	1.84	.418	2.28	.248
.54	.433	.98	.644	1.42	.390	1.86	.398	2.30	
.56	.451	1.00	.632	1.44	.380	1.88	.349	2.32	
.58	.465	1.02	.627	1.46	.376	1.90	.253	2.34	
.60	.492	1.04	.636	1.48	.382	1.92	.217	2.36	
.62	.516	1.06	.655	1.50	.401	1.94	.203	2.38	
.64	.530	1.08	.664	1.52	.425	1.96	.203	2.40	
.66	.550	1.10	.663	1.54	.447	1.98	.211	2.42	
.68	.560	1.12	.648	1.56	.469	2.00	.221	2.44	
.70	.563	1.14	.629	1.58	.488	2.02	.231	2.46	
.72	.568	1.16	.622	1.60	.501	2.04	.245	2.48	

NO.111 - QUARTZ BEACH SAND SAMPLE



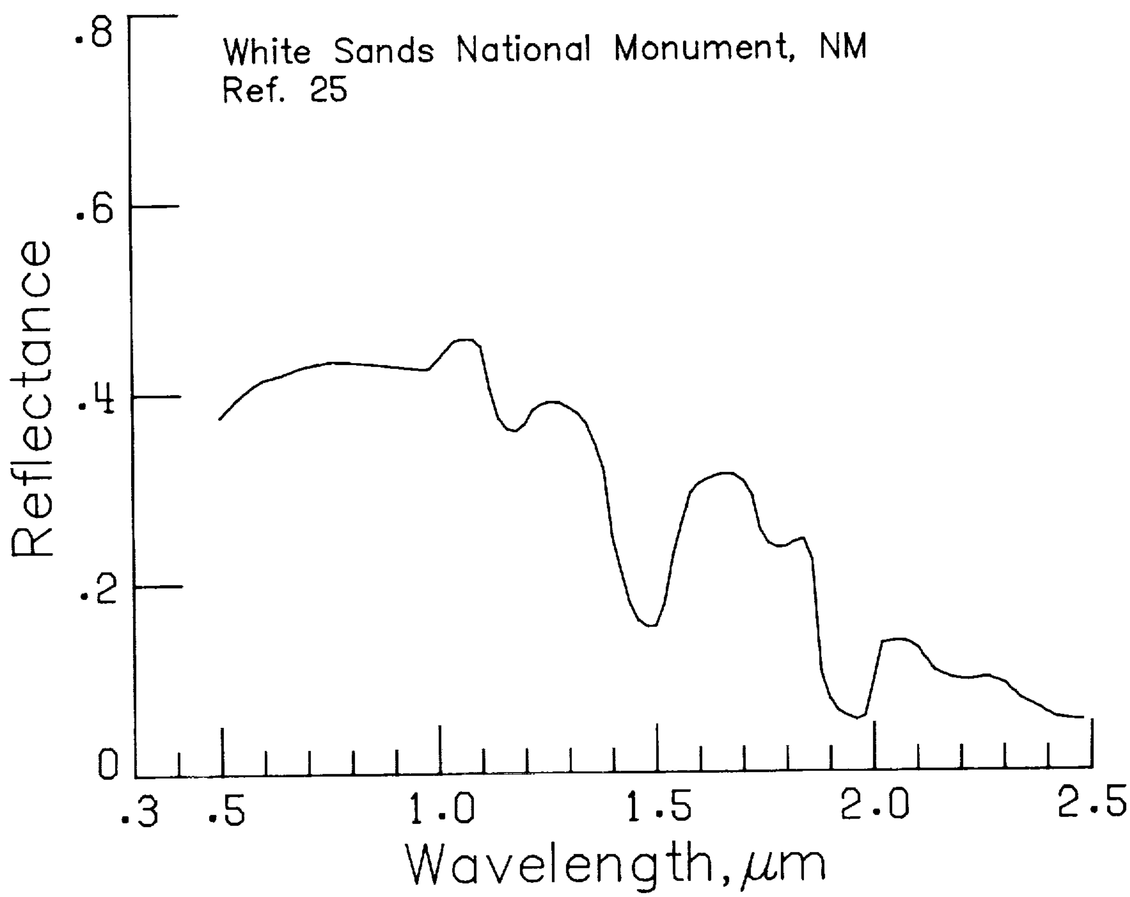
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.226	1.18	.279	1.62	.235	2.06	.123
.32		.76	.238	1.20	.278	1.64	.238	2.08	.133
.34	.084	.78	.243	1.22	.278	1.66	.241	2.10	.142
.36	.091	.80	.241	1.24	.277	1.68	.243	2.12	.151
.38	.098	.82	.240	1.26	.275	1.70	.240	2.14	.157
.40	.102	.84	.241	1.28	.274	1.72	.236	2.16	.160
.42	.109	.86	.244	1.30	.272	1.74	.229	2.18	.163
.44	.114	.88	.247	1.32	.264	1.76	.220	2.20	.165
.46	.120	.90	.250	1.34	.254	1.78	.216	2.22	.164
.48	.128	.92	.253	1.36	.232	1.80	.215	2.24	.162
.50	.144	.94	.257	1.38	.193	1.82	.213	2.26	.157
.52	.167	.96	.261	1.40	.170	1.84	.208	2.28	.151
.54	.184	.98	.266	1.42	.143	1.86	.192	2.30	.142
.56	.191	1.00	.270	1.44	.138	1.88	.154	2.32	.133
.58	.198	1.02	.275	1.46	.140	1.90	.088	2.34	.123
.60	.204	1.04	.279	1.48	.157	1.92	.074	2.36	.112
.62	.210	1.06	.283	1.50	.168	1.94	.070	2.38	.102
.64	.212	1.08	.285	1.52	.174	1.96	.070	2.40	.095
.66	.213	1.10	.285	1.54	.193	1.98	.078	2.42	.088
.68	.213	1.12	.284	1.56	.211	2.00	.087	2.44	.082
.70	.217	1.14	.282	1.58	.225	2.02	.097	2.46	.077
.72	.222	1.16	.280	1.60	.231	2.04	.111	2.48	.077

NO.112 - DRY SAND



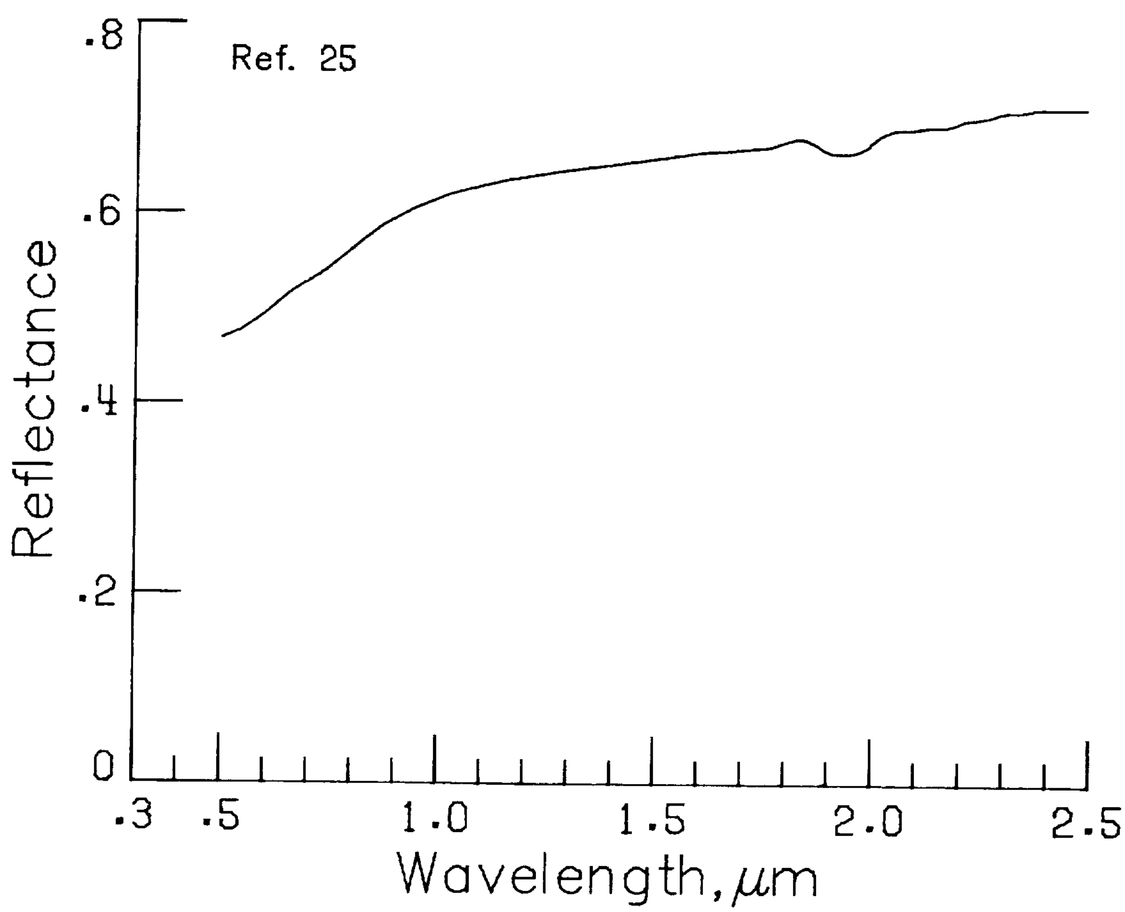
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.071	.66	.335	.84	.434	1.02	
.31		.49	.077	.67	.343	.85	.435	1.03	
.32	.044	.50	.082	.68	.353	.86	.437	1.04	
.33	.043	.51	.088	.69	.362	.87	.440	1.05	
.34	.042	.52	.094	.70	.371	.88	.442	1.06	
.35	.042	.53	.103	.71	.378	.89	.445	1.07	
.36	.043	.54	.114	.72	.386	.90	.448	1.08	
.37	.045	.55	.131	.73	.395	.91	.452	1.09	
.38	.047	.56	.154	.74	.403	.92	.457	1.10	
.39	.048	.57	.186	.75	.410	.93	.461	1.11	
.40	.050	.58	.225	.76	.416	.94	.465	1.12	
.41	.051	.59	.251	.77	.421	.95	.470	1.13	
.42	.053	.60	.268	.78	.427	.96	.474	1.14	
.43	.053	.61	.283	.79	.430	.97	.478	1.15	
.44	.055	.62	.297	.80	.431	.98	.482	1.16	
.45	.058	.63	.309	.81	.430	.99	.485	1.17	
.46	.062	.64	.320	.82	.431	1.00		1.18	
.47	.067	.65	.329	.83	.432	1.01		1.19	

NO.113 - GYPSUM SAND SAMPLE



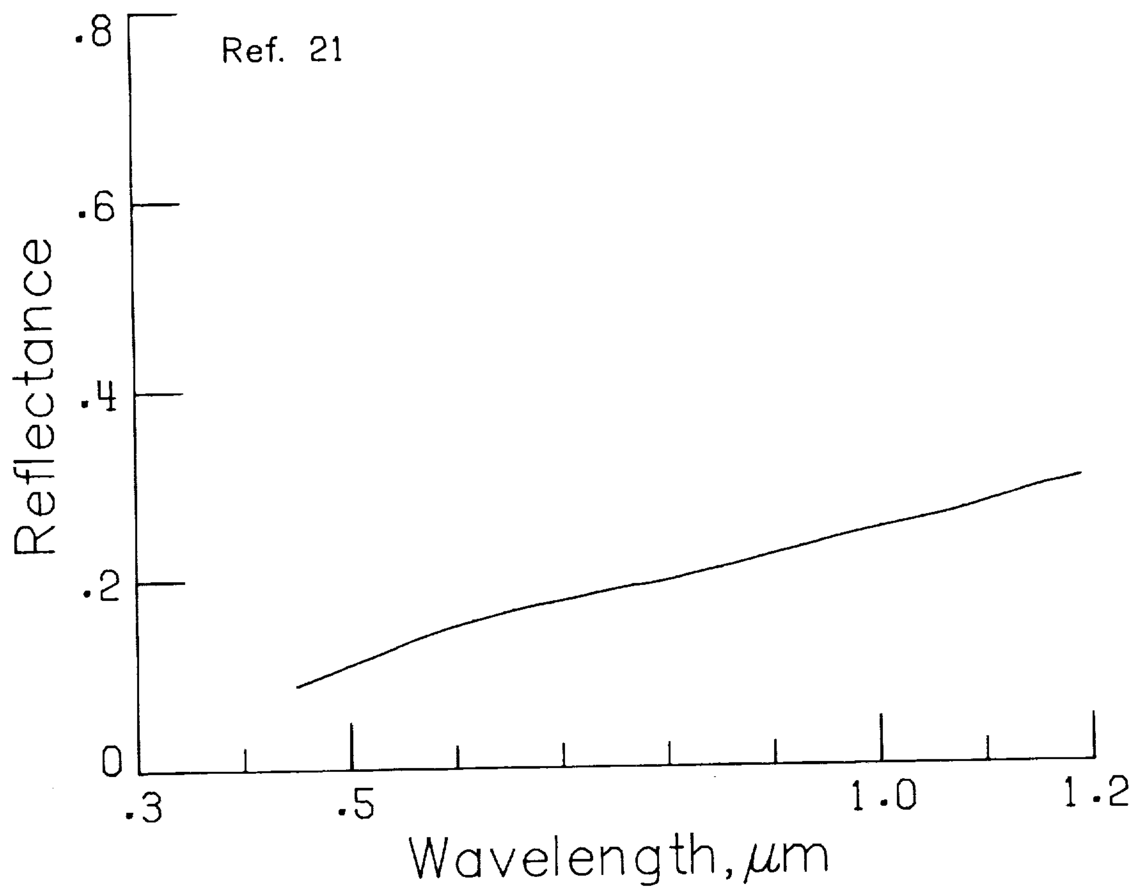
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.432	1.18	.360	1.62	.308	2.06	.138
.32		.76	.434	1.20	.367	1.64	.312	2.08	.136
.34		.78	.433	1.22	.383	1.66	.313	2.10	.130
.36		.80	.432	1.24	.388	1.68	.312	2.12	.118
.38		.82	.432	1.26	.390	1.70	.306	2.14	.106
.40		.84	.431	1.28	.389	1.72	.292	2.16	.101
.42		.86	.430	1.30	.384	1.74	.254	2.18	.098
.44		.88	.429	1.32	.378	1.76	.240	2.20	.096
.46		.90	.428	1.34	.368	1.78	.236	2.22	.096
.48		.92	.427	1.36	.347	1.80	.237	2.24	.097
.50	.376	.94	.426	1.38	.319	1.82	.242	2.26	.098
.52	.385	.96	.425	1.40	.247	1.84	.245	2.28	.095
.54	.395	.98	.425	1.42	.212	1.86	.223	2.30	.092
.56	.402	1.00	.435	1.44	.177	1.88	.104	2.32	.083
.58	.409	1.02	.445	1.46	.159	1.90	.076	2.34	.075
.60	.415	1.04	.455	1.48	.154	1.92	.063	2.36	.070
.62	.417	1.06	.457	1.50	.154	1.94	.058	2.38	.066
.64	.419	1.08	.457	1.52	.177	1.96	.054	2.40	.060
.66	.423	1.10	.448	1.54	.228	1.98	.058	2.42	.055
.68	.427	1.12	.404	1.56	.263	2.00	.095	2.44	.054
.70	.429	1.14	.373	1.58	.294	2.02	.135	2.46	.053
.72	.431	1.16	.362	1.60	.304	2.04	.136	2.48	.053

NO.114 - SILICA SAND SAMPLE



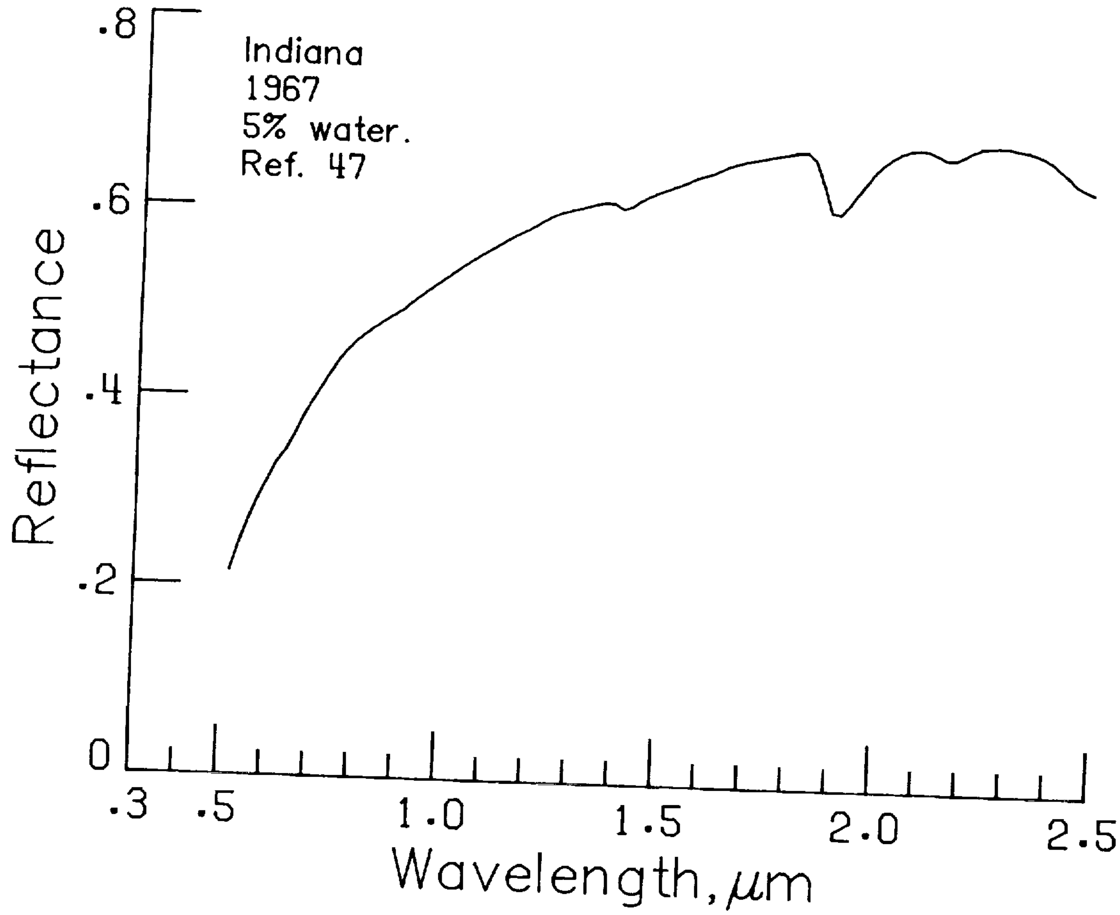
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.542	1.18	.638	1.62	.666	2.06	.690
.32		.76	.549	1.20	.639	1.64	.667	2.08	.690
.34		.78	.556	1.22	.641	1.66	.667	2.10	.692
.36		.80	.564	1.24	.642	1.68	.668	2.12	.693
.38		.82	.571	1.26	.644	1.70	.669	2.14	.694
.40		.84	.579	1.28	.645	1.72	.670	2.16	.694
.42		.86	.586	1.30	.646	1.74	.670	2.18	.697
.44		.88	.591	1.32	.648	1.76	.672	2.20	.700
.46		.90	.596	1.34	.649	1.78	.675	2.22	.701
.48		.92	.601	1.36	.650	1.80	.678	2.24	.702
.50	.468	.94	.606	1.38	.651	1.82	.681	2.26	.704
.52	.472	.96	.610	1.40	.653	1.84	.678	2.28	.708
.54	.476	.98	.613	1.42	.654	1.86	.674	2.30	.710
.56	.482	1.00	.617	1.44	.655	1.88	.668	2.32	.710
.58	.488	1.02	.620	1.46	.656	1.90	.665	2.34	.710
.60	.495	1.04	.623	1.48	.657	1.92	.665	2.36	.712
.62	.503	1.06	.626	1.50	.659	1.94	.665	2.38	.713
.64	.511	1.08	.628	1.52	.660	1.96	.667	2.40	.713
.66	.518	1.10	.630	1.54	.662	1.98	.672	2.42	.713
.68	.524	1.12	.632	1.56	.663	2.00	.681	2.44	.713
.70	.530	1.14	.634	1.58	.664	2.02	.686	2.46	.713
.72	.536	1.16	.636	1.60	.665	2.04	.690	2.48	.713

NO.115 - SHALE



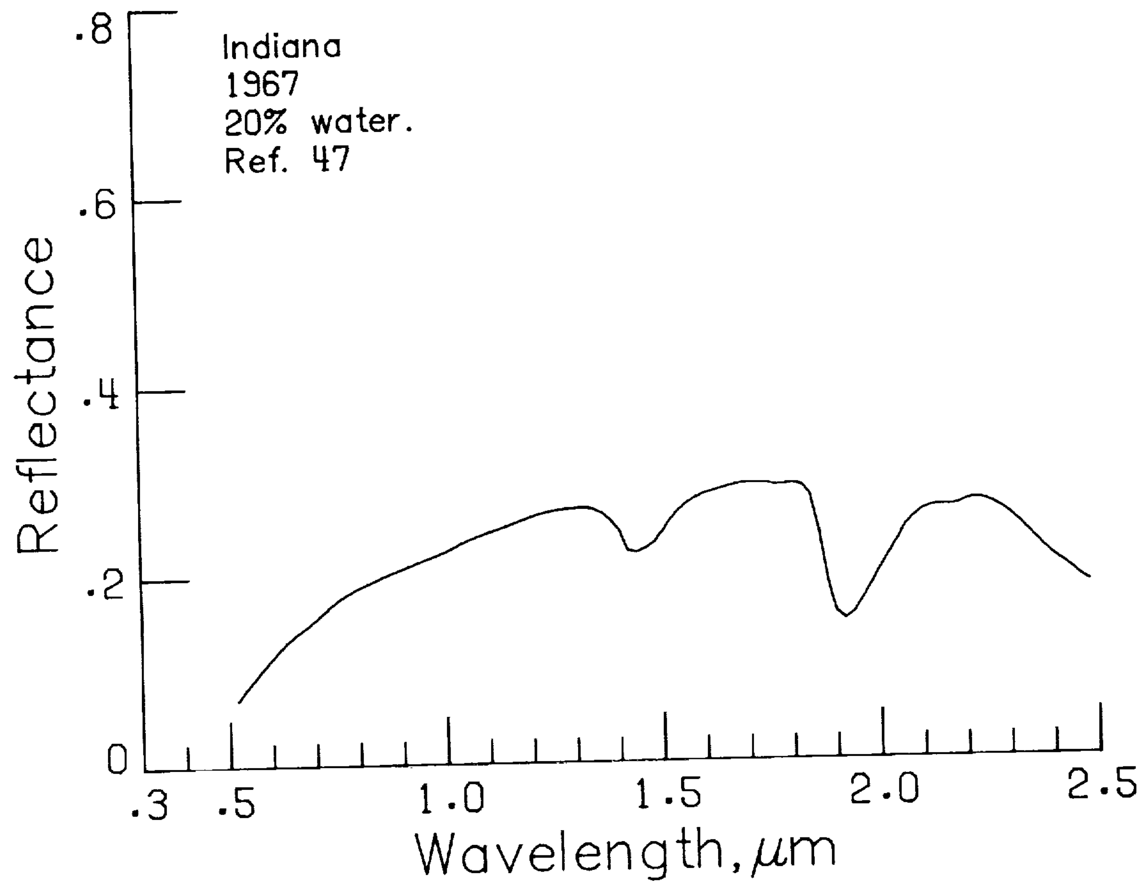
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.101	.66	.167	.84	.206	1.02	.254
.31		.49	.106	.67	.170	.85	.208	1.03	.256
.32		.50	.110	.68	.172	.86	.211	1.04	.258
.33		.51	.114	.69	.174	.87	.214	1.05	.260
.34		.52	.118	.70	.176	.88	.217	1.06	.263
.35		.53	.123	.71	.178	.89	.220	1.07	.265
.36		.54	.127	.72	.180	.90	.222	1.08	.268
.37		.55	.132	.73	.183	.91	.225	1.09	.271
.38		.56	.136	.74	.185	.92	.228	1.10	.275
.39		.57	.140	.75	.187	.93	.230	1.11	.278
.40		.58	.144	.76	.189	.94	.233	1.12	.281
.41		.59	.147	.77	.191	.95	.236	1.13	.284
.42		.60	.150	.78	.192	.96	.239	1.14	.288
.43		.61	.153	.79	.194	.97	.242	1.15	.291
.44		.62	.156	.80	.196	.98	.244	1.16	.294
.45	.089	.63	.159	.81	.198	.99	.247	1.17	.296
.46	.093	.64	.162	.82	.201	1.00	.249	1.18	.298
.47	.097	.65	.165	.83	.204	1.01	.251	1.19	.301

NO.116 - DRY SILT SAMPLE



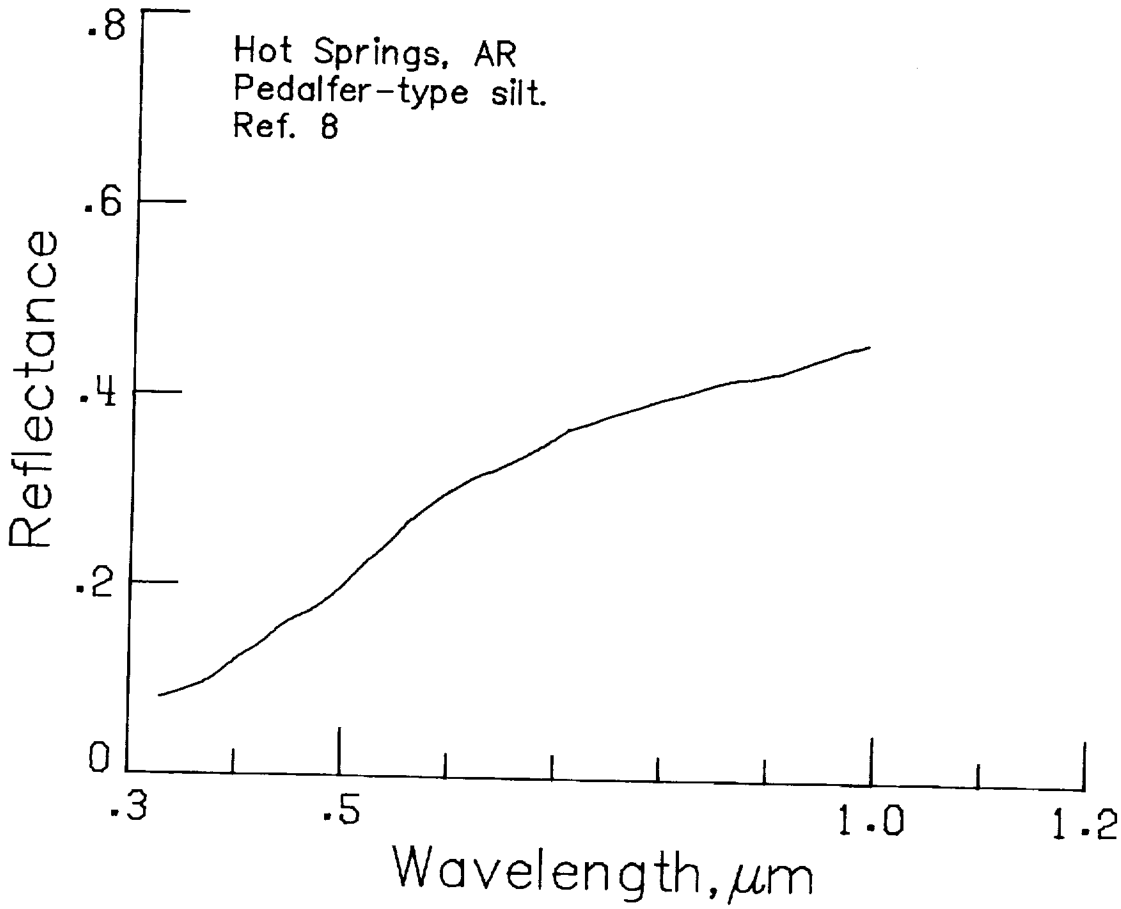
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.428	1.18	.581	1.62	.650	2.06	.676
.32		.76	.442	1.20	.586	1.64	.654	2.08	.677
.34		.78	.453	1.22	.592	1.66	.657	2.10	.675
.36		.80	.462	1.24	.597	1.68	.660	2.12	.671
.38		.82	.469	1.26	.601	1.70	.662	2.14	.667
.40		.84	.476	1.28	.603	1.72	.663	2.16	.667
.42		.86	.482	1.30	.606	1.74	.665	2.18	.671
.44		.88	.488	1.32	.609	1.76	.667	2.20	.677
.46		.90	.494	1.34	.611	1.78	.669	2.22	.680
.48		.92	.502	1.36	.612	1.80	.670	2.24	.681
.50		.94	.509	1.38	.611	1.82	.671	2.26	.682
.52	.216	.96	.516	1.40	.606	1.84	.663	2.28	.681
.54	.246	.98	.523	1.42	.609	1.86	.638	2.30	.679
.56	.271	1.00	.530	1.44	.616	1.88	.608	2.32	.678
.58	.294	1.02	.536	1.46	.620	1.90	.607	2.34	.676
.60	.312	1.04	.543	1.48	.625	1.92	.617	2.36	.672
.62	.331	1.06	.549	1.50	.628	1.94	.630	2.38	.667
.64	.343	1.08	.555	1.52	.632	1.96	.641	2.40	.660
.66	.360	1.10	.561	1.54	.635	1.98	.653	2.42	.652
.68	.381	1.12	.566	1.56	.640	2.00	.662	2.44	.644
.70	.397	1.14	.572	1.58	.643	2.02	.668	2.46	.639
.72	.412	1.16	.577	1.60	.646	2.04	.673	2.48	.635

NO.117 - WET SILT SAMPLE



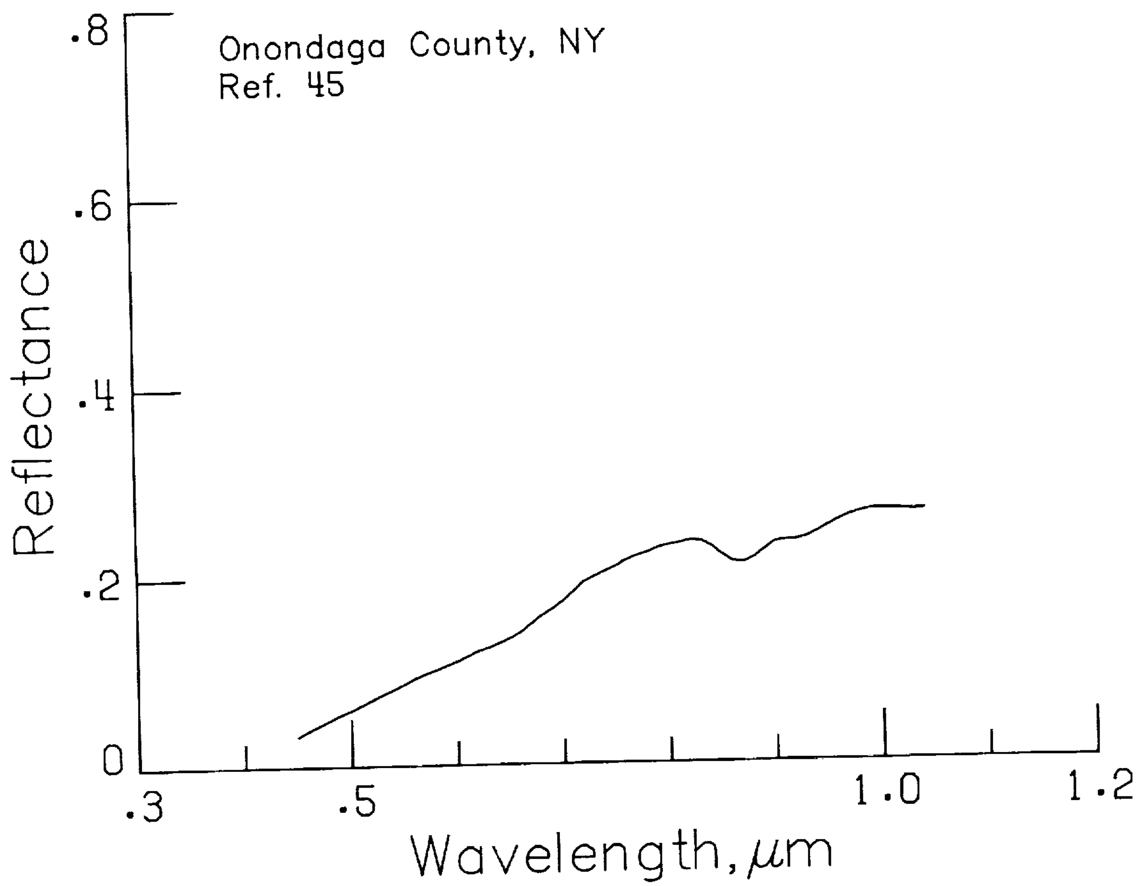
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.171	1.18	.256	1.62	.284	2.06	.246
.32		.76	.177	1.20	.260	1.64	.287	2.08	.255
.34		.78	.183	1.22	.262	1.66	.290	2.10	.262
.36		.80	.188	1.24	.265	1.68	.291	2.12	.265
.38		.82	.192	1.26	.266	1.70	.292	2.14	.266
.40		.84	.196	1.28	.267	1.72	.292	2.16	.266
.42		.86	.200	1.30	.268	1.74	.291	2.18	.267
.44		.88	.203	1.32	.268	1.76	.289	2.20	.271
.46		.90	.207	1.34	.267	1.78	.290	2.22	.273
.48		.92	.210	1.36	.262	1.80	.291	2.24	.271
.50		.94	.214	1.38	.255	1.82	.289	2.26	.267
.52	.071	.96	.217	1.40	.244	1.84	.279	2.28	.262
.54	.083	.98	.220	1.42	.222	1.86	.239	2.30	.255
.56	.094	1.00	.224	1.44	.221	1.88	.187	2.32	.247
.58	.104	1.02	.228	1.46	.225	1.90	.154	2.34	.237
.60	.115	1.04	.233	1.48	.230	1.92	.147	2.36	.228
.62	.125	1.06	.237	1.50	.242	1.94	.154	2.38	.218
.64	.134	1.08	.240	1.52	.255	1.96	.168	2.40	.210
.66	.141	1.10	.244	1.54	.265	1.98	.184	2.42	.204
.68	.147	1.12	.246	1.56	.273	2.00	.201	2.44	.196
.70	.154	1.14	.250	1.58	.278	2.02	.215	2.46	.189
.72	.163	1.16	.253	1.60	.282	2.04	.230	2.48	.183

NO.118 - DRY SILT



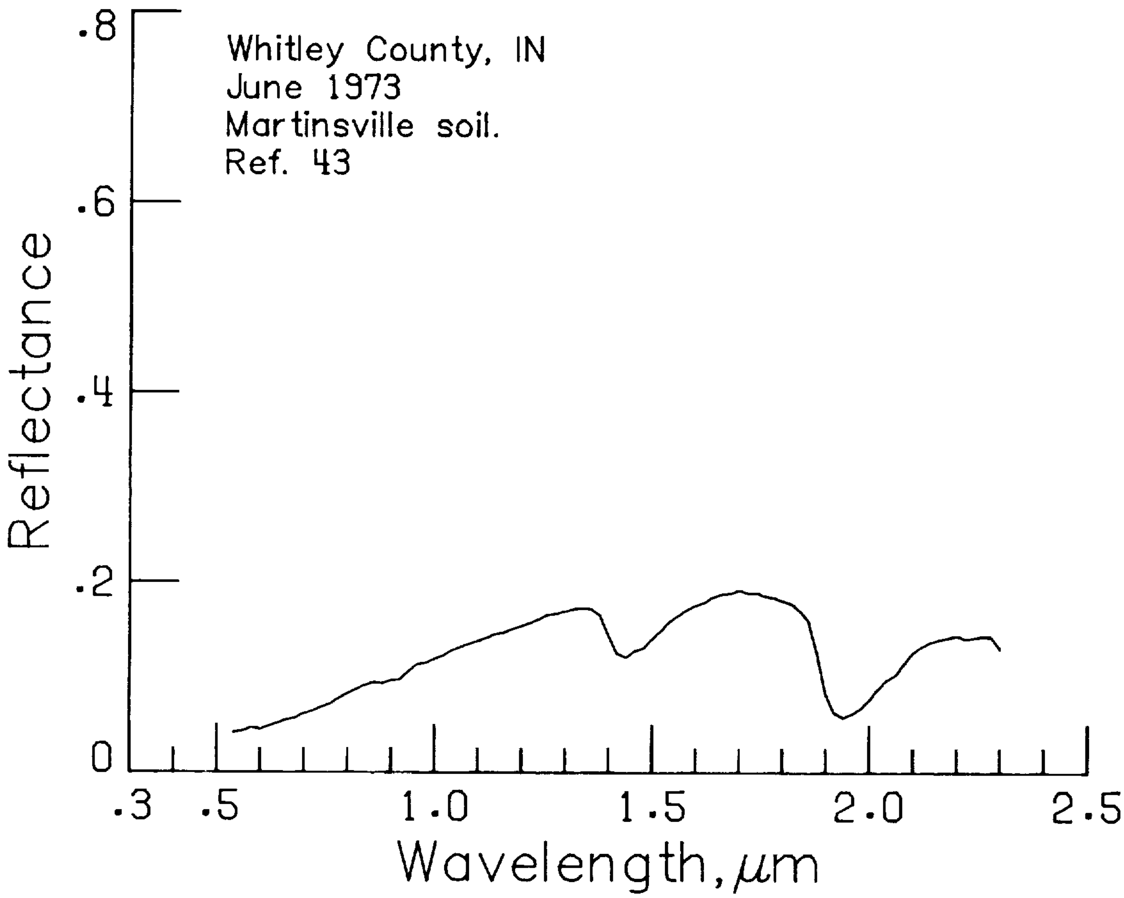
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.182	.66	.334	.84	.414	1.02	
.31		.49	.190	.67	.340	.85	.418	1.03	
.32		.50	.201	.68	.346	.86	.421	1.04	
.33	.081	.51	.212	.69	.352	.87	.423	1.05	
.34	.084	.52	.224	.70	.360	.88	.423	1.06	
.35	.088	.53	.233	.71	.367	.89	.426	1.07	
.36	.092	.54	.244	.72	.371	.90	.428	1.08	
.37	.096	.55	.255	.73	.375	.91	.430	1.09	
.38	.103	.56	.268	.74	.379	.92	.435	1.10	
.39	.112	.57	.277	.75	.383	.93	.439	1.11	
.40	.122	.58	.286	.76	.386	.94	.442	1.12	
.41	.130	.59	.294	.77	.390	.95	.446	1.13	
.42	.136	.60	.301	.78	.394	.96	.451	1.14	
.43	.145	.61	.308	.79	.398	.97	.455	1.15	
.44	.155	.62	.315	.80	.401	.98	.457	1.16	
.45	.163	.63	.320	.81	.404	.99	.460	1.17	
.46	.169	.64	.323	.82	.407	1.00		1.18	
.47	.174	.65	.329	.83	.411	1.01		1.19	

NO.119 - DRY LACUSTRINE SILT AND CLAY



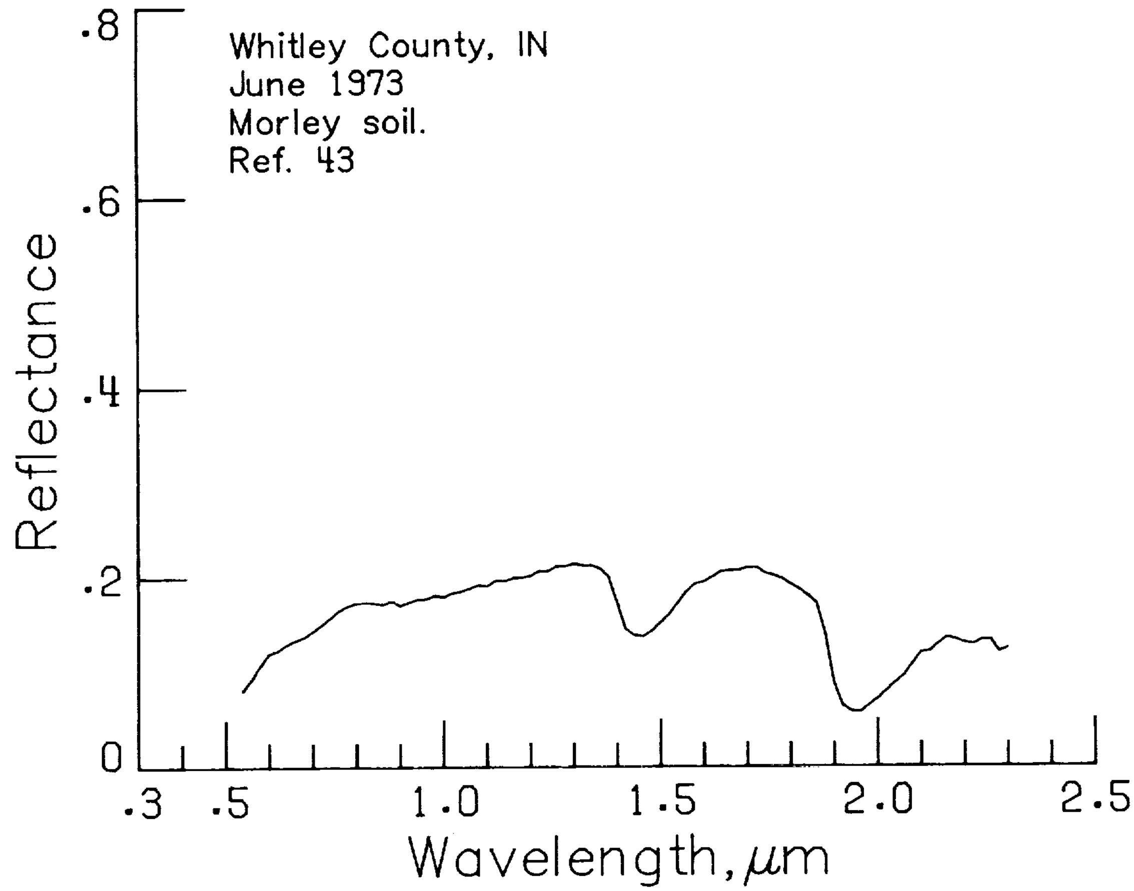
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.050	.66	.140	.84	.228	1.02	.262
.31		.49	.055	.67	.149	.85	.219	1.03	.262
.32		.50	.060	.68	.157	.86	.211	1.04	.263
.33		.51	.065	.69	.164	.87	.210	1.05	
.34		.52	.071	.70	.172	.88	.215	1.06	
.35		.53	.076	.71	.182	.89	.223	1.07	
.36		.54	.081	.72	.192	.90	.231	1.08	
.37		.55	.086	.73	.198	.91	.233	1.09	
.38		.56	.092	.74	.203	.92	.233	1.10	
.39		.57	.097	.75	.208	.93	.236	1.11	
.40		.58	.101	.76	.214	.94	.241	1.12	
.41		.59	.105	.77	.219	.95	.247	1.13	
.42		.60	.110	.78	.222	.96	.253	1.14	
.43		.61	.115	.79	.227	.97	.258	1.15	
.44		.62	.120	.80	.230	.98	.261	1.16	
.45	.033	.63	.124	.81	.231	.99	.264	1.17	
.46	.039	.64	.128	.82	.234	1.00	.264	1.18	
.47	.044	.65	.134	.83	.233	1.01	.264	1.19	

NO.120 - SOIL SAMPLE



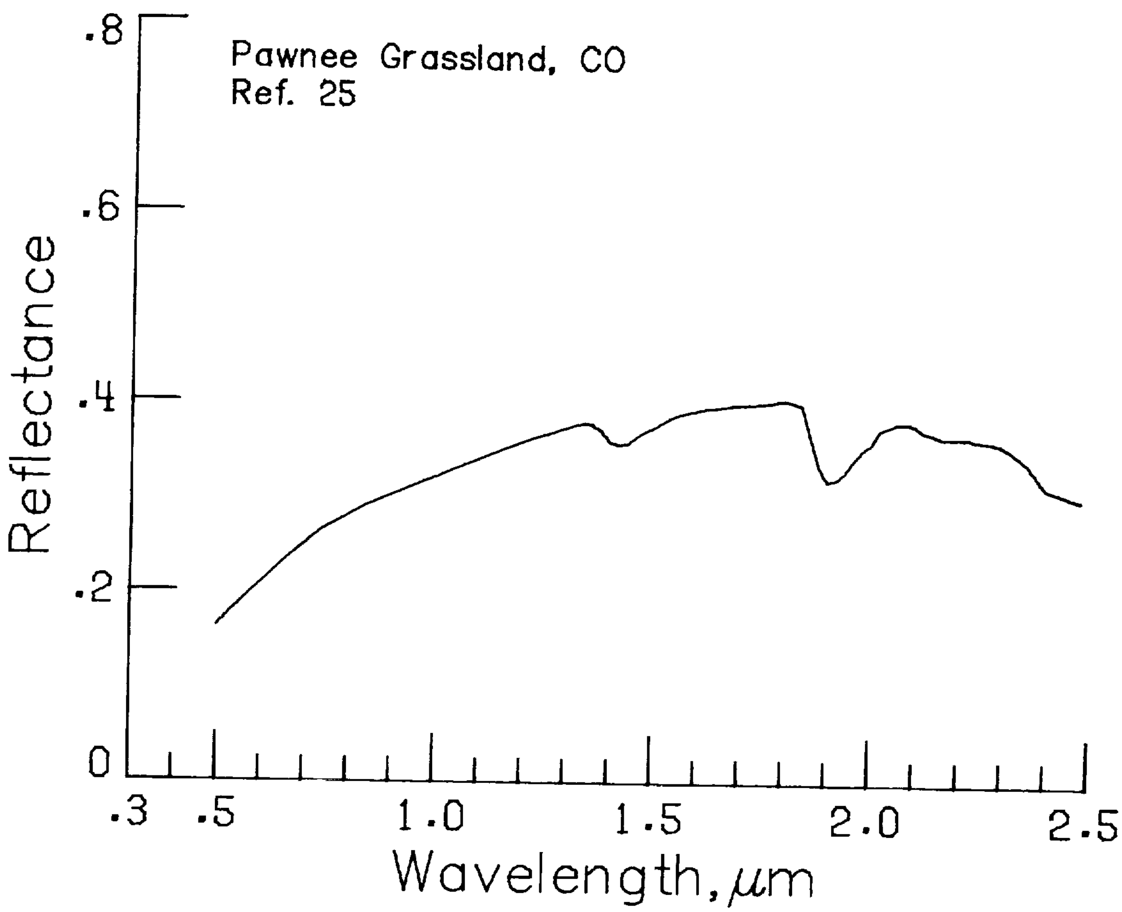
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.069	1.18	.152	1.62	.180	2.06	.104
.32		.76	.072	1.20	.154	1.64	.185	2.08	.116
.34		.78	.078	1.22	.158	1.66	.188	2.10	.127
.36		.80	.083	1.24	.162	1.68	.189	2.12	.134
.38		.82	.088	1.26	.166	1.70	.192	2.14	.138
.40		.84	.092	1.28	.168	1.72	.189	2.16	.141
.42		.86	.095	1.30	.170	1.74	.189	2.18	.143
.44		.88	.094	1.32	.172	1.76	.186	2.20	.145
.46		.90	.097	1.34	.173	1.78	.184	2.22	.141
.48		.92	.098	1.36	.172	1.80	.181	2.24	.143
.50		.94	.107	1.38	.166	1.82	.178	2.26	.144
.52		.96	.114	1.40	.145	1.84	.170	2.28	.143
.54	.042	.98	.116	1.42	.125	1.86	.160	2.30	.131
.56	.044	1.00	.120	1.44	.122	1.88	.126	2.32	
.58	.047	1.02	.123	1.46	.128	1.90	.083	2.34	
.60	.045	1.04	.129	1.48	.131	1.92	.063	2.36	
.62	.049	1.06	.133	1.50	.141	1.94	.058	2.38	
.64	.052	1.08	.136	1.52	.149	1.96	.062	2.40	
.66	.055	1.10	.139	1.54	.159	1.98	.068	2.42	
.68	.057	1.12	.142	1.56	.166	2.00	.077	2.44	
.70	.062	1.14	.146	1.58	.172	2.02	.089	2.46	
.72	.064	1.16	.148	1.60	.176	2.04	.098	2.48	

NO.121 - SOIL SAMPLE



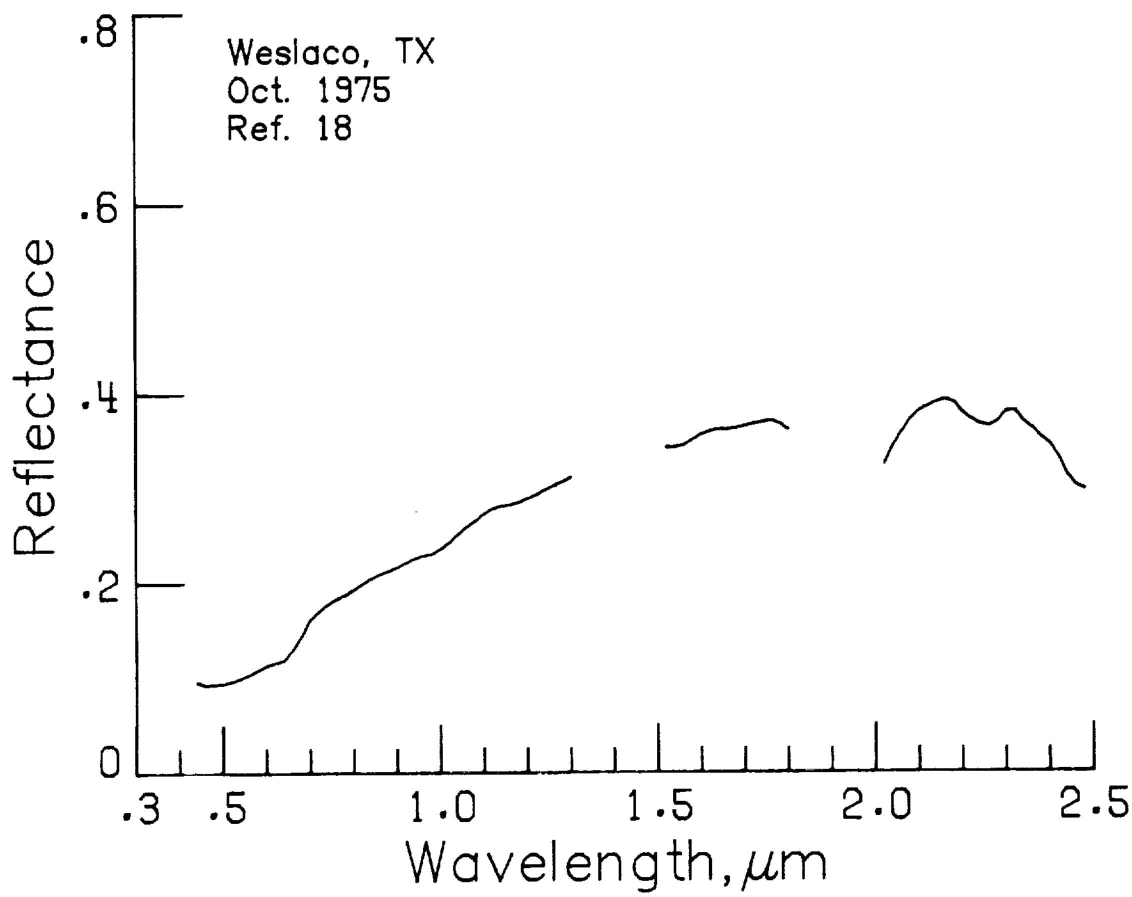
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.158	1.18	.200	1.62	.200	2.06	.096
.32		.76	.166	1.20	.202	1.64	.206	2.08	.108
.34		.78	.170	1.22	.207	1.66	.207	2.10	.120
.36		.80	.173	1.24	.207	1.68	.207	2.12	.121
.38		.82	.174	1.26	.212	1.70	.210	2.14	.129
.40		.84	.173	1.28	.212	1.72	.210	2.16	.136
.42		.86	.172	1.30	.214	1.74	.204	2.18	.133
.44		.88	.175	1.32	.212	1.76	.201	2.20	.129
.46		.90	.170	1.34	.213	1.78	.198	2.22	.128
.48		.92	.174	1.36	.209	1.80	.192	2.24	.133
.50		.94	.177	1.38	.201	1.82	.187	2.26	.133
.52		.96	.178	1.40	.173	1.84	.180	2.28	.120
.54	.082	.98	.181	1.42	.145	1.86	.172	2.30	.124
.56	.094	1.00	.179	1.44	.138	1.88	.139	2.32	
.58	.108	1.02	.184	1.46	.137	1.90	.088	2.34	
.60	.121	1.04	.186	1.48	.143	1.92	.064	2.36	
.62	.124	1.06	.189	1.50	.152	1.94	.058	2.38	
.64	.130	1.08	.192	1.52	.161	1.96	.058	2.40	
.66	.134	1.10	.191	1.54	.173	1.98	.065	2.42	
.68	.138	1.12	.197	1.56	.185	2.00	.072	2.44	
.70	.144	1.14	.196	1.58	.193	2.02	.080	2.46	
.72	.151	1.16	.200	1.60	.195	2.04	.088	2.48	

NO.122 - SOIL SAMPLE



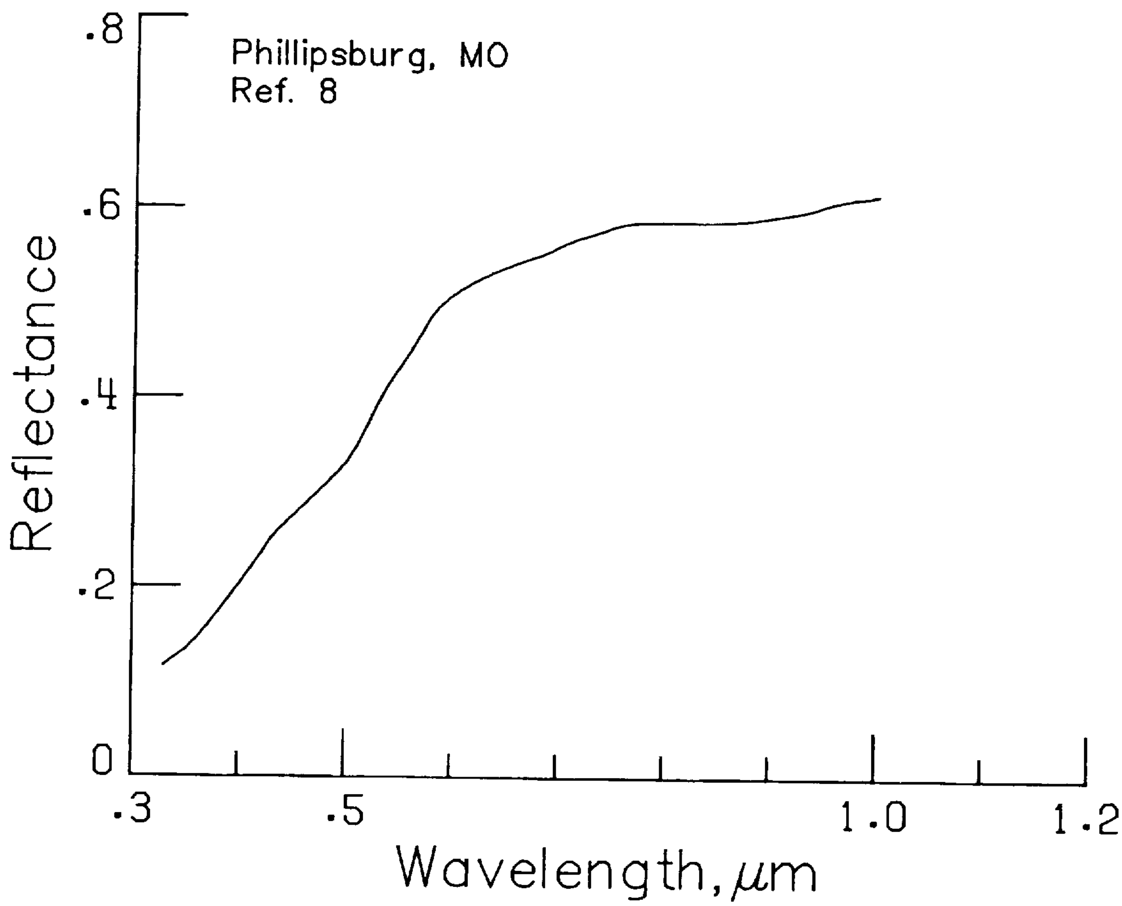
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.265	1.18	.355	1.62	.395	2.06	.381
.32		.76	.270	1.20	.359	1.64	.396	2.08	.381
.34		.78	.276	1.22	.362	1.66	.397	2.10	.379
.36		.80	.281	1.24	.365	1.68	.398	2.12	.371
.38		.82	.286	1.26	.367	1.70	.399	2.14	.369
.40		.84	.291	1.28	.370	1.72	.400	2.16	.366
.42		.86	.295	1.30	.374	1.74	.401	2.18	.366
.44		.88	.298	1.32	.377	1.76	.401	2.20	.366
.46		.90	.302	1.34	.379	1.78	.403	2.22	.365
.48		.92	.306	1.36	.377	1.80	.404	2.24	.363
.50	.163	.94	.310	1.38	.371	1.82	.402	2.26	.362
.52	.173	.96	.314	1.40	.359	1.84	.395	2.28	.361
.54	.183	.98	.318	1.42	.356	1.86	.366	2.30	.357
.56	.192	1.00	.322	1.44	.357	1.88	.334	2.32	.352
.58	.200	1.02	.325	1.46	.364	1.90	.319	2.34	.345
.60	.209	1.04	.329	1.48	.370	1.92	.321	2.36	.338
.62	.218	1.06	.333	1.50	.375	1.94	.329	2.38	.325
.64	.227	1.08	.337	1.52	.380	1.96	.342	2.40	.313
.66	.235	1.10	.340	1.54	.385	1.98	.352	2.42	.310
.68	.243	1.12	.344	1.56	.389	2.00	.359	2.44	.307
.70	.251	1.14	.348	1.58	.391	2.02	.374	2.46	.303
.72	.258	1.16	.351	1.60	.393	2.04	.378	2.48	.301

NO.123 - DISKED BARE SOIL



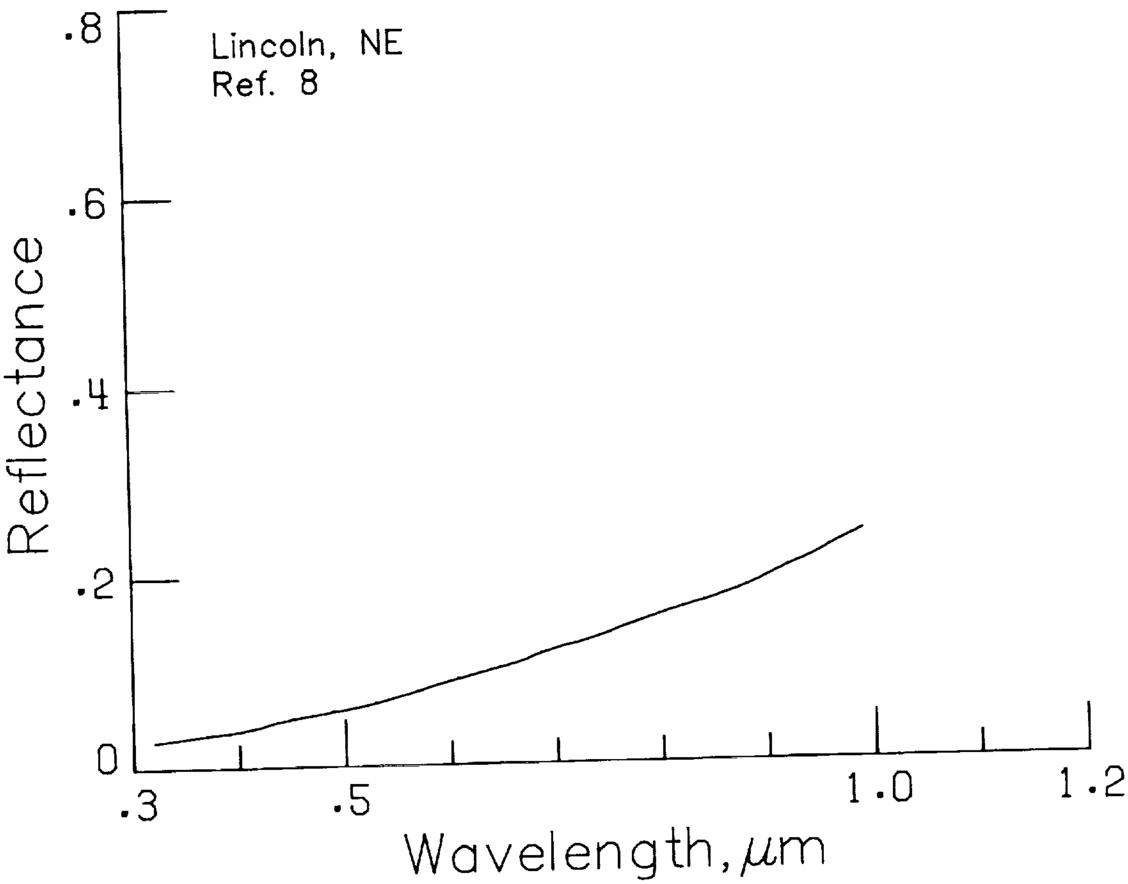
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.178	1.18	.286	1.62	.360	2.06	.359
.32		.76	.184	1.20	.290	1.64	.362	2.08	.373
.34		.78	.188	1.22	.294	1.66	.362	2.10	.381
.36		.80	.194	1.24	.299	1.68	.364	2.12	.386
.38		.82	.199	1.26	.303	1.70	.366	2.14	.391
.40		.84	.205	1.28	.308	1.72	.368	2.16	.393
.42		.86	.209	1.30	.312	1.74	.370	2.18	.390
.44	.096	.88	.213	1.32		1.76	.371	2.20	.379
.46	.093	.90	.217	1.34		1.78	.368	2.22	.372
.48	.094	.92	.221	1.36		1.80	.361	2.24	.367
.50	.095	.94	.226	1.38		1.82		2.26	.365
.52	.097	.96	.229	1.40		1.84		2.28	.369
.54	.101	.98	.231	1.42		1.86		2.30	.380
.56	.105	1.00	.236	1.44		1.88		2.32	.381
.58	.110	1.02	.243	1.46		1.90		2.34	.369
.60	.114	1.04	.252	1.48		1.92		2.36	.362
.62	.117	1.06	.260	1.50		1.94		2.38	.353
.64	.120	1.08	.266	1.52	.343	1.96		2.40	.346
.66	.131	1.10	.273	1.54	.343	1.98		2.42	.331
.68	.145	1.12	.279	1.56	.346	2.00		2.44	.312
.70	.162	1.14	.282	1.58	.351	2.02	.326	2.46	.302
.72	.171	1.16	.283	1.60	.357	2.04	.345	2.48	.298

NO.124 - DRY PEDOCAL-TYPE SOIL



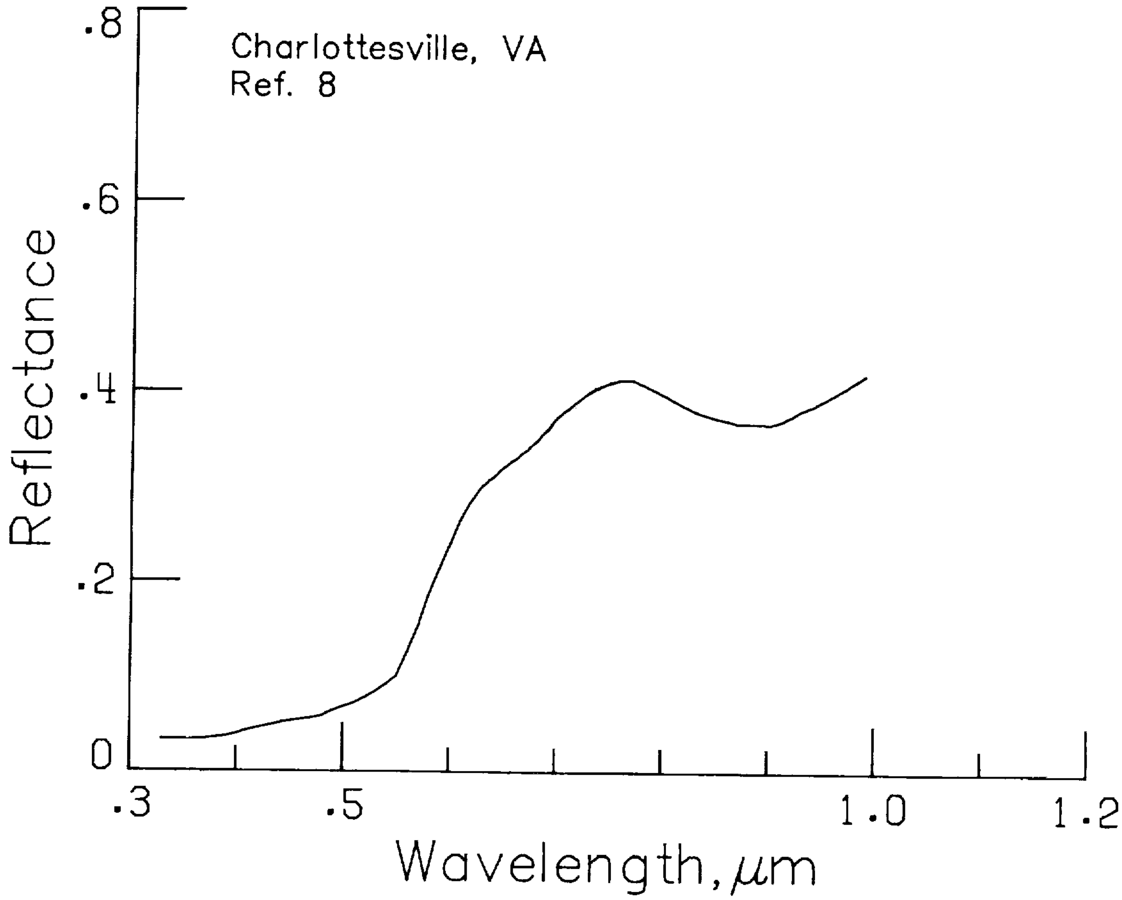
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.308	.66	.542	.84	.586	1.02	
.31		.49	.319	.67	.547	.85	.586	1.03	
.32		.50	.332	.68	.550	.86	.587	1.04	
.33	.117	.51	.349	.69	.555	.87	.588	1.05	
.34	.125	.52	.371	.70	.561	.88	.589	1.06	
.35	.133	.53	.395	.71	.566	.89	.591	1.07	
.36	.145	.54	.415	.72	.570	.90	.592	1.08	
.37	.158	.55	.432	.73	.573	.91	.594	1.09	
.38	.172	.56	.449	.74	.577	.92	.596	1.10	
.39	.187	.57	.468	.75	.581	.93	.598	1.11	
.40	.202	.58	.488	.76	.584	.94	.601	1.12	
.41	.218	.59	.500	.77	.586	.95	.605	1.13	
.42	.234	.60	.509	.78	.586	.96	.608	1.14	
.43	.252	.61	.516	.79	.587	.97	.610	1.15	
.44	.264	.62	.523	.80	.587	.98	.612	1.16	
.45	.275	.63	.528	.81	.586	.99	.613	1.17	
.46	.286	.64	.534	.82	.586	1.00	.615	1.18	
.47	.297	.65	.538	.83	.586	1.01		1.19	

NO.125 - DRY CHERNOZEM-TYPE SOIL



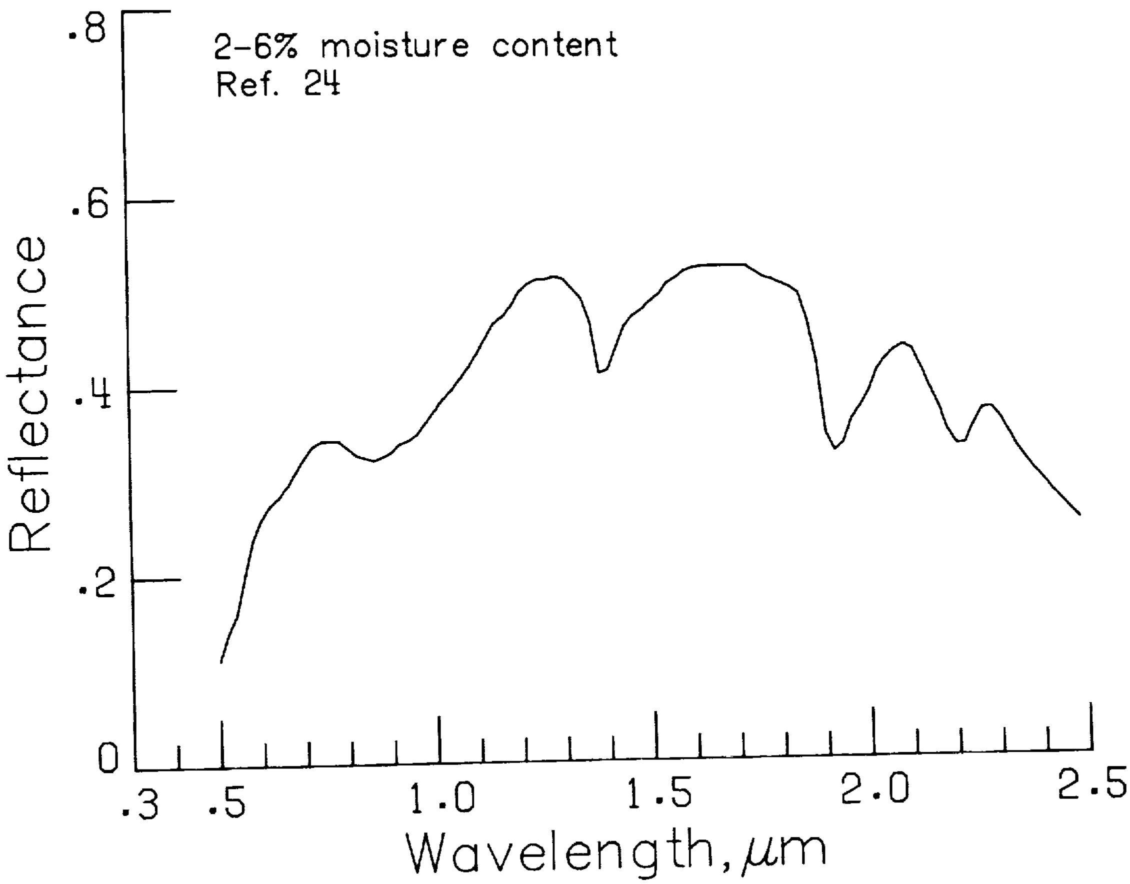
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.057	.66	.106	.84	.168	1.02	
.31		.49	.059	.67	.109	.85	.172	1.03	
.32	.029	.50	.060	.68	.114	.86	.175	1.04	
.33	.030	.51	.062	.69	.117	.87	.179	1.05	
.34	.031	.52	.065	.70	.121	.88	.183	1.06	
.35	.032	.53	.067	.71	.124	.89	.188	1.07	
.36	.034	.54	.070	.72	.126	.90	.193	1.08	
.37	.035	.55	.073	.73	.129	.91	.199	1.09	
.38	.036	.56	.076	.74	.132	.92	.204	1.10	
.39	.037	.57	.079	.75	.136	.93	.208	1.11	
.40	.039	.58	.083	.76	.141	.94	.213	1.12	
.41	.041	.59	.086	.77	.144	.95	.219	1.13	
.42	.043	.60	.089	.78	.148	.96	.225	1.14	
.43	.047	.61	.091	.79	.152	.97	.230	1.15	
.44	.049	.62	.094	.80	.155	.98	.236	1.16	
.45	.051	.63	.097	.81	.159	.99	.241	1.17	
.46	.053	.64	.100	.82	.162	1.00		1.18	
.47	.055	.65	.103	.83	.165	1.01		1.19	

NO.126 - DRY LATERITE-TYPE SOIL



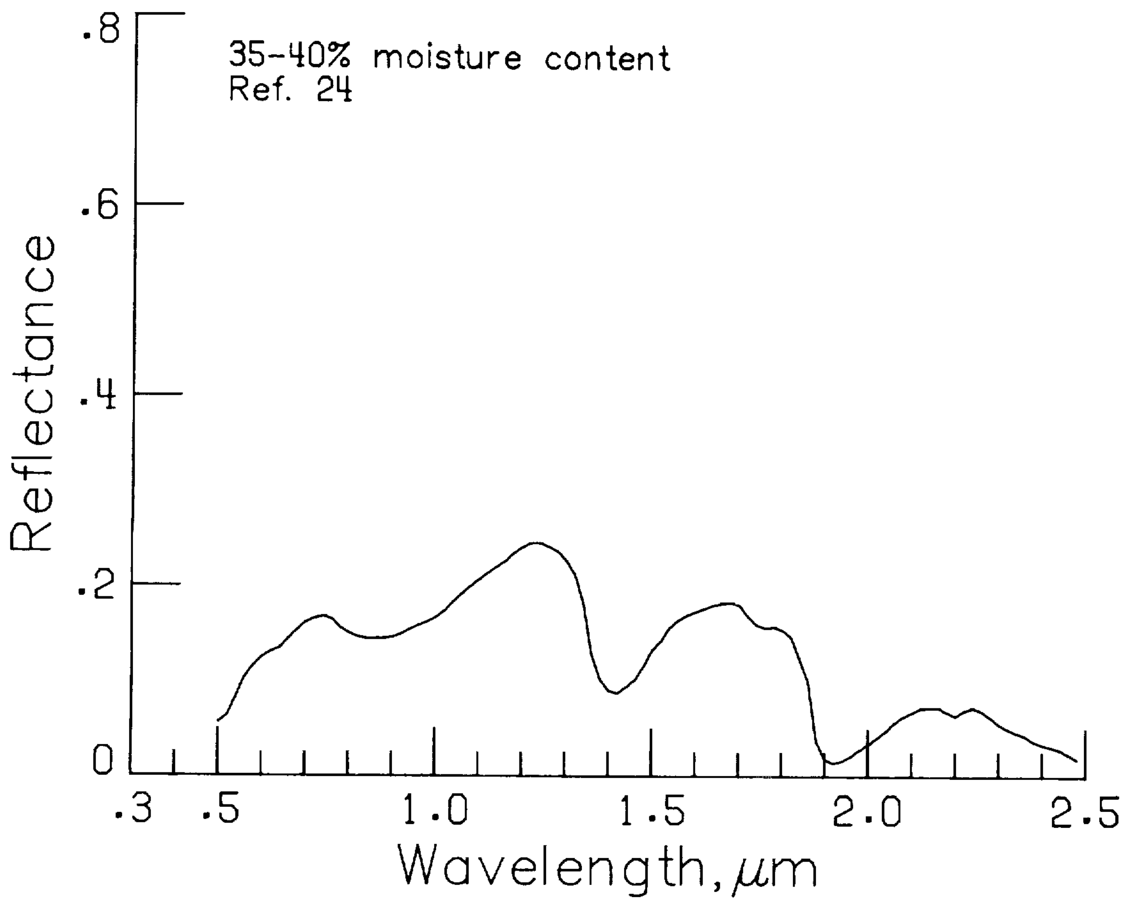
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.059	.66	.329	.84	.376	1.02	
.31		.49	.064	.67	.338	.85	.373	1.03	
.32		.50	.069	.68	.348	.86	.371	1.04	
.33	.033	.51	.072	.69	.361	.87	.368	1.05	
.34	.033	.52	.078	.70	.374	.88	.368	1.06	
.35	.033	.53	.084	.71	.383	.89	.368	1.07	
.36	.033	.54	.092	.72	.392	.90	.367	1.08	
.37	.034	.55	.101	.73	.401	.91	.371	1.09	
.38	.036	.56	.126	.74	.406	.92	.376	1.10	
.39	.037	.57	.153	.75	.410	.93	.382	1.11	
.40	.040	.58	.187	.76	.413	.94	.386	1.12	
.41	.043	.59	.214	.77	.413	.95	.393	1.13	
.42	.046	.60	.240	.78	.408	.96	.399	1.14	
.43	.048	.61	.267	.79	.403	.97	.405	1.15	
.44	.051	.62	.286	.80	.397	.98	.412	1.16	
.45	.053	.63	.302	.81	.391	.99	.419	1.17	
.46	.055	.64	.311	.82	.385	1.00		1.18	
.47	.056	.65	.321	.83	.380	1.01		1.19	

NO.127 - DRY CLAY SOIL SAMPLE



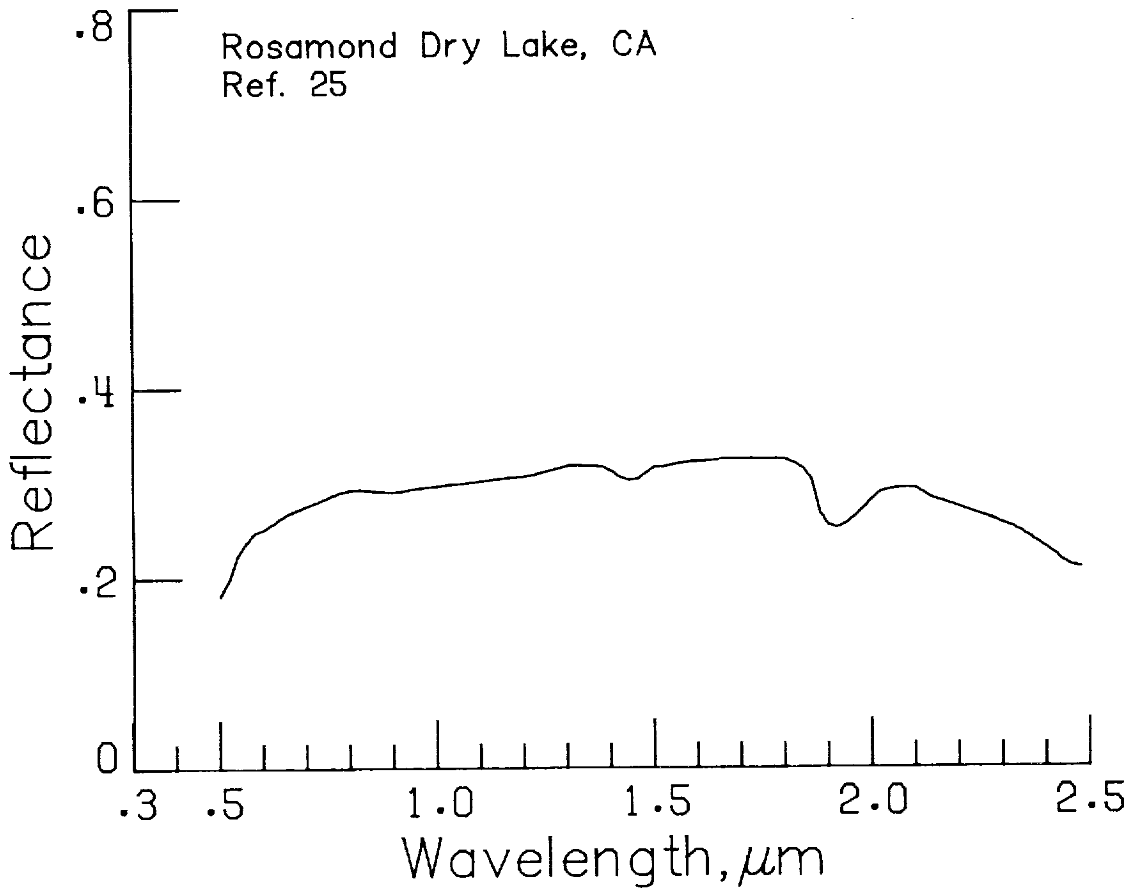
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.342	1.18	.482	1.62	.520	2.06	.430
.32		.76	.343	1.20	.497	1.64	.520	2.08	.435
.34		.78	.342	1.22	.505	1.66	.520	2.10	.430
.36		.80	.334	1.24	.509	1.68	.520	2.12	.411
.38		.82	.326	1.26	.509	1.70	.520	2.14	.389
.40		.84	.323	1.28	.512	1.72	.520	2.16	.370
.42		.86	.321	1.30	.509	1.74	.514	2.18	.344
.44		.88	.325	1.32	.499	1.76	.508	2.20	.329
.46		.90	.329	1.34	.489	1.78	.505	2.22	.330
.48		.92	.338	1.36	.464	1.80	.501	2.24	.350
.50	.113	.94	.342	1.38	.410	1.82	.497	2.26	.366
.52	.140	.96	.348	1.40	.413	1.84	.491	2.28	.368
.54	.160	.98	.360	1.42	.436	1.86	.462	2.30	.358
.56	.202	1.00	.373	1.44	.459	1.88	.419	2.32	.341
.58	.240	1.02	.385	1.46	.470	1.90	.342	2.34	.324
.60	.261	1.04	.394	1.48	.476	1.92	.324	2.36	.312
.62	.275	1.06	.406	1.50	.485	1.94	.332	2.38	.300
.64	.283	1.08	.418	1.52	.492	1.96	.358	2.40	.290
.66	.295	1.10	.433	1.54	.504	1.98	.371	2.42	.278
.68	.310	1.12	.449	1.56	.509	2.00	.386	2.44	.268
.70	.325	1.14	.464	1.58	.516	2.02	.410	2.46	.258
.72	.337	1.16	.471	1.60	.519	2.04	.422	2.48	.248

NO.128 - WET CLAY SOIL SAMPLE



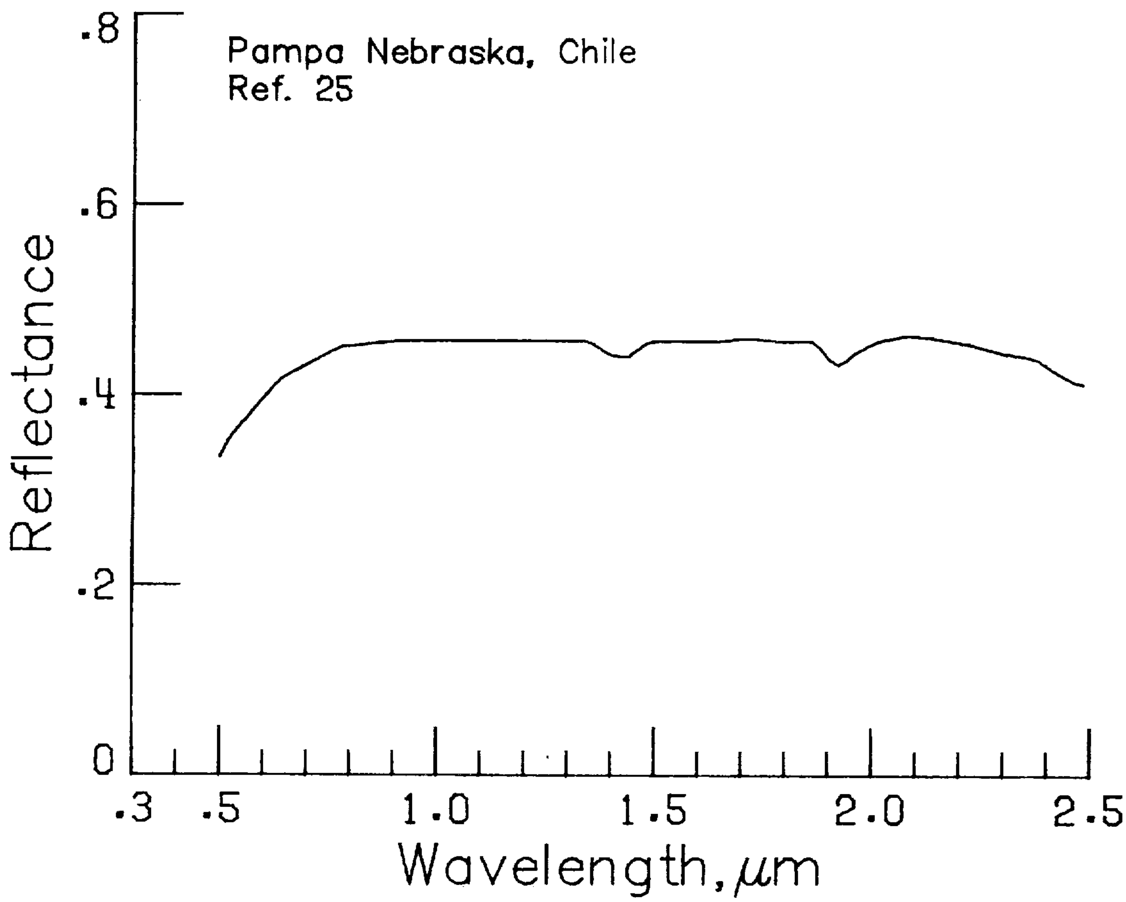
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.168	1.18	.235	1.62	.176	2.06	.057
.32		.76	.165	1.20	.241	1.64	.180	2.08	.063
.34		.78	.156	1.22	.246	1.66	.182	2.10	.068
.36		.80	.150	1.24	.246	1.68	.183	2.12	.072
.38		.82	.146	1.26	.241	1.70	.180	2.14	.073
.40		.84	.144	1.28	.237	1.72	.168	2.16	.073
.42		.86	.145	1.30	.227	1.74	.159	2.18	.068
.44		.88	.145	1.32	.212	1.76	.156	2.20	.064
.46		.90	.146	1.34	.182	1.78	.157	2.22	.070
.48		.92	.149	1.36	.128	1.80	.154	2.24	.072
.50	.057	.94	.154	1.38	.101	1.82	.147	2.26	.069
.52	.064	.96	.159	1.40	.090	1.84	.123	2.28	.063
.54	.084	.98	.162	1.42	.087	1.86	.100	2.30	.055
.56	.105	1.00	.167	1.44	.094	1.88	.037	2.32	.050
.58	.117	1.02	.174	1.46	.102	1.90	.018	2.34	.046
.60	.126	1.04	.183	1.48	.116	1.92	.014	2.36	.043
.62	.131	1.06	.192	1.50	.133	1.94	.017	2.38	.037
.64	.135	1.08	.200	1.52	.142	1.96	.022	2.40	.034
.66	.144	1.10	.207	1.54	.157	1.98	.029	2.42	.031
.68	.154	1.12	.214	1.56	.164	2.00	.034	2.44	.029
.70	.162	1.14	.221	1.58	.170	2.02	.041	2.46	.024
.72	.166	1.16	.227	1.60	.173	2.04	.048	2.48	.019

NO.129 - DRY LAKE SOIL SAMPLE



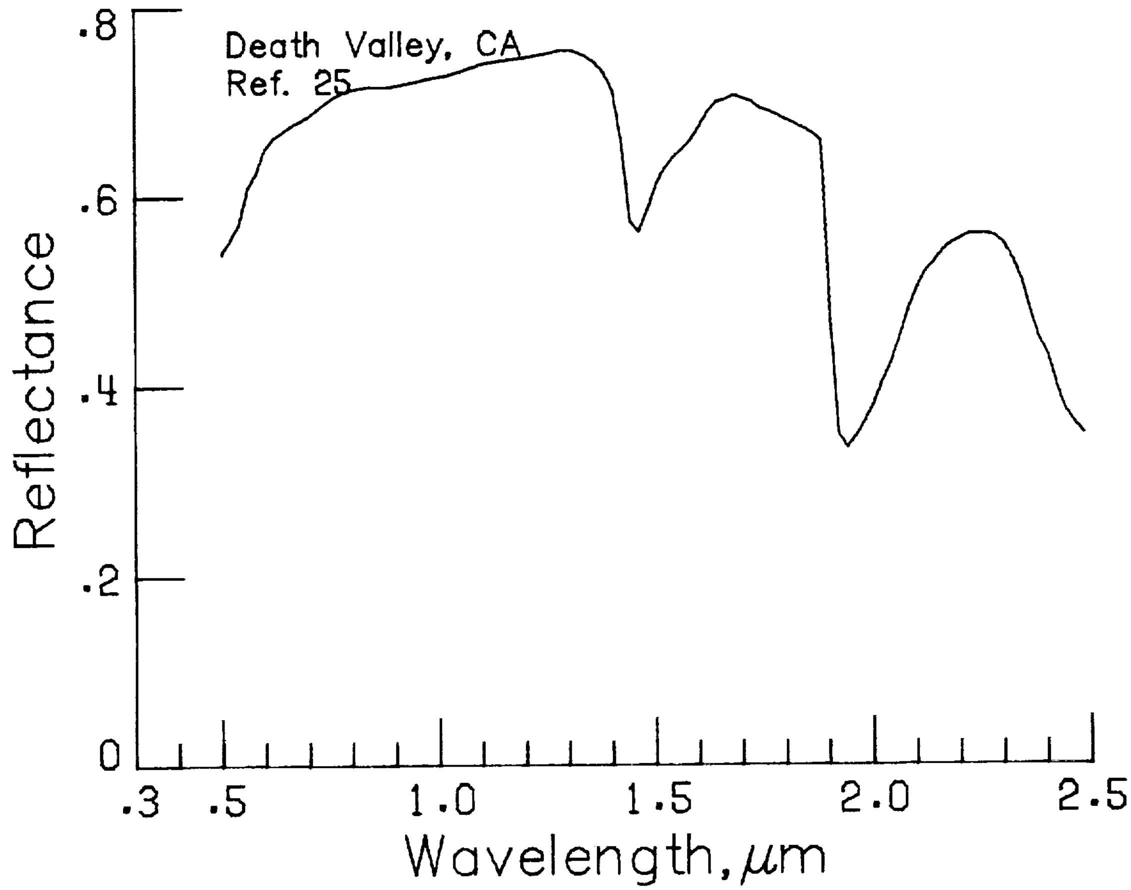
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.284	1.18	.307	1.62	.323	2.06	.293
.32		.76	.288	1.20	.307	1.64	.324	2.08	.294
.34		.78	.291	1.22	.309	1.66	.325	2.10	.293
.36		.80	.293	1.24	.311	1.68	.325	2.12	.288
.38		.82	.294	1.26	.314	1.70	.325	2.14	.283
.40		.84	.292	1.28	.316	1.72	.325	2.16	.280
.42		.86	.292	1.30	.318	1.74	.325	2.18	.277
.44		.88	.291	1.32	.319	1.76	.324	2.20	.273
.46		.90	.291	1.34	.318	1.78	.325	2.22	.270
.48		.92	.292	1.36	.318	1.80	.324	2.24	.267
.50	.182	.94	.294	1.38	.317	1.82	.321	2.26	.264
.52	.199	.96	.295	1.40	.313	1.84	.315	2.28	.260
.54	.225	.98	.296	1.42	.306	1.86	.304	2.30	.256
.56	.238	1.00	.297	1.44	.303	1.88	.267	2.32	.253
.58	.249	1.02	.298	1.46	.304	1.90	.255	2.34	.248
.60	.252	1.04	.299	1.48	.311	1.92	.252	2.36	.242
.62	.258	1.06	.300	1.50	.317	1.94	.256	2.38	.236
.64	.264	1.08	.301	1.52	.317	1.96	.264	2.40	.230
.66	.269	1.10	.303	1.54	.319	1.98	.272	2.42	.223
.68	.273	1.12	.304	1.56	.321	2.00	.282	2.44	.216
.70	.277	1.14	.305	1.58	.322	2.02	.290	2.46	.211
.72	.280	1.16	.306	1.60	.322	2.04	.292	2.48	.209

NO.130 - CHILEAN NITRATE SOIL SAMPLE



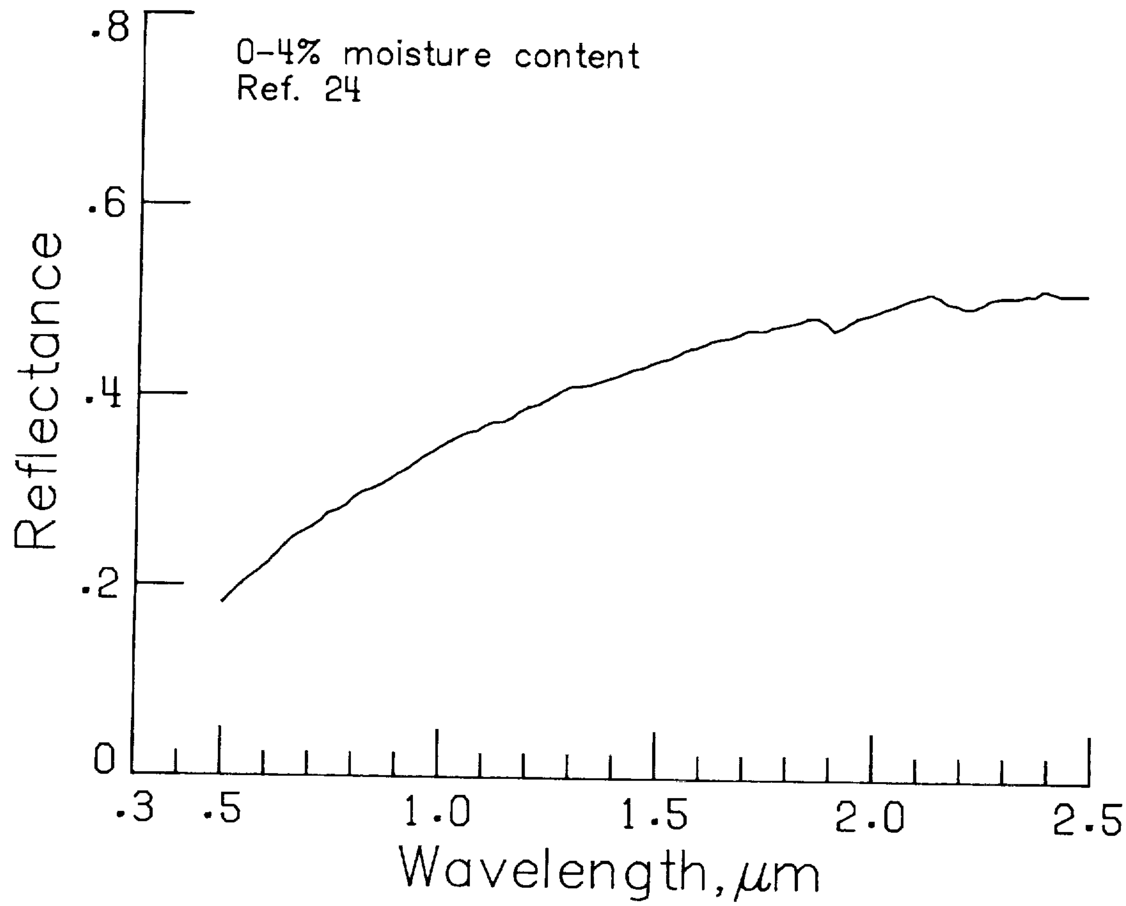
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.442	1.18	.457	1.62	.457	2.06	.462
.32		.76	.447	1.20	.457	1.64	.457	2.08	.463
.34		.78	.451	1.22	.457	1.66	.458	2.10	.462
.36		.80	.452	1.24	.457	1.68	.459	2.12	.461
.38		.82	.453	1.26	.457	1.70	.460	2.14	.460
.40		.84	.454	1.28	.457	1.72	.460	2.16	.459
.42		.86	.455	1.30	.457	1.74	.459	2.18	.457
.44		.88	.456	1.32	.457	1.76	.458	2.20	.456
.46		.90	.456	1.34	.457	1.78	.457	2.22	.454
.48		.92	.457	1.36	.453	1.80	.457	2.24	.451
.50	.335	.94	.457	1.38	.447	1.82	.457	2.26	.449
.52	.353	.96	.457	1.40	.442	1.84	.457	2.28	.447
.54	.365	.98	.457	1.42	.441	1.86	.457	2.30	.444
.56	.375	1.00	.457	1.44	.441	1.88	.450	2.32	.443
.58	.386	1.02	.457	1.46	.449	1.90	.438	2.34	.442
.60	.397	1.04	.457	1.48	.455	1.92	.432	2.36	.440
.62	.407	1.06	.457	1.50	.457	1.94	.437	2.38	.437
.64	.417	1.08	.457	1.52	.457	1.96	.445	2.40	.430
.66	.423	1.10	.457	1.54	.457	1.98	.450	2.42	.424
.68	.428	1.12	.457	1.56	.457	2.00	.455	2.44	.419
.70	.433	1.14	.457	1.58	.457	2.02	.458	2.46	.414
.72	.437	1.16	.457	1.60	.457	2.04	.460	2.48	.412

NO.131 - SALT POOL SOIL SAMPLE



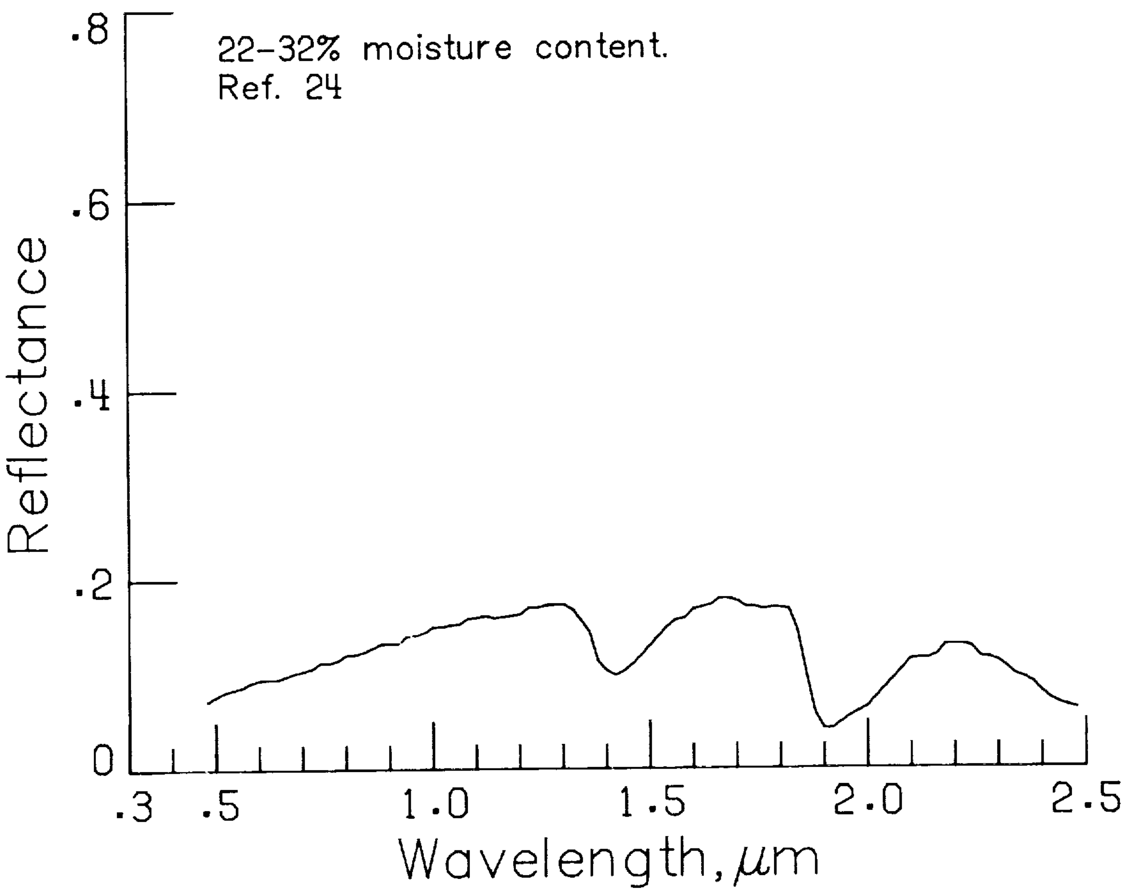
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.699	1.18	.745	1.62	.689	2.06	.452
.32		.76	.705	1.20	.747	1.64	.699	2.08	.480
.34		.78	.710	1.22	.748	1.66	.702	2.10	.504
.36		.80	.713	1.24	.750	1.68	.706	2.12	.521
.38		.82	.715	1.26	.752	1.70	.703	2.14	.530
.40		.84	.715	1.28	.754	1.72	.699	2.16	.543
.42		.86	.715	1.30	.753	1.74	.692	2.18	.550
.44		.88	.715	1.32	.751	1.76	.689	2.20	.555
.46		.90	.717	1.34	.747	1.78	.685	2.22	.559
.48		.92	.718	1.36	.740	1.80	.680	2.24	.559
.50	.541	.94	.720	1.38	.730	1.82	.675	2.26	.559
.52	.555	.96	.722	1.40	.710	1.84	.670	2.28	.556
.54	.571	.98	.724	1.42	.659	1.86	.665	2.30	.548
.56	.610	1.00	.726	1.44	.573	1.88	.657	2.32	.531
.58	.626	1.02	.728	1.46	.562	1.90	.468	2.34	.510
.60	.651	1.04	.731	1.48	.583	1.92	.349	2.36	.477
.62	.662	1.06	.734	1.50	.611	1.94	.335	2.38	.448
.64	.668	1.08	.737	1.52	.629	1.96	.346	2.40	.431
.66	.675	1.10	.740	1.54	.640	1.98	.362	2.42	.398
.68	.680	1.12	.742	1.56	.648	2.00	.380	2.44	.374
.70	.685	1.14	.743	1.58	.658	2.02	.403	2.46	.360
.72	.692	1.16	.744	1.60	.672	2.04	.424	2.48	.349

NO.132 - DRY SANDY SOIL SAMPLE



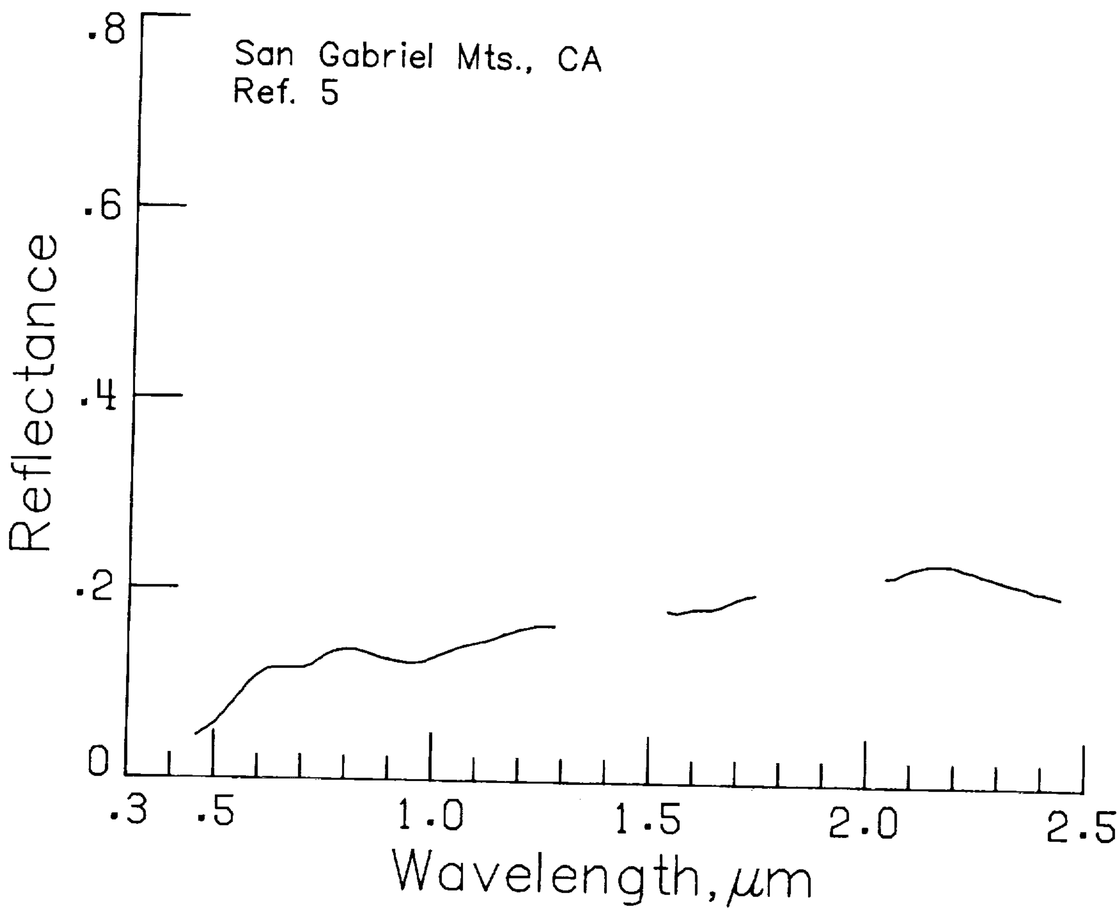
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.277	1.18	.386	1.62	.461	2.06	.504
.32		.76	.280	1.20	.390	1.64	.463	2.08	.507
.34		.78	.285	1.22	.392	1.66	.465	2.10	.510
.36		.80	.294	1.24	.398	1.68	.468	2.12	.513
.38		.82	.300	1.26	.403	1.70	.473	2.14	.509
.40		.84	.303	1.28	.409	1.72	.473	2.16	.503
.42		.86	.307	1.30	.412	1.74	.473	2.18	.501
.44		.88	.313	1.32	.412	1.76	.477	2.20	.498
.46		.90	.319	1.34	.414	1.78	.478	2.22	.498
.48		.92	.324	1.36	.417	1.80	.480	2.24	.502
.50	.182	.94	.331	1.38	.420	1.82	.482	2.26	.508
.52	.192	.96	.338	1.40	.423	1.84	.486	2.28	.509
.54	.201	.98	.343	1.42	.427	1.86	.487	2.30	.510
.56	.209	1.00	.349	1.44	.431	1.88	.482	2.32	.509
.58	.216	1.02	.354	1.46	.432	1.90	.473	2.34	.512
.60	.223	1.04	.359	1.48	.437	1.92	.477	2.36	.512
.62	.233	1.06	.363	1.50	.440	1.94	.483	2.38	.518
.64	.243	1.08	.365	1.52	.442	1.96	.488	2.40	.515
.66	.251	1.10	.371	1.54	.446	1.98	.490	2.42	.512
.68	.257	1.12	.374	1.56	.452	2.00	.493	2.44	.513
.70	.262	1.14	.374	1.58	.454	2.02	.497	2.46	.513
.72	.268	1.16	.379	1.60	.457	2.04	.500	2.48	.513

NO.133 - WET SANDY SOIL SAMPLE



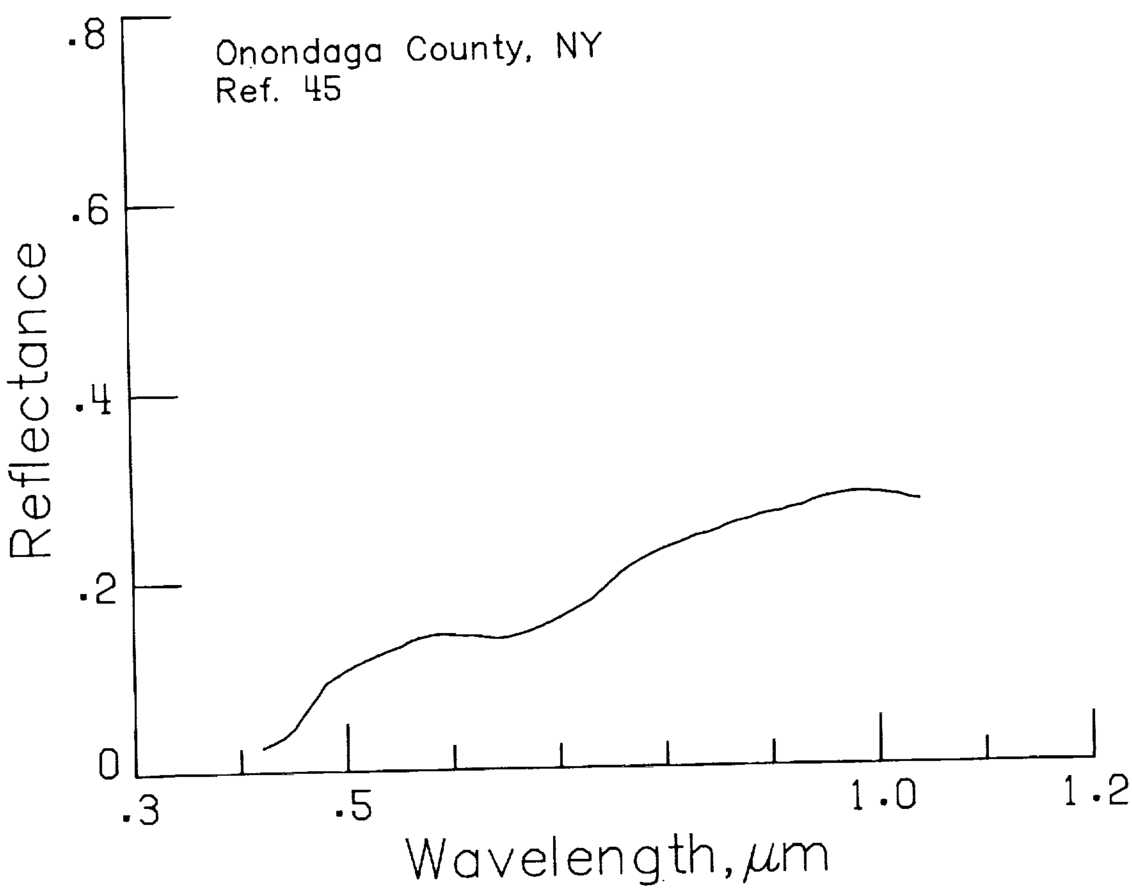
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.113	1.18	.162	1.62	.170	2.06	.095
.32		.76	.113	1.20	.163	1.64	.172	2.08	.105
.34		.78	.116	1.22	.170	1.66	.179	2.10	.115
.36		.80	.122	1.24	.170	1.68	.179	2.12	.116
.38		.82	.122	1.26	.172	1.70	.176	2.14	.116
.40		.84	.125	1.28	.173	1.72	.171	2.16	.120
.42		.86	.129	1.30	.173	1.74	.170	2.18	.130
.44		.88	.133	1.32	.168	1.76	.168	2.20	.130
.46		.90	.133	1.34	.157	1.78	.169	2.22	.130
.48	.073	.92	.133	1.36	.144	1.80	.169	2.24	.128
.50	.079	.94	.141	1.38	.113	1.82	.167	2.26	.117
.52	.083	.96	.142	1.40	.104	1.84	.145	2.28	.116
.54	.085	.98	.145	1.42	.099	1.86	.099	2.30	.113
.56	.088	1.00	.150	1.44	.103	1.88	.057	2.32	.106
.58	.093	1.02	.150	1.46	.111	1.90	.042	2.34	.098
.60	.095	1.04	.152	1.48	.120	1.92	.042	2.36	.095
.62	.096	1.06	.153	1.50	.130	1.94	.049	2.38	.090
.64	.096	1.08	.159	1.52	.140	1.96	.055	2.40	.080
.66	.099	1.10	.160	1.54	.150	1.98	.060	2.42	.072
.68	.102	1.12	.162	1.56	.157	2.00	.065	2.44	.068
.70	.105	1.14	.159	1.58	.159	2.02	.075	2.46	.064
.72	.107	1.16	.161	1.60	.168	2.04	.085	2.48	.062

NO.134 - SYENITE



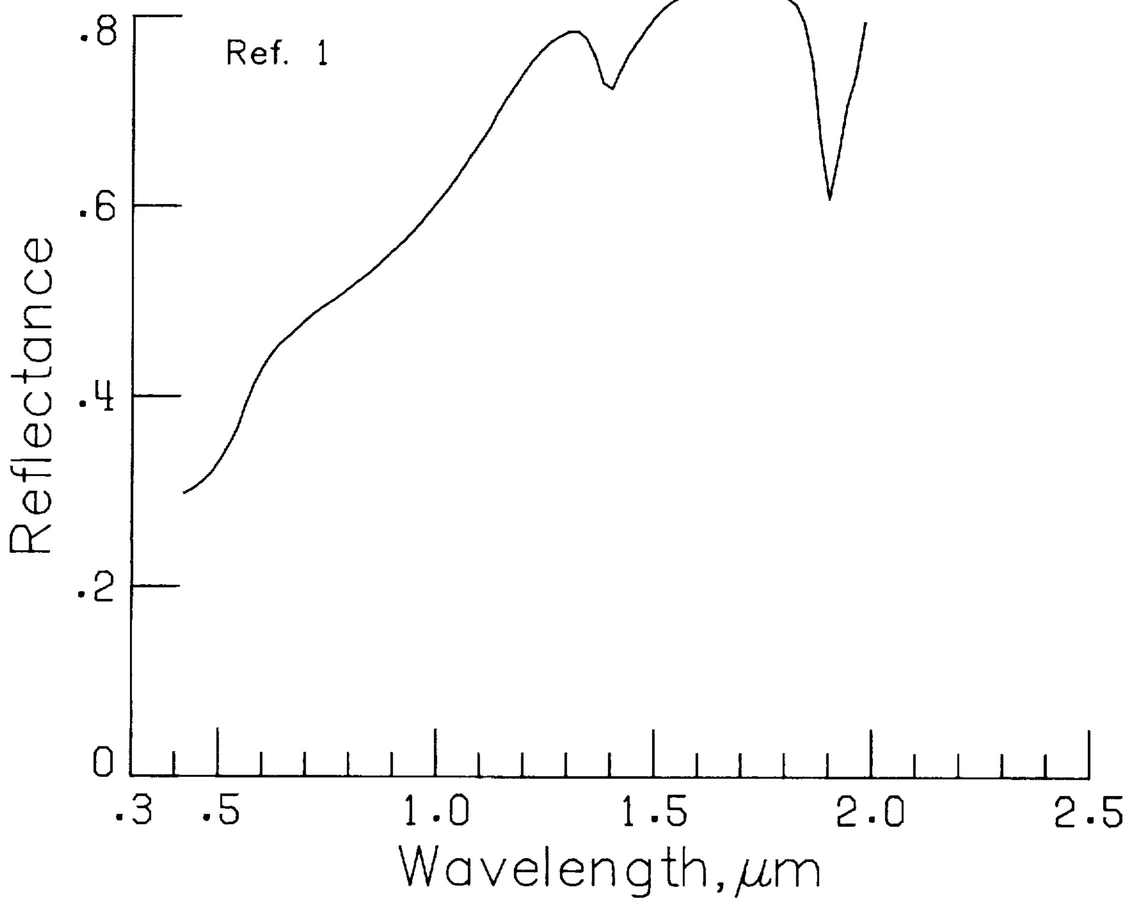
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.127	1.18	.157	1.62	.184	2.06	.221
.32		.76	.133	1.20	.160	1.64	.184	2.08	.226
.34		.78	.136	1.22	.162	1.66	.187	2.10	.229
.36		.80	.137	1.24	.164	1.68	.191	2.12	.232
.38		.82	.137	1.26	.164	1.70	.195	2.14	.234
.40		.84	.135	1.28	.164	1.72	.198	2.16	.234
.42		.86	.132	1.30		1.74	.200	2.18	.234
.44		.88	.129	1.32		1.76		2.20	.232
.46	.045	.90	.127	1.34		1.78		2.22	.229
.48	.052	.92	.125	1.36		1.80		2.24	.227
.50	.058	.94	.124	1.38		1.82		2.26	.223
.52	.068	.96	.124	1.40		1.84		2.28	.221
.54	.079	.98	.125	1.42		1.86		2.30	.218
.56	.090	1.00	.129	1.44		1.88		2.32	.215
.58	.102	1.02	.133	1.46		1.90		2.34	.213
.60	.110	1.04	.137	1.48		1.92		2.36	.211
.62	.116	1.06	.140	1.50		1.94		2.38	.207
.64	.117	1.08	.143	1.52		1.96		2.40	.206
.66	.117	1.10	.145	1.54	.182	1.98		2.42	.203
.68	.117	1.12	.147	1.56	.180	2.00		2.44	.201
.70	.117	1.14	.150	1.58	.182	2.02		2.46	
.72	.120	1.16	.154	1.60	.184	2.04	.220	2.48	

NO.135 - DRY GLACIAL TILL



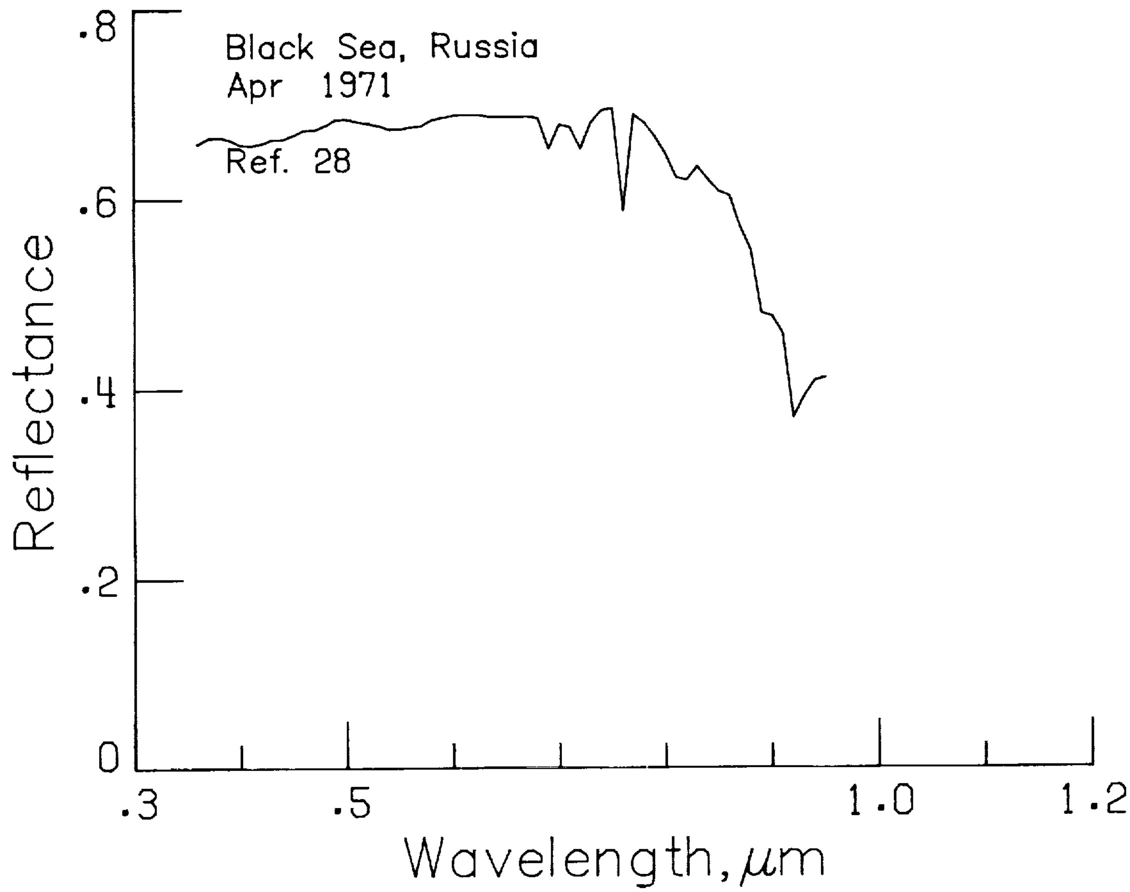
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.094	.66	.142	.84	.245	1.02	.283
.31		.49	.100	.67	.145	.85	.249	1.03	.279
.32		.50	.107	.68	.149	.86	.254	1.04	.278
.33		.51	.113	.69	.154	.87	.258	1.05	
.34		.52	.118	.70	.159	.88	.260	1.06	
.35		.53	.123	.71	.165	.89	.264	1.07	
.36		.54	.127	.72	.171	.90	.267	1.08	
.37		.55	.131	.73	.177	.91	.268	1.09	
.38		.56	.137	.74	.187	.92	.272	1.10	
.39		.57	.141	.75	.197	.93	.274	1.11	
.40		.58	.143	.76	.206	.94	.279	1.12	
.41		.59	.144	.77	.214	.95	.282	1.13	
.42	.026	.60	.142	.78	.220	.96	.284	1.14	
.43	.031	.61	.141	.79	.226	.97	.286	1.15	
.44	.037	.62	.141	.80	.231	.98	.287	1.16	
.45	.047	.63	.140	.81	.234	.99	.287	1.17	
.46	.063	.64	.139	.82	.239	1.00	.286	1.18	
.47	.077	.65	.139	.83	.243	1.01	.284	1.19	

NO.136 - RHYOLITE TUFF SAMPLE



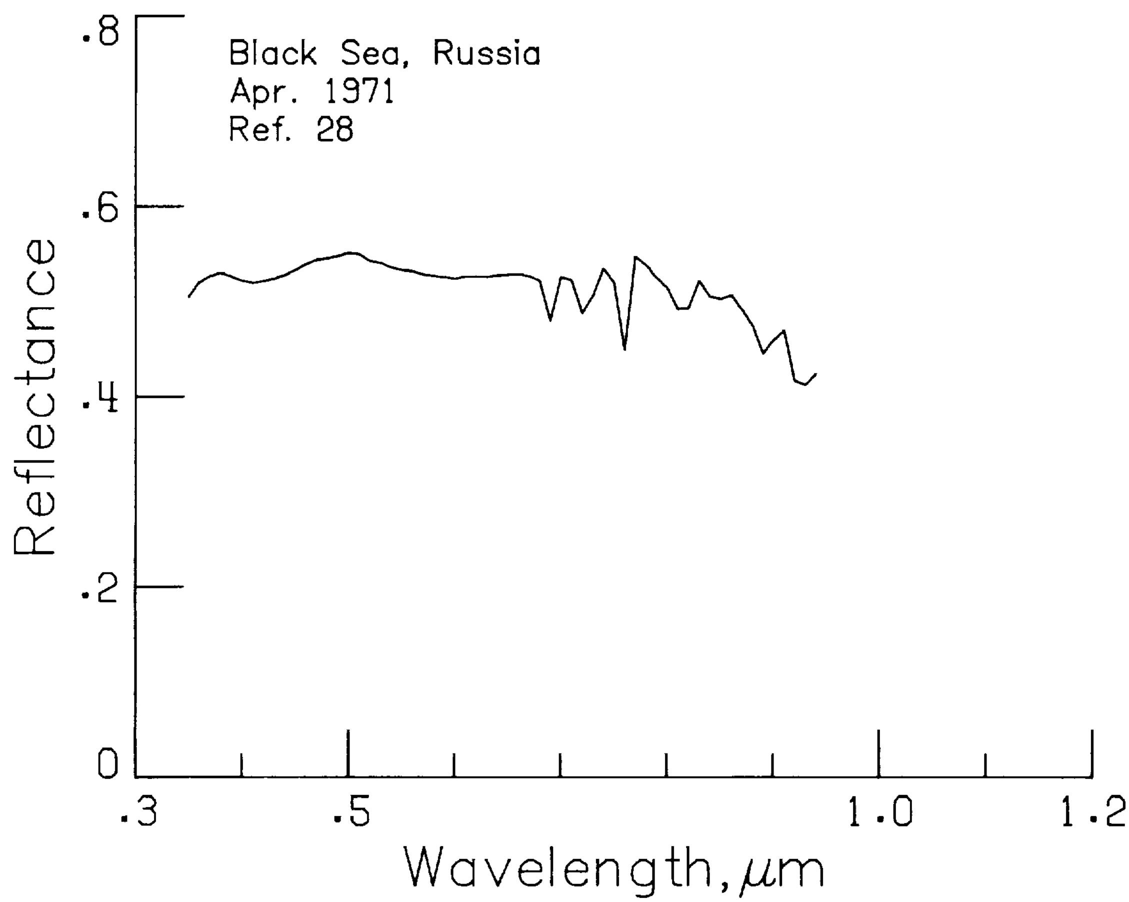
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.495	1.18	.729	1.62	.831	2.06	
.32		.76	.501	1.20	.742	1.64	.834	2.08	
.34		.78	.508	1.22	.755	1.66	.835	2.10	
.36		.80	.515	1.24	.765	1.68	.835	2.12	
.38		.82	.522	1.26	.774	1.70	.834	2.14	
.40		.84	.529	1.28	.779	1.72	.832	2.16	
.42	.298	.86	.537	1.30	.784	1.74	.830	2.18	
.44	.303	.88	.546	1.32	.785	1.76	.827	2.20	
.46	.310	.90	.555	1.34	.777	1.78	.824	2.22	
.48	.319	.92	.563	1.36	.759	1.80	.820	2.24	
.50	.332	.94	.572	1.38	.730	1.82	.813	2.26	
.52	.348	.96	.582	1.40	.724	1.84	.794	2.28	
.54	.365	.98	.594	1.42	.745	1.86	.754	2.30	
.56	.392	1.00	.605	1.44	.763	1.88	.665	2.32	
.58	.414	1.02	.616	1.46	.776	1.90	.608	2.34	
.60	.432	1.04	.629	1.48	.789	1.92	.654	2.36	
.62	.445	1.06	.642	1.50	.801	1.94	.707	2.38	
.64	.456	1.08	.656	1.52	.810	1.96	.738	2.40	
.66	.464	1.10	.669	1.54	.817	1.98	.794	2.42	
.68	.473	1.12	.683	1.56	.822	2.00		2.44	
.70	.481	1.14	.701	1.58	.825	2.02		2.46	
.72	.489	1.16	.715	1.60	.828	2.04		2.48	

NO.137 - ALTOCUMULUS CLOUDS



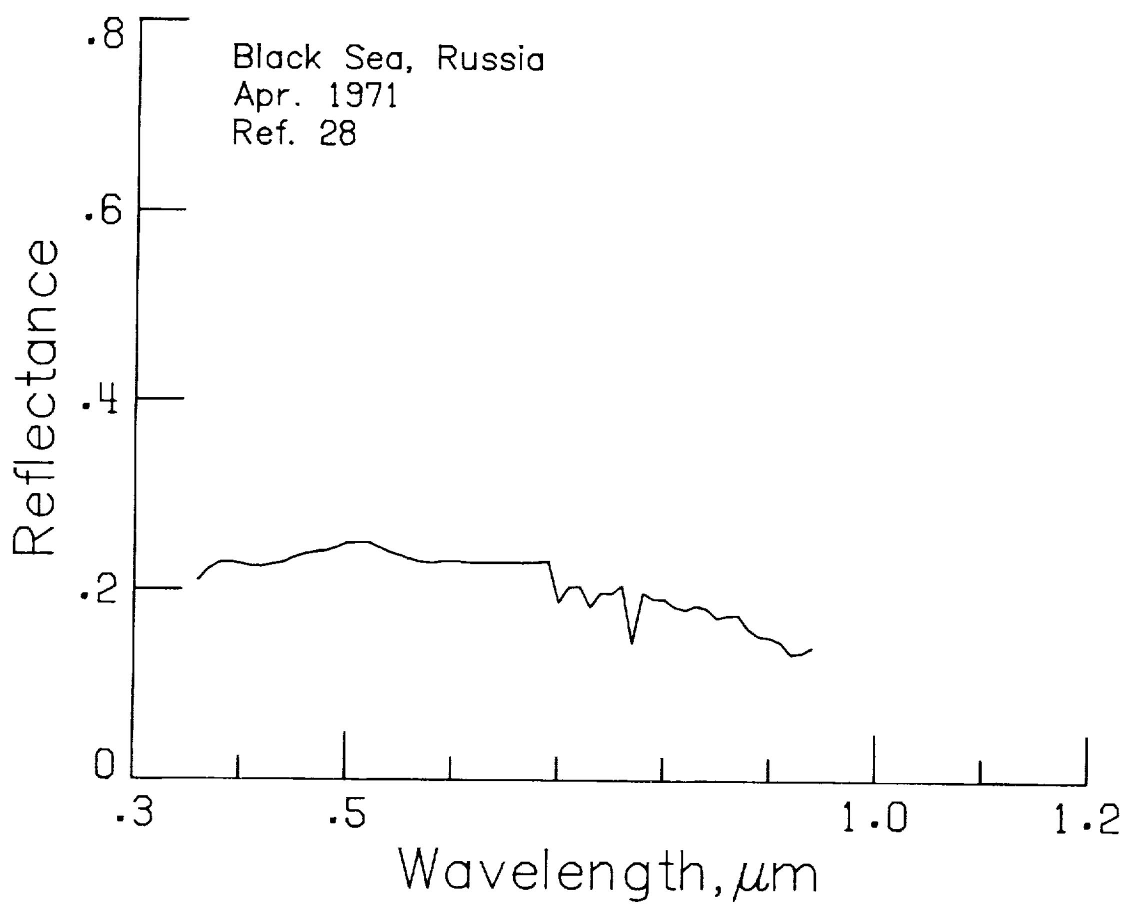
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.678	.66	.687	.84	.620	1.02	
.31		.49	.684	.67	.687	.85	.607	1.03	
.32		.50	.684	.68	.685	.86	.603	1.04	
.33		.51	.682	.69	.653	.87	.570	1.05	
.34		.52	.680	.70	.678	.88	.546	1.06	
.35		.53	.678	.71	.676	.89	.479	1.07	
.36	.659	.54	.674	.72	.653	.90	.477	1.08	
.37	.665	.55	.674	.73	.681	.91	.458	1.09	
.38	.666	.56	.676	.74	.693	.92	.369	1.10	
.39	.663	.57	.677	.75	.696	.93	.391	1.11	
.40	.658	.58	.684	.76	.587	.94	.408	1.12	
.41	.657	.59	.686	.77	.689	.95	.412	1.13	
.42	.659	.60	.688	.78	.680	.96		1.14	
.43	.663	.61	.689	.79	.666	.97		1.15	
.44	.664	.62	.689	.80	.647	.98		1.16	
.45	.668	.63	.688	.81	.622	.99		1.17	
.46	.673	.64	.687	.82	.620	1.00		1.18	
.47	.673	.65	.687	.83	.634	1.01		1.19	

NO.138 - STRATUS CLOUDS



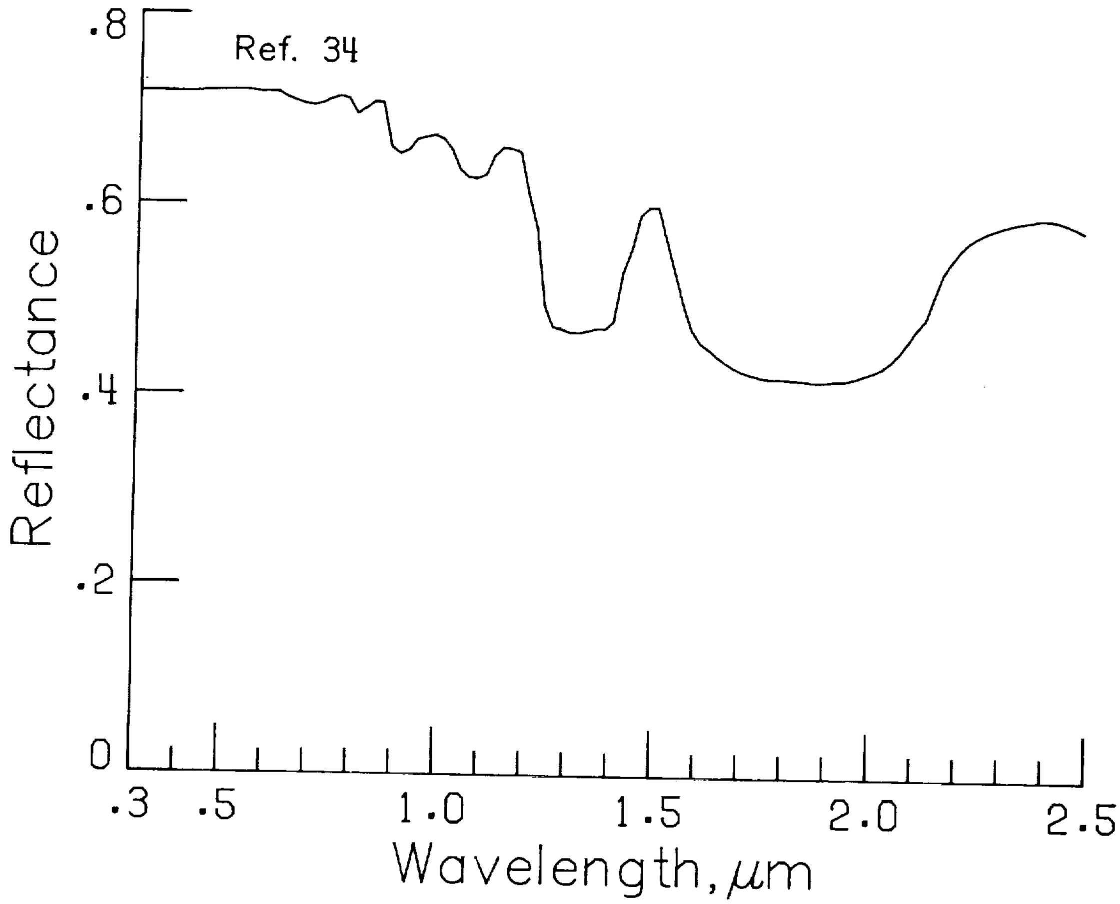
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.546	.66	.529	.84	.505	1.02	
.31		.49	.549	.67	.527	.85	.503	1.03	
.32		.50	.552	.68	.522	.86	.507	1.04	
.33		.51	.550	.69	.480	.87	.492	1.05	
.34		.52	.542	.70	.526	.88	.475	1.06	
.35	.506	.53	.541	.71	.523	.89	.446	1.07	
.36	.521	.54	.536	.72	.488	.90	.460	1.08	
.37	.527	.55	.533	.73	.506	.91	.470	1.09	
.38	.531	.56	.532	.74	.535	.92	.417	1.10	
.39	.526	.57	.529	.75	.520	.93	.413	1.11	
.40	.522	.58	.527	.76	.449	.94	.424	1.12	
.41	.520	.59	.525	.77	.547	.95		1.13	
.42	.522	.60	.524	.78	.539	.96		1.14	
.43	.524	.61	.526	.79	.525	.97		1.15	
.44	.528	.62	.527	.80	.515	.98		1.16	
.45	.534	.63	.526	.81	.493	.99		1.17	
.46	.540	.64	.528	.82	.493	1.00		1.18	
.47	.544	.65	.528	.83	.522	1.01		1.19	

NO.139 - CIRROSTRATUS CLOUDS



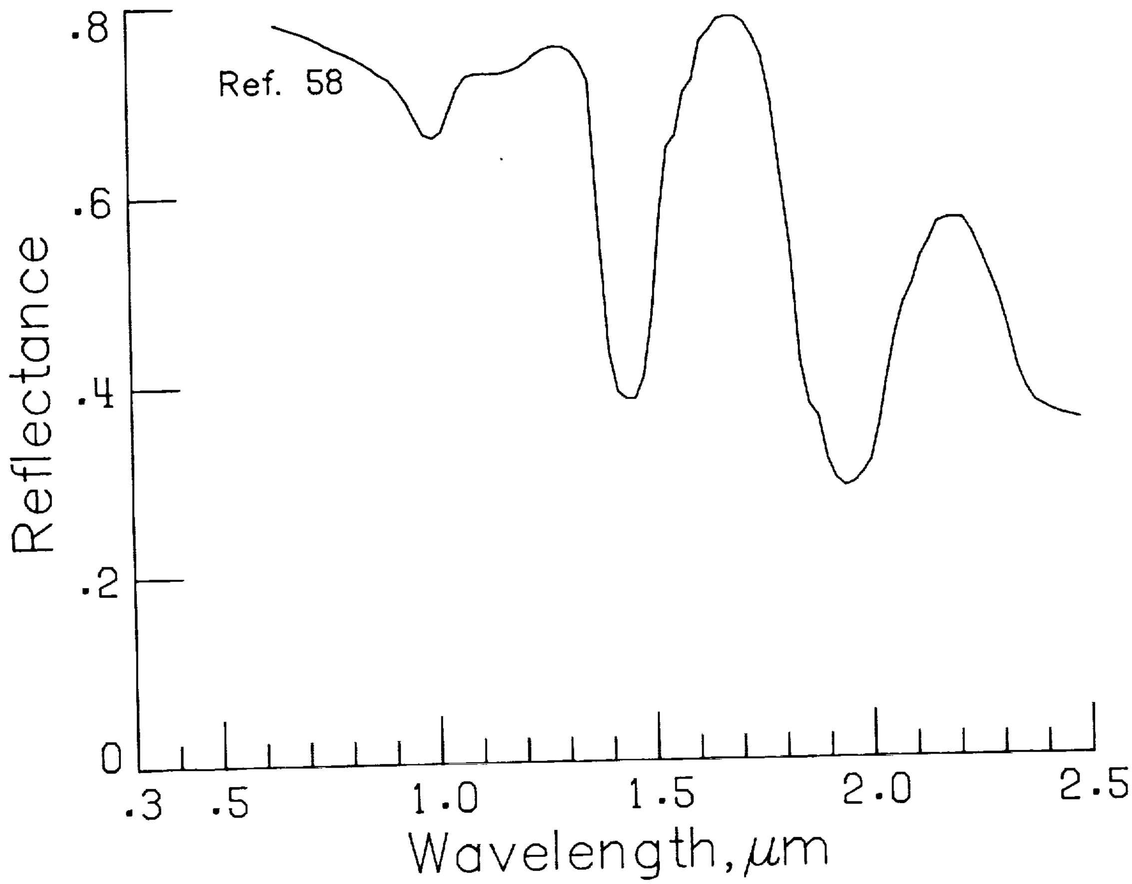
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.241	.66	.229	.84	.181	1.02	
.31		.49	.245	.67	.229	.85	.172	1.03	
.32		.50	.250	.68	.230	.86	.174	1.04	
.33		.51	.250	.69	.231	.87	.175	1.05	
.34		.52	.250	.70	.188	.88	.159	1.06	
.35		.53	.245	.71	.204	.89	.152	1.07	
.36	.210	.54	.240	.72	.204	.90	.151	1.08	
.37	.222	.55	.236	.73	.183	.91	.146	1.09	
.38	.229	.56	.233	.74	.197	.92	.133	1.10	
.39	.229	.57	.230	.75	.197	.93	.135	1.11	
.40	.228	.58	.229	.76	.205	.94	.140	1.12	
.41	.225	.59	.230	.77	.145	.95		1.13	
.42	.225	.60	.231	.78	.197	.96		1.14	
.43	.227	.61	.229	.79	.191	.97		1.15	
.44	.229	.62	.229	.80	.191	.98		1.16	
.45	.235	.63	.229	.81	.183	.99		1.17	
.46	.238	.64	.229	.82	.180	1.00		1.18	
.47	.240	.65	.229	.83	.184	1.01		1.19	

NO.140 - MIDDLE LAYER CLOUDS



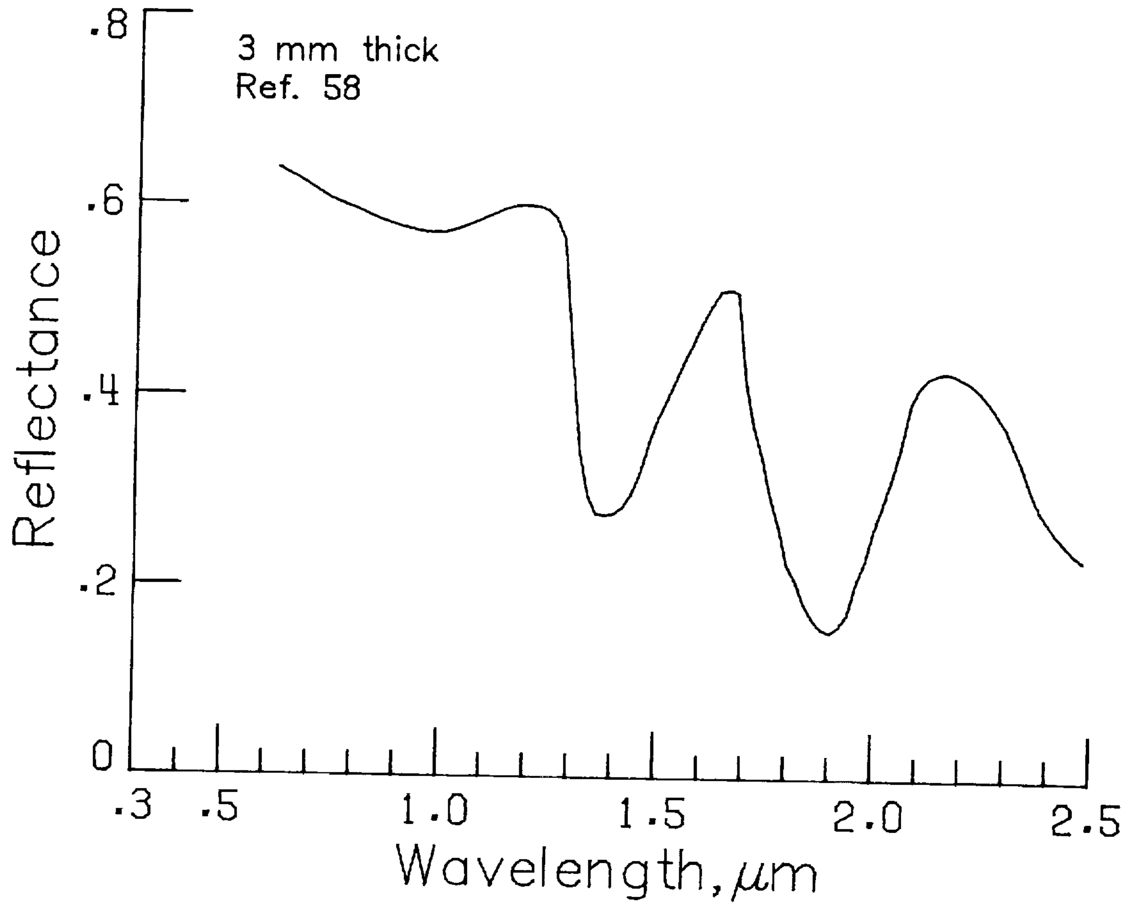
λ	R	λ	R	λ	R	λ	R	λ	R
.30	.718	.74	.711	1.18	.658	1.62	.451	2.06	.450
.32	.718	.76	.714	1.20	.612	1.64	.444	2.08	.462
.34	.718	.78	.712	1.22	.578	1.66	.437	2.10	.475
.36	.717	.80	.696	1.24	.496	1.68	.432	2.12	.486
.38	.717	.82	.702	1.26	.474	1.70	.428	2.14	.512
.40	.717	.84	.709	1.28	.471	1.72	.425	2.16	.535
.42	.717	.86	.708	1.30	.468	1.74	.423	2.18	.549
.44	.718	.88	.661	1.32	.468	1.76	.421	2.20	.561
.46	.719	.90	.655	1.34	.470	1.78	.422	2.22	.569
.48	.719	.92	.659	1.36	.472	1.80	.421	2.24	.574
.50	.720	.94	.670	1.38	.472	1.82	.420	2.26	.579
.52	.720	.96	.672	1.40	.480	1.84	.420	2.28	.582
.54	.720	.98	.675	1.42	.532	1.86	.418	2.30	.585
.56	.719	1.00	.671	1.44	.557	1.88	.418	2.32	.588
.58	.718	1.02	.660	1.46	.593	1.90	.419	2.34	.589
.60	.718	1.04	.638	1.48	.600	1.92	.420	2.36	.591
.62	.717	1.06	.630	1.50	.600	1.94	.421	2.38	.593
.64	.712	1.08	.630	1.52	.566	1.96	.423	2.40	.592
.66	.709	1.10	.634	1.54	.532	1.98	.426	2.42	.591
.68	.706	1.12	.654	1.56	.498	2.00	.429	2.44	.588
.70	.705	1.14	.662	1.58	.472	2.02	.434	2.46	.584
.72	.707	1.16	.661	1.60	.458	2.04	.440	2.48	.580

NO.141 - DENSE ICE CLOUD SAMPLE



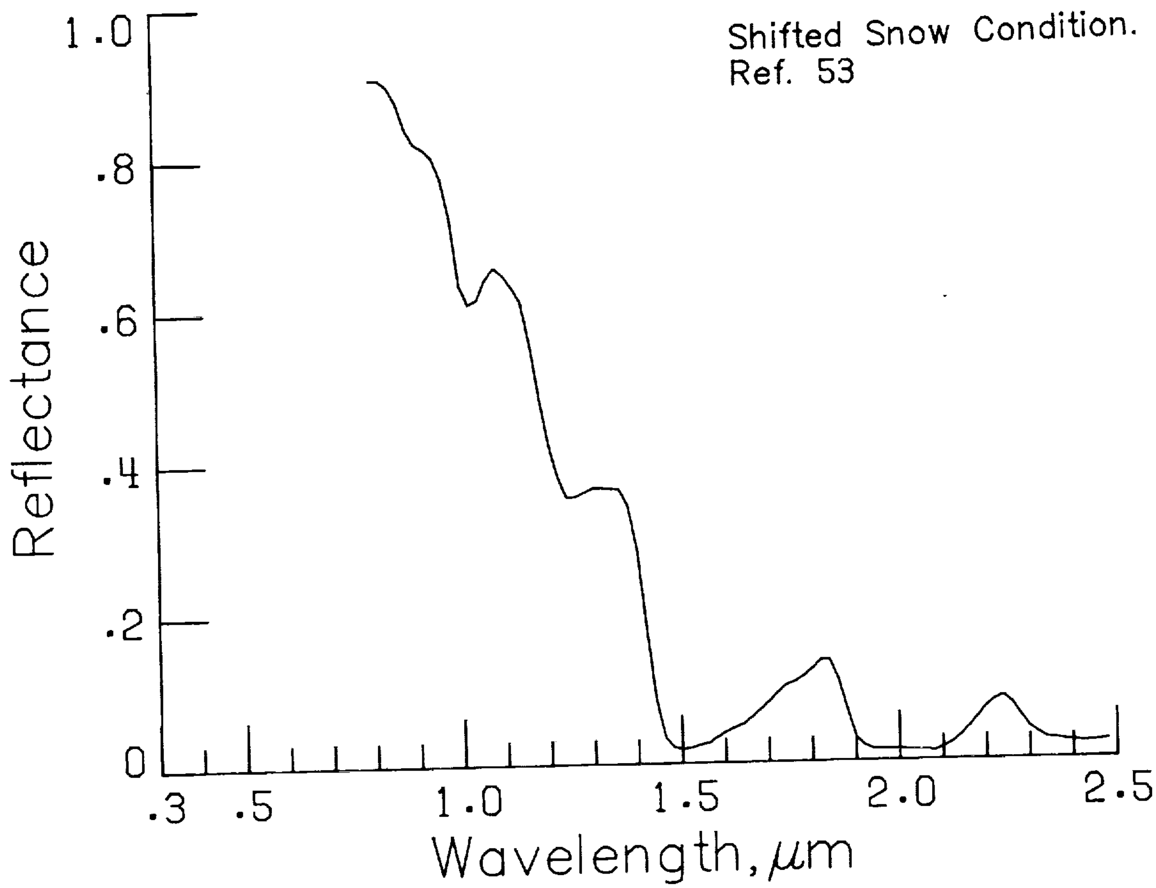
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.763	1.18	.729	1.62	.758	2.06	.448
.32		.76	.757	1.20	.732	1.64	.768	2.08	.480
.34		.78	.753	1.22	.738	1.66	.780	2.10	.498
.36		.80	.750	1.24	.746	1.68	.783	2.12	.528
.38		.82	.745	1.26	.751	1.70	.782	2.14	.543
.40		.84	.740	1.28	.754	1.72	.777	2.16	.563
.42		.86	.734	1.30	.753	1.74	.762	2.18	.567
.44		.88	.727	1.32	.749	1.76	.741	2.20	.568
.46		.90	.722	1.34	.738	1.78	.695	2.22	.566
.48		.92	.711	1.36	.718	1.80	.616	2.24	.552
.50		.94	.699	1.38	.560	1.82	.541	2.26	.530
.52		.96	.680	1.40	.432	1.84	.419	2.28	.507
.54		.98	.663	1.42	.389	1.86	.373	2.30	.483
.56		1.00	.660	1.44	.382	1.88	.360	2.32	.449
.58		1.02	.666	1.46	.382	1.90	.315	2.34	.409
.60		1.04	.689	1.48	.404	1.92	.294	2.36	.387
.62		1.06	.712	1.50	.469	1.94	.287	2.38	.372
.64	.780	1.08	.724	1.52	.573	1.96	.291	2.40	.367
.66	.777	1.10	.726	1.54	.647	1.98	.300	2.42	.362
.68	.774	1.12	.727	1.56	.658	2.00	.313	2.44	.359
.70	.771	1.14	.726	1.58	.704	2.02	.351	2.46	.356
.72	.767	1.16	.727	1.60	.716	2.04	.403	2.48	.354

NO.142 - HOARFROST SAMPLE



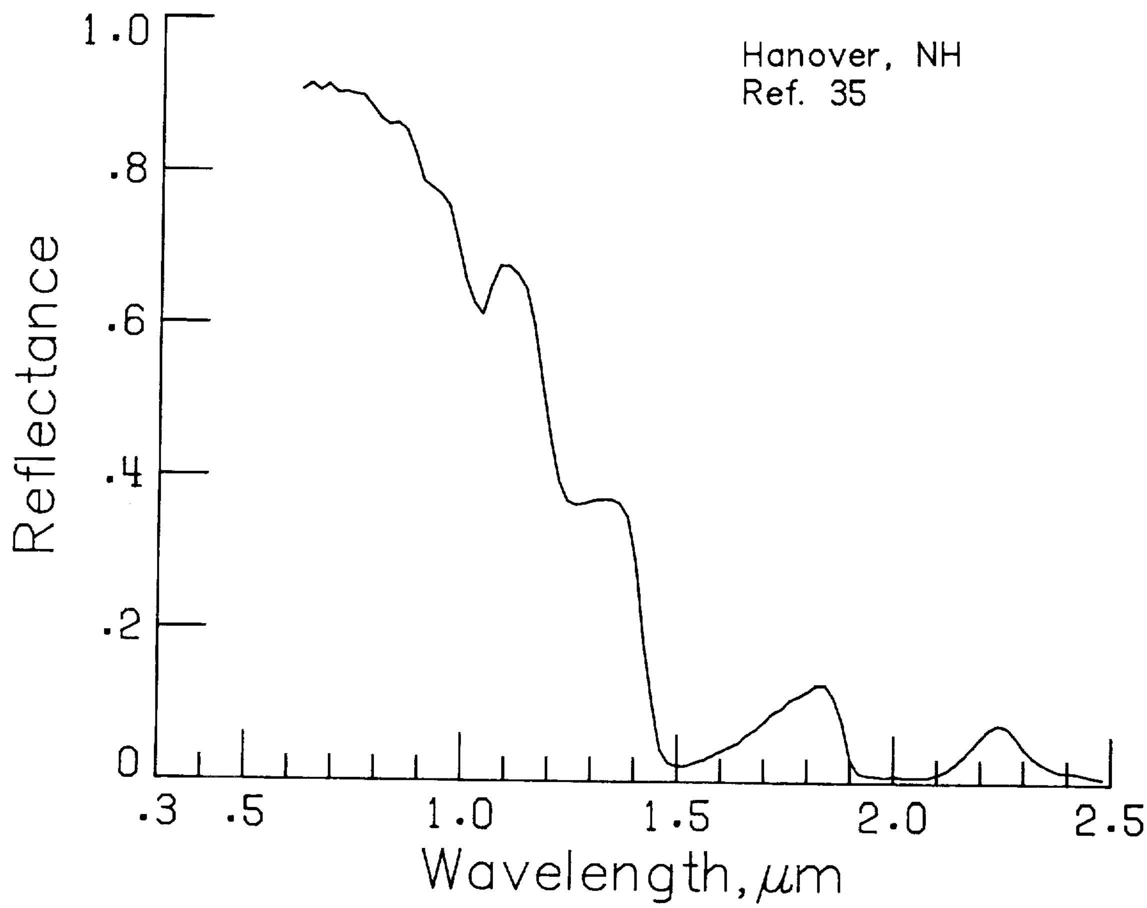
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.606	1.18	.601	1.62	.498	2.06	.353
.32		.76	.603	1.20	.601	1.64	.513	2.08	.396
.34		.78	.599	1.22	.600	1.66	.514	2.10	.414
.36		.80	.596	1.24	.597	1.68	.511	2.12	.424
.38		.82	.592	1.26	.589	1.70	.421	2.14	.428
.40		.84	.588	1.28	.568	1.72	.372	2.16	.430
.42		.86	.584	1.30	.454	1.74	.340	2.18	.427
.44		.88	.581	1.32	.344	1.76	.297	2.20	.422
.46		.90	.578	1.34	.296	1.78	.266	2.22	.418
.48		.92	.576	1.36	.277	1.80	.226	2.24	.409
.50		.94	.574	1.38	.277	1.82	.209	2.26	.399
.52		.96	.573	1.40	.278	1.84	.185	2.28	.385
.54		.98	.572	1.42	.285	1.86	.170	2.30	.372
.56		1.00	.572	1.44	.300	1.88	.159	2.32	.350
.58		1.02	.575	1.46	.322	1.90	.155	2.34	.329
.60		1.04	.578	1.48	.354	1.92	.162	2.36	.304
.62	.639	1.06	.582	1.50	.380	1.94	.175	2.38	.284
.64	.634	1.08	.586	1.52	.400	1.96	.208	2.40	.271
.66	.629	1.10	.590	1.54	.420	1.98	.231	2.42	.259
.68	.624	1.12	.594	1.56	.442	2.00	.265	2.44	.249
.70	.618	1.14	.598	1.58	.460	2.02	.291	2.46	.239
.72	.612	1.16	.600	1.60	.482	2.04	.320	2.48	.233

NO.143 - SNOW SAMPLE



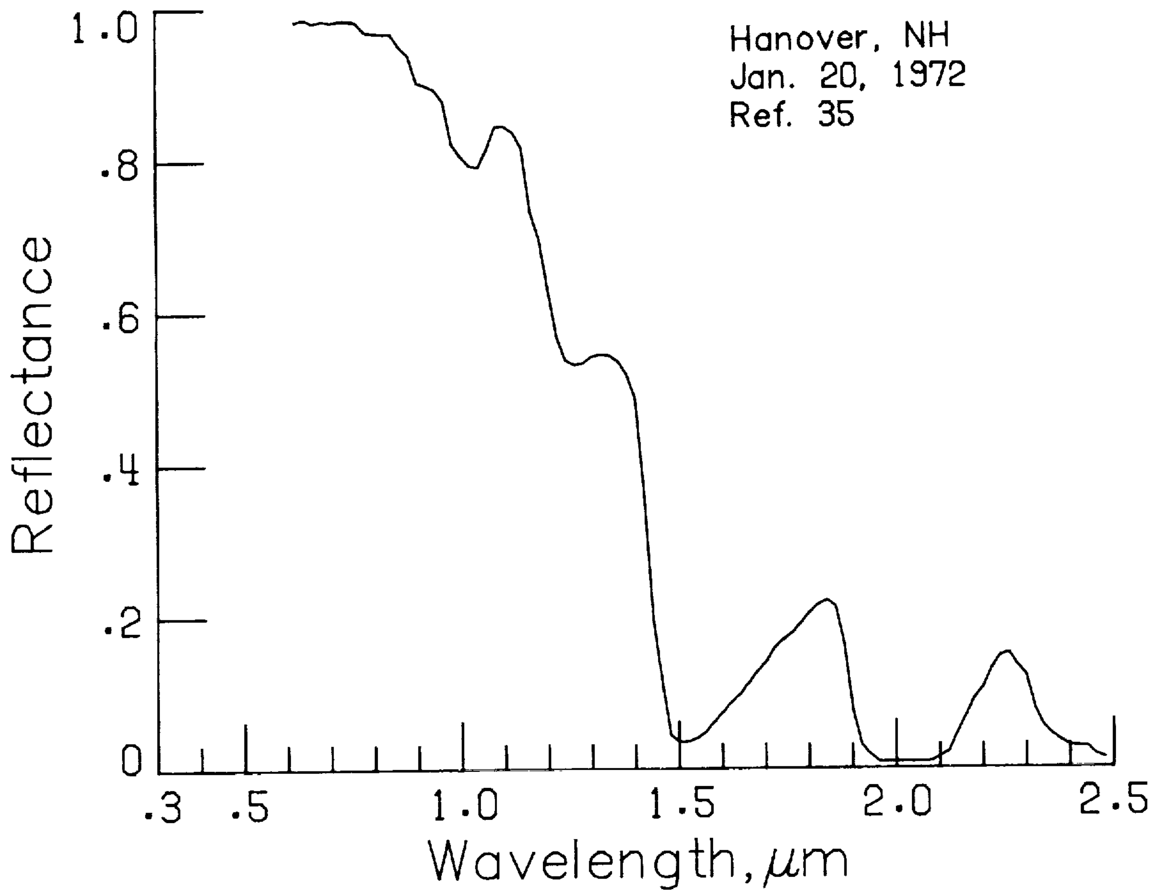
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74		1.18	.484	1.62	.046	2.06	.013
.32		.76		1.20	.423	1.64	.051	2.08	.012
.34		.78		1.22	.380	1.66	.060	2.10	.017
.36		.80	.906	1.24	.352	1.68	.070	2.12	.022
.38		.82	.906	1.26	.354	1.70	.080	2.14	.032
.40		.84	.896	1.28	.359	1.72	.092	2.16	.043
.42		.86	.875	1.30	.364	1.74	.102	2.18	.056
.44		.88	.840	1.32	.365	1.76	.106	2.20	.069
.46		.90	.821	1.34	.363	1.78	.113	2.22	.078
.48		.92	.814	1.36	.362	1.80	.122	2.24	.083
.50		.94	.803	1.38	.341	1.82	.133	2.26	.073
.52		.96	.775	1.40	.282	1.84	.134	2.28	.056
.54		.98	.724	1.42	.180	1.86	.108	2.30	.041
.56		1.00	.633	1.44	.084	1.88	.066	2.32	.033
.58		1.02	.609	1.46	.034	1.90	.029	2.34	.026
.60		1.04	.614	1.48	.021	1.92	.019	2.36	.025
.62		1.06	.642	1.50	.019	1.94	.015	2.38	.023
.64		1.08	.656	1.52	.021	1.96	.015	2.40	.022
.66		1.10	.647	1.54	.024	1.98	.015	2.42	.021
.68		1.12	.631	1.56	.027	2.00	.015	2.44	.021
.70		1.14	.612	1.58	.034	2.02	.014	2.46	.022
.72		1.16	.556	1.60	.041	2.04	.013	2.48	.024

NO.144 - TYPICAL SNOW SAMPLE



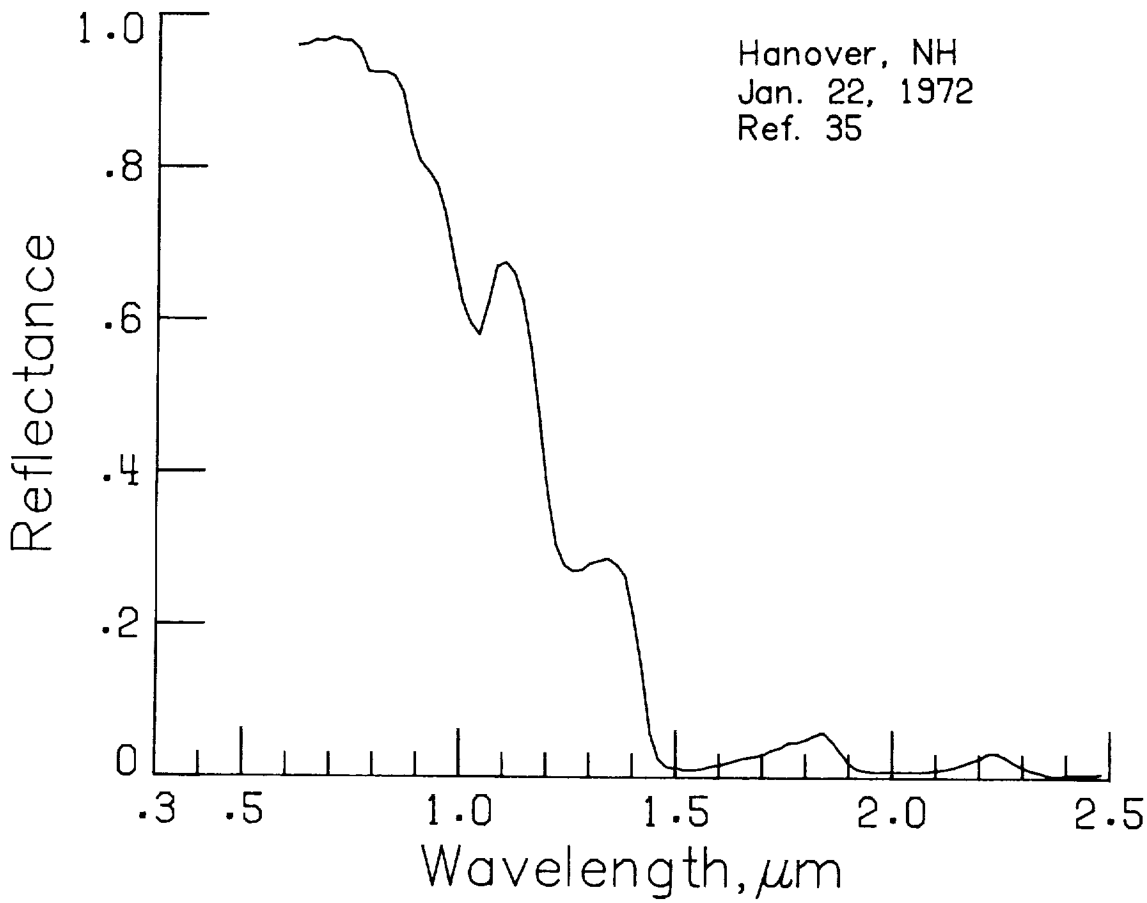
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.901	1.18	.523	1.62	.047	2.06	.007
.32		.76	.899	1.20	.452	1.64	.052	2.08	.008
.34		.78	.885	1.22	.394	1.66	.063	2.10	.012
.36		.80	.870	1.24	.368	1.68	.070	2.12	.016
.38		.82	.862	1.26	.363	1.70	.080	2.14	.025
.40		.84	.864	1.28	.366	1.72	.092	2.16	.035
.42		.86	.854	1.30	.369	1.74	.097	2.18	.048
.44		.88	.826	1.32	.371	1.76	.109	2.20	.060
.46		.90	.788	1.34	.370	1.78	.113	2.22	.072
.48		.92	.779	1.36	.366	1.80	.120	2.24	.077
.50		.94	.771	1.38	.348	1.82	.128	2.26	.074
.52		.96	.756	1.40	.287	1.84	.128	2.28	.062
.54		.98	.710	1.42	.183	1.86	.112	2.30	.045
.56		1.00	.660	1.44	.106	1.88	.081	2.32	.034
.58		1.02	.629	1.46	.042	1.90	.029	2.34	.026
.60		1.04	.613	1.48	.025	1.92	.012	2.36	.021
.62	.908	1.06	.652	1.50	.021	1.94	.009	2.38	.016
.64	.915	1.08	.677	1.52	.022	1.96	.009	2.40	.015
.66	.906	1.10	.677	1.54	.026	1.98	.007	2.42	.014
.68	.913	1.12	.666	1.56	.030	2.00	.009	2.44	.012
.70	.903	1.14	.648	1.58	.035	2.02	.007	2.46	.009
.72	.905	1.16	.599	1.60	.041	2.04	.007	2.48	.007

NO.145 - FRESH SNOW SAMPLE



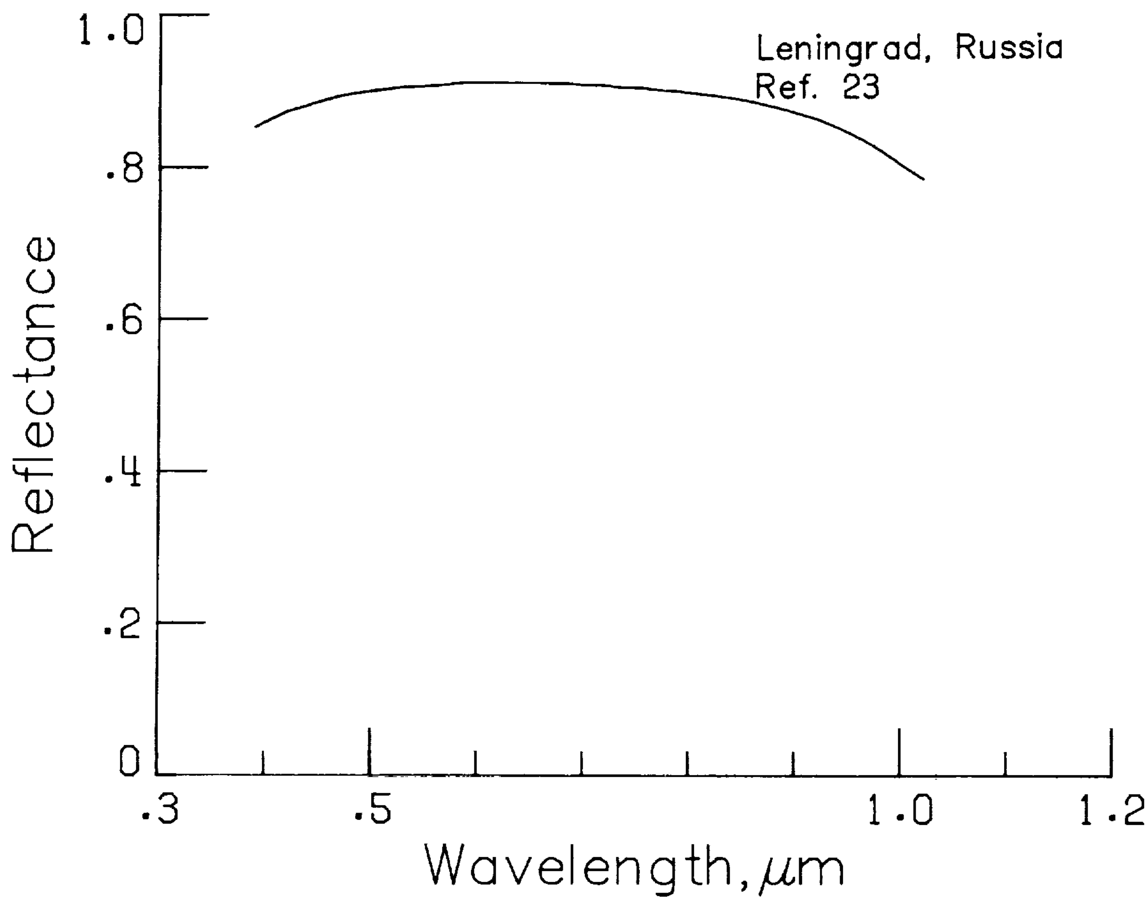
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.983	1.18	.697	1.62	.088	2.06	.008
.32		.76	.981	1.20	.630	1.64	.098	2.08	.009
.34		.78	.969	1.22	.568	1.66	.113	2.10	.015
.36		.80	.967	1.24	.537	1.68	.128	2.12	.021
.38		.82	.966	1.26	.532	1.70	.141	2.14	.046
.40		.84	.966	1.28	.534	1.72	.160	2.16	.069
.42		.86	.949	1.30	.542	1.74	.170	2.18	.093
.44		.88	.938	1.32	.545	1.76	.178	2.20	.106
.46		.90	.902	1.34	.543	1.78	.191	2.22	.131
.48		.92	.898	1.36	.536	1.80	.205	2.24	.148
.50		.94	.893	1.38	.519	1.82	.216	2.26	.151
.52		.96	.877	1.40	.487	1.84	.221	2.28	.134
.54		.98	.821	1.42	.361	1.86	.213	2.30	.121
.56		1.00	.805	1.44	.198	1.88	.162	2.32	.076
.58		1.02	.793	1.46	.117	1.90	.074	2.34	.053
.60		1.04	.791	1.48	.043	1.92	.029	2.36	.042
.62	.982	1.06	.814	1.50	.035	1.94	.017	2.38	.035
.64	.985	1.08	.845	1.52	.036	1.96	.008	2.40	.028
.66	.981	1.10	.845	1.54	.040	1.98	.008	2.42	.027
.68	.983	1.12	.837	1.56	.048	2.00	.008	2.44	.027
.70	.982	1.14	.817	1.58	.061	2.02	.008	2.46	.016
.72	.983	1.16	.733	1.60	.074	2.04	.008	2.48	.012

NO.146 - TWO DAY OLD SNOW SAMPLE



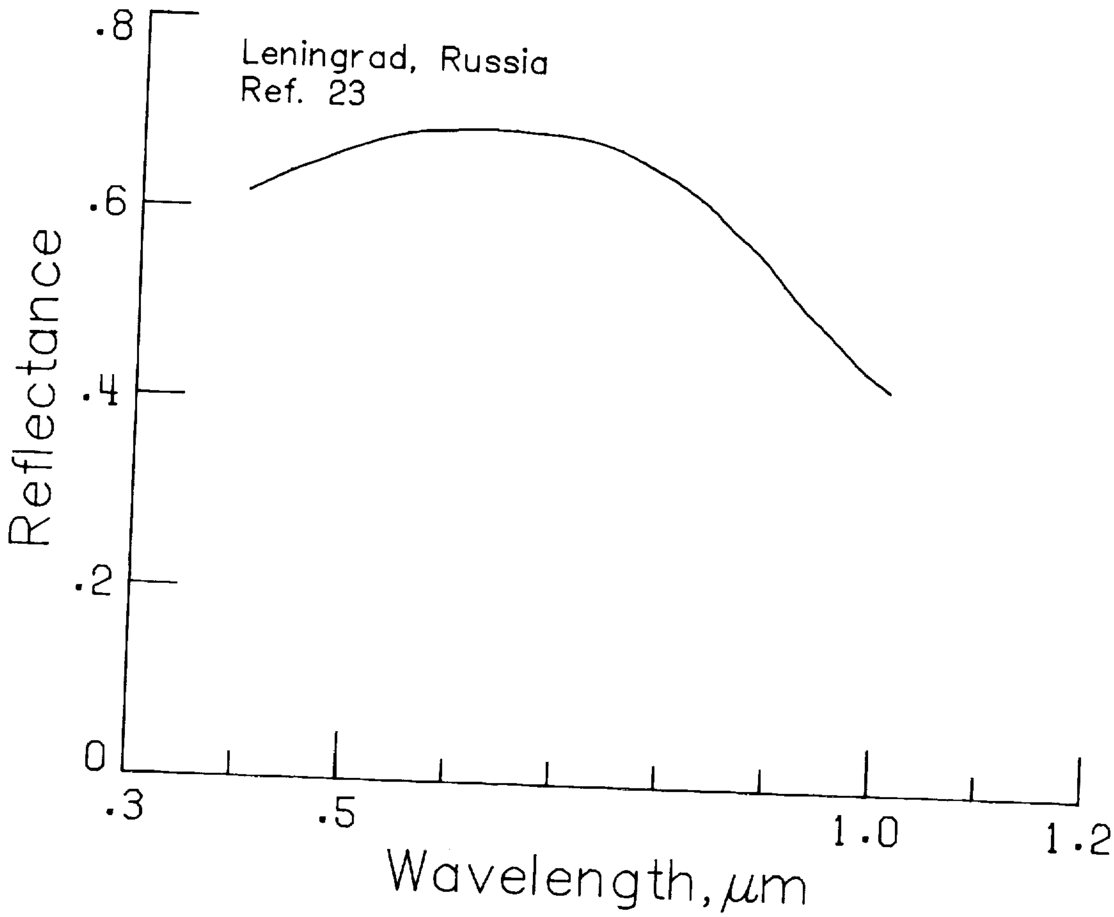
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.966	1.18	.470	1.62	.020	2.06	.008
.32		.76	.956	1.20	.373	1.64	.023	2.08	.009
.34		.78	.926	1.22	.305	1.66	.026	2.10	.010
.36		.80	.925	1.24	.279	1.68	.028	2.12	.012
.38		.82	.926	1.26	.271	1.70	.030	2.14	.014
.40		.84	.921	1.28	.273	1.72	.036	2.16	.018
.42		.86	.899	1.30	.282	1.74	.039	2.18	.022
.44		.88	.843	1.32	.285	1.76	.046	2.20	.027
.46		.90	.809	1.34	.287	1.78	.047	2.22	.033
.48		.92	.795	1.36	.280	1.80	.050	2.24	.032
.50		.94	.778	1.38	.265	1.82	.056	2.26	.028
.52		.96	.739	1.40	.212	1.84	.059	2.28	.020
.54		.98	.680	1.42	.144	1.86	.049	2.30	.015
.56		1.00	.624	1.44	.058	1.88	.034	2.32	.010
.58		1.02	.596	1.46	.024	1.90	.019	2.34	.007
.60		1.04	.582	1.48	.014	1.92	.011	2.36	.004
.62	.961	1.06	.623	1.50	.012	1.94	.009	2.38	.002
.64	.962	1.08	.671	1.52	.010	1.96	.008	2.40	.004
.66	.968	1.10	.676	1.54	.010	1.98	.009	2.42	.005
.68	.966	1.12	.663	1.56	.012	2.00	.009	2.44	.005
.70	.971	1.14	.626	1.58	.015	2.02	.009	2.46	.004
.72	.967	1.16	.562	1.60	.017	2.04	.009	2.48	.006

NO.147 - DRY FRESH SNOW



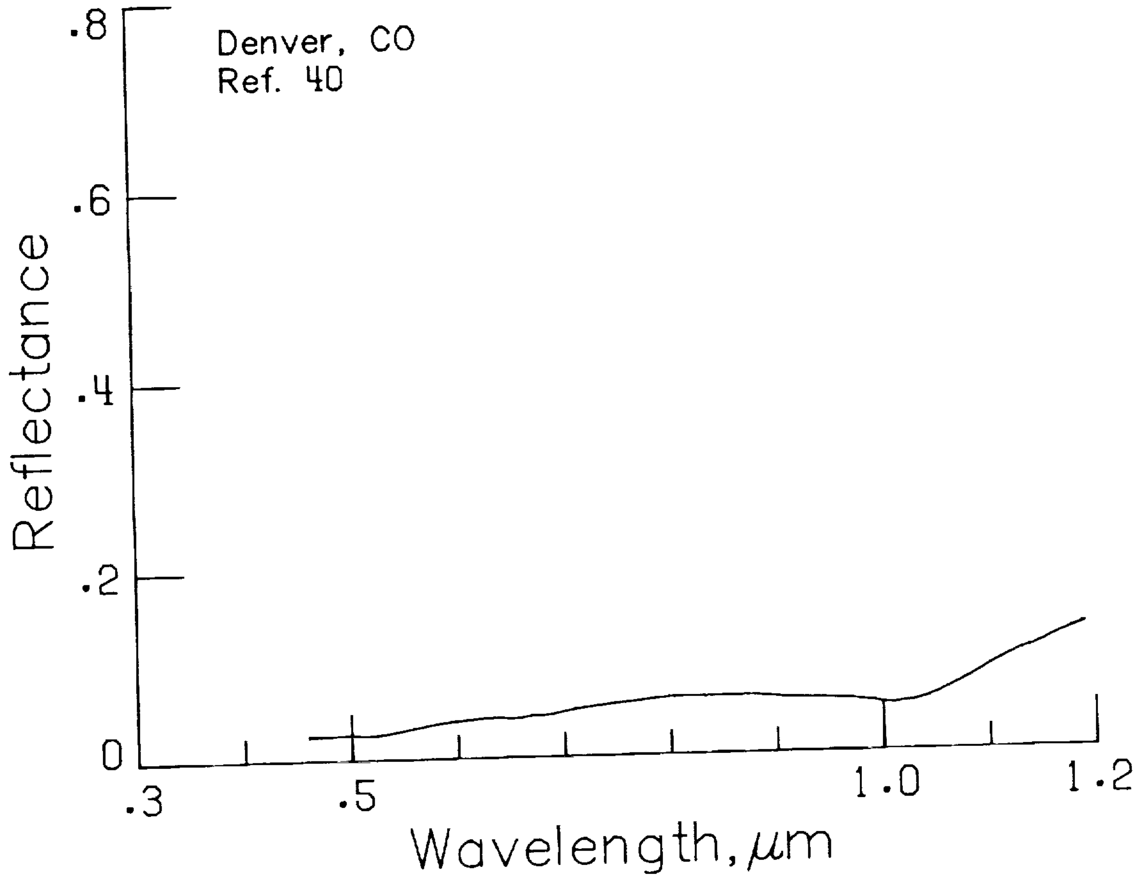
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.896	.66	.910	.84	.890	1.02	.785
.31		.49	.898	.67	.909	.85	.888	1.03	
.32		.50	.900	.68	.909	.86	.885	1.04	
.33		.51	.901	.69	.908	.87	.882	1.05	
.34		.52	.903	.70	.907	.88	.878	1.06	
.35		.53	.905	.71	.907	.89	.875	1.07	
.36		.54	.905	.72	.906	.90	.871	1.08	
.37		.55	.906	.73	.905	.91	.867	1.09	
.38		.56	.907	.74	.904	.92	.863	1.10	
.39	.853	.57	.908	.75	.903	.93	.857	1.11	
.40	.860	.58	.910	.76	.902	.94	.851	1.12	
.41	.867	.59	.910	.77	.901	.95	.845	1.13	
.42	.873	.60	.911	.78	.900	.96	.838	1.14	
.43	.877	.61	.911	.79	.898	.97	.830	1.15	
.44	.881	.62	.910	.80	.897	.98	.822	1.16	
.45	.886	.63	.910	.81	.895	.99	.813	1.17	
.46	.890	.64	.910	.82	.894	1.00	.803	1.18	
.47	.893	.65	.910	.83	.892	1.01	.794	1.19	

NO.148 - WET SNOW



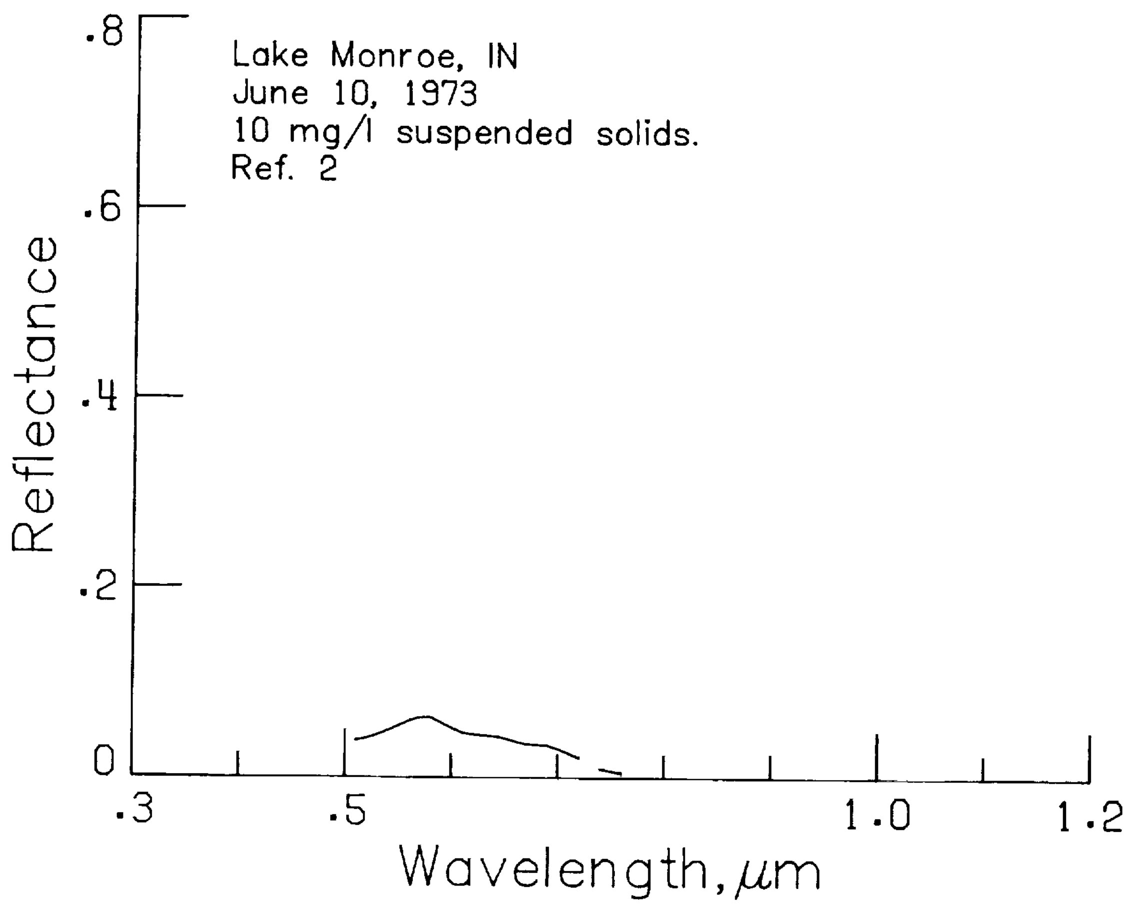
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.658	.66	.687	.84	.609	1.02	
.31		.49	.663	.67	.686	.85	.597	1.03	
.32		.50	.667	.68	.685	.86	.587	1.04	
.33		.51	.671	.69	.685	.87	.578	1.05	
.34		.52	.675	.70	.684	.88	.568	1.06	
.35		.53	.678	.71	.682	.89	.557	1.07	
.36		.54	.680	.72	.680	.90	.543	1.08	
.37		.55	.683	.73	.678	.91	.530	1.09	
.38		.56	.685	.74	.674	.92	.517	1.10	
.39		.57	.686	.75	.670	.93	.505	1.11	
.40	.618	.58	.686	.76	.665	.94	.495	1.12	
.41	.623	.59	.687	.77	.659	.95	.484	1.13	
.42	.629	.60	.687	.78	.653	.96	.473	1.14	
.43	.635	.61	.688	.79	.647	.97	.462	1.15	
.44	.640	.62	.689	.80	.642	.98	.450	1.16	
.45	.645	.63	.689	.81	.634	.99	.440	1.17	
.46	.649	.64	.688	.82	.627	1.00	.432	1.18	
.47	.653	.65	.688	.83	.618	1.01	.425	1.19	

NO.149 - WATER



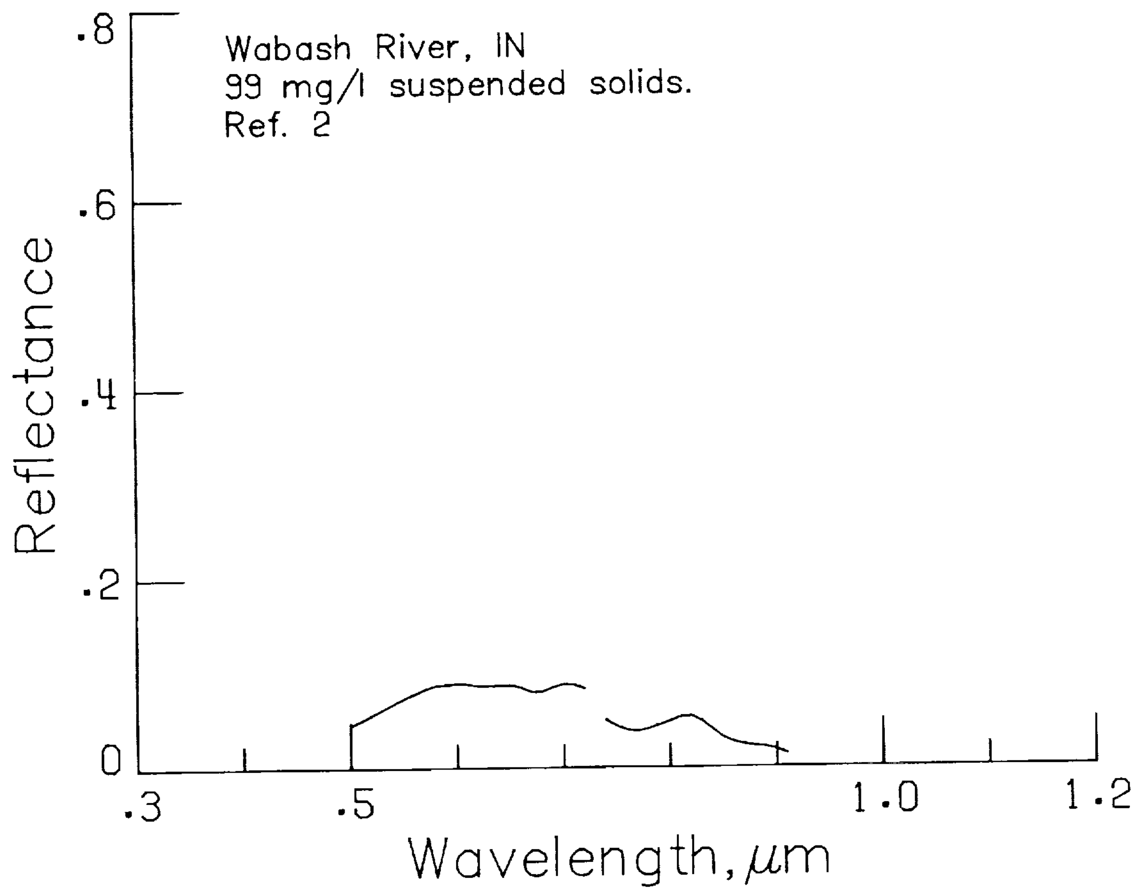
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.026	.66	.043	.84	.061	1.02	.051
.31		.49	.027	.67	.044	.85	.061	1.03	.053
.32		.50	.027	.68	.044	.86	.061	1.04	.055
.33		.51	.026	.69	.046	.87	.062	1.05	.060
.34		.52	.026	.70	.048	.88	.061	1.06	.065
.35		.53	.027	.71	.050	.89	.060	1.07	.070
.36		.54	.029	.72	.052	.90	.059	1.08	.076
.37		.55	.031	.73	.053	.91	.058	1.09	.082
.38		.56	.033	.74	.054	.92	.058	1.10	.088
.39		.57	.035	.75	.056	.93	.057	1.11	.094
.40		.58	.037	.76	.057	.94	.057	1.12	.099
.41		.59	.039	.77	.058	.95	.056	1.13	.104
.42		.60	.040	.78	.059	.96	.056	1.14	.108
.43		.61	.041	.79	.060	.97	.055	1.15	.112
.44		.62	.042	.80	.061	.98	.054	1.16	.118
.45		.63	.043	.81	.061	.99	.053	1.17	.122
.46	.026	.64	.043	.82	.061	1.00	.050	1.18	.127
.47	.026	.65	.042	.83	.061	1.01	.050	1.19	.131

NO. 150 - CLEAR LAKE WATER



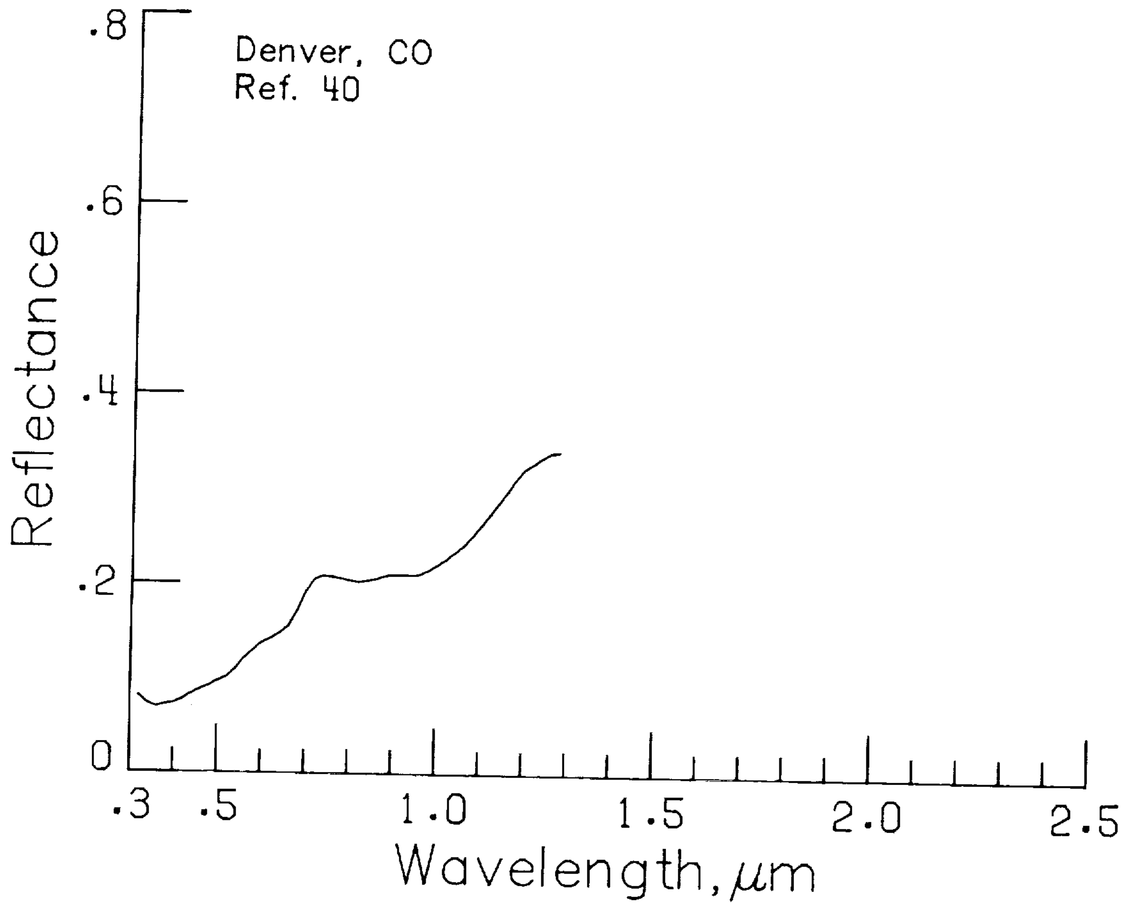
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48		.66	.038	.84		1.02	
.31		.49		.67	.035	.85		1.03	
.32		.50		.68	.035	.86		1.04	
.33		.51	.039	.69	.034	.87		1.05	
.34		.52	.041	.70	.031	.88		1.06	
.35		.53	.045	.71	.026	.89		1.07	
.36		.54	.049	.72	.021	.90		1.08	
.37		.55	.055	.73		.91		1.09	
.38		.56	.060	.74	.009	.92		1.10	
.39		.57	.063	.75	.007	.93		1.11	
.40		.58	.063	.76	.005	.94		1.12	
.41		.59	.058	.77		.95		1.13	
.42		.60	.052	.78		.96		1.14	
.43		.61	.047	.79		.97		1.15	
.44		.62	.045	.80		.98		1.16	
.45		.63	.045	.81		.99		1.17	
.46		.64	.043	.82		1.00		1.18	
.47		.65	.041	.83		1.01		1.19	

NO.151 - TURBID RIVER WATER



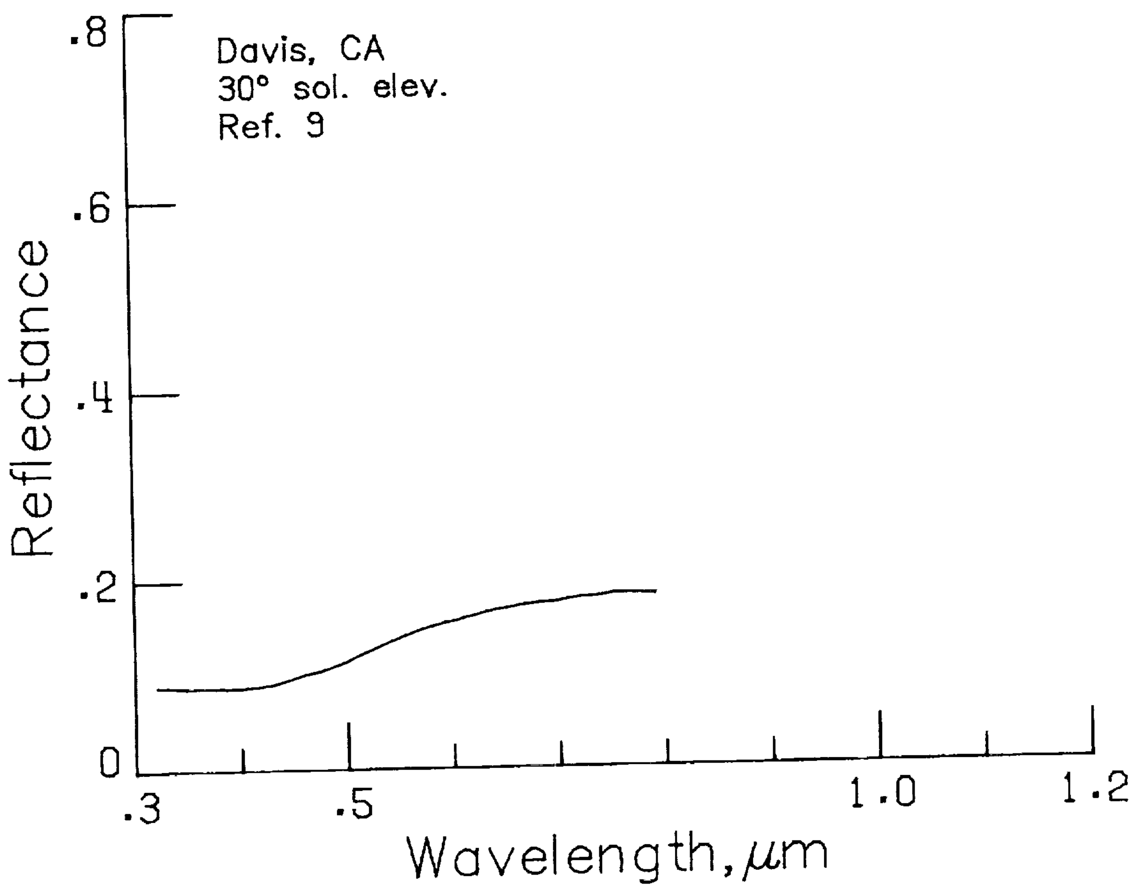
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48		.66	.085	.84	.040	1.02	
.31		.49		.67	.080	.85	.031	1.03	
.32		.50	.046	.68	.080	.86	.027	1.04	
.33		.51	.051	.69	.085	.87	.024	1.05	
.34		.52	.057	.70	.088	.88	.022	1.06	
.35		.53	.062	.71	.087	.89	.021	1.07	
.36		.54	.068	.72	.083	.90	.018	1.08	
.37		.55	.074	.73		.91	.014	1.09	
.38		.56	.079	.74	.050	.92		1.10	
.39		.57	.084	.75	.044	.93		1.11	
.40		.58	.087	.76	.040	.94		1.12	
.41		.59	.088	.77	.039	.95		1.13	
.42		.60	.089	.78	.041	.96		1.14	
.43		.61	.088	.79	.045	.97		1.15	
.44		.62	.086	.80	.049	.98		1.16	
.45		.63	.086	.81	.053	.99		1.17	
.46		.64	.087	.82	.054	1.00		1.18	
.47		.65	.087	.83	.049	1.01		1.19	

NO.152 - ASPHALT



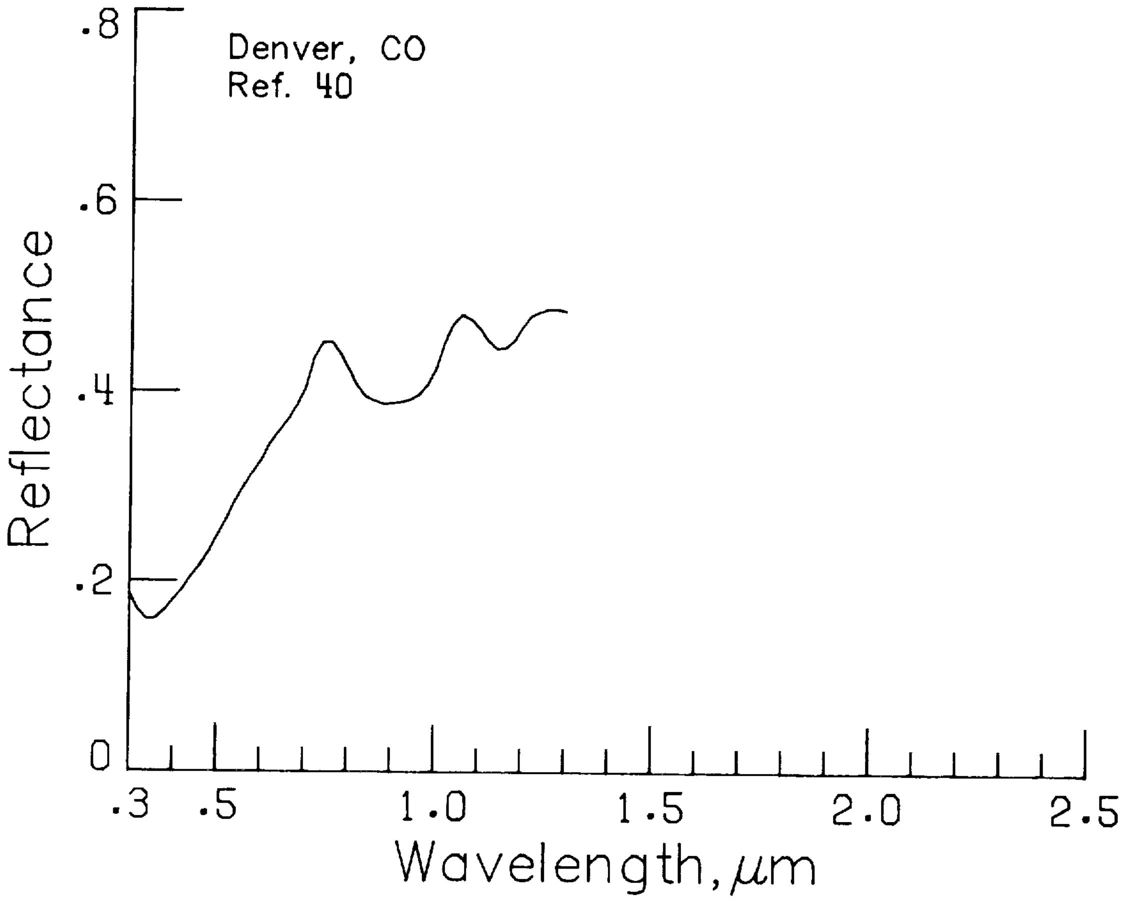
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.74	.209	1.18	.313	1.62		2.06	
.32	.081	.76	.208	1.20	.324	1.64		2.08	
.34	.073	.78	.206	1.22	.329	1.66		2.10	
.36	.069	.80	.204	1.24	.336	1.68		2.12	
.38	.072	.82	.202	1.26	.340	1.70		2.14	
.40	.074	.84	.204	1.28	.342	1.72		2.16	
.42	.078	.86	.206	1.30		1.74		2.18	
.44	.084	.88	.209	1.32		1.76		2.20	
.46	.088	.90	.211	1.34		1.78		2.22	
.48	.092	.92	.210	1.36		1.80		2.24	
.50	.097	.94	.210	1.38		1.82		2.26	
.52	.101	.96	.211	1.40		1.84		2.28	
.54	.109	.98	.215	1.42		1.86		2.30	
.56	.121	1.00	.221	1.44		1.88		2.32	
.58	.130	1.02	.227	1.46		1.90		2.34	
.60	.138	1.04	.234	1.48		1.92		2.36	
.62	.142	1.06	.242	1.50		1.94		2.38	
.64	.148	1.08	.252	1.52		1.96		2.40	
.66	.155	1.10	.263	1.54		1.98		2.42	
.68	.171	1.12	.274	1.56		2.00		2.44	
.70	.193	1.14	.287	1.58		2.02		2.46	
.72	.206	1.16	.299	1.60		2.04		2.48	

NO.153 - BLACKTOP



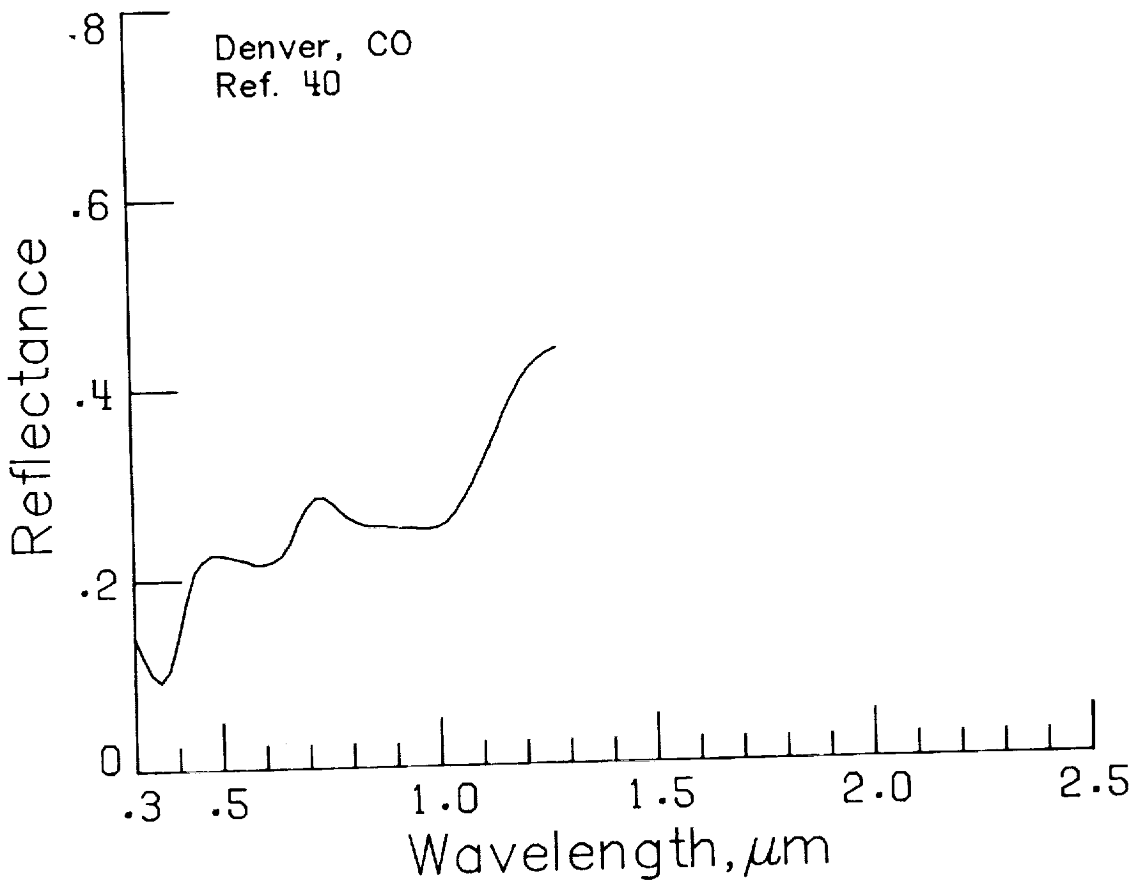
λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.108	.66	.171	.84		1.02	
.31		.49	.112	.67	.173	.85		1.03	
.32	.090	.50	.116	.68	.174	.86		1.04	
.33	.090	.51	.121	.69	.175	.87		1.05	
.34	.088	.52	.126	.70	.176	.88		1.06	
.35	.088	.53	.131	.71	.178	.89		1.07	
.36	.088	.54	.136	.72	.179	.90		1.08	
.37	.088	.55	.140	.73	.180	.91		1.09	
.38	.088	.56	.144	.74	.181	.92		1.10	
.39	.087	.57	.148	.75	.183	.93		1.11	
.40	.088	.58	.151	.76	.183	.94		1.12	
.41	.089	.59	.154	.77	.183	.95		1.13	
.42	.090	.60	.157	.78	.182	.96		1.14	
.43	.092	.61	.160	.79	.182	.97		1.15	
.44	.095	.62	.162	.80		.98		1.16	
.45	.099	.63	.165	.81		.99		1.17	
.46	.102	.64	.168	.82		1.00		1.18	
.47	.104	.65	.169	.83		1.01		1.19	

NO.154 - CONCRETE



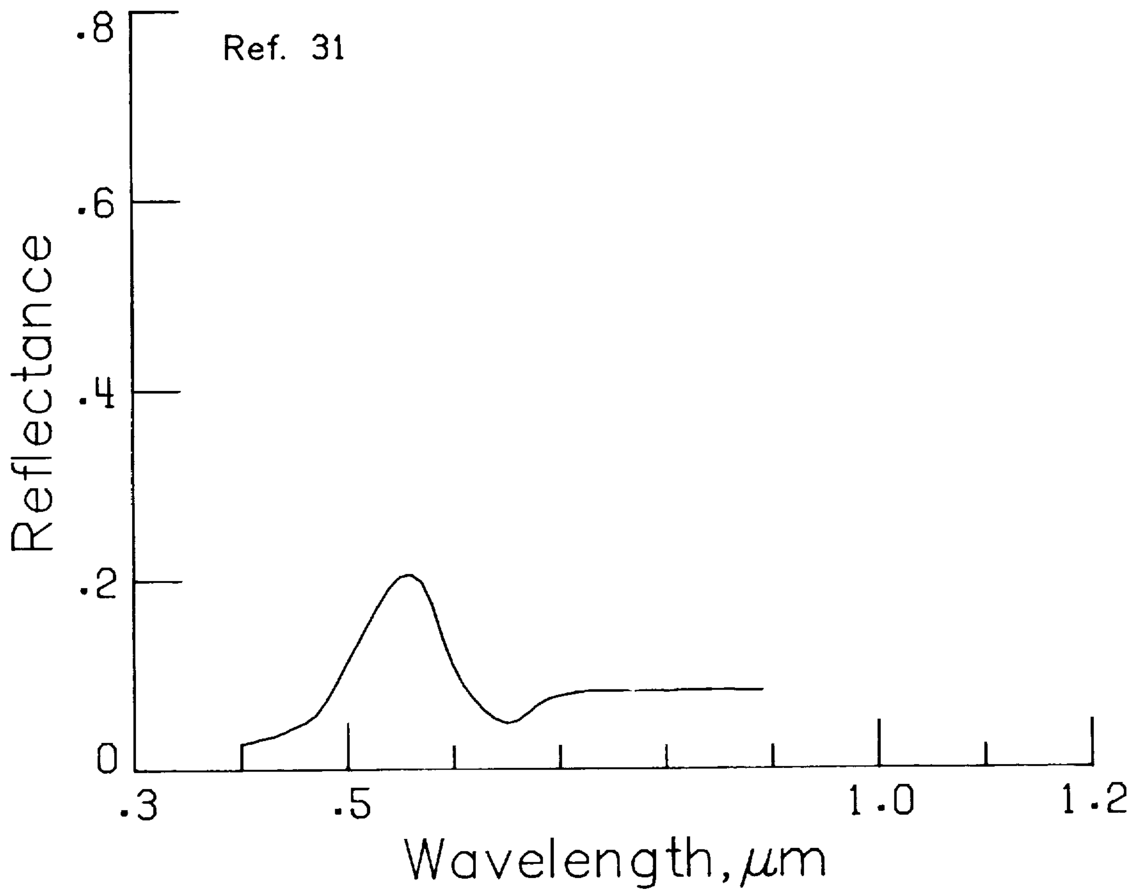
λ	R	λ	R	λ	R	λ	R	λ	R
.30	.186	.74	.452	1.18	.455	1.62		2.06	
.32	.169	.76	.453	1.20	.470	1.64		2.08	
.34	.160	.78	.441	1.22	.481	1.66		2.10	
.36	.161	.80	.424	1.24	.485	1.68		2.12	
.38	.169	.82	.406	1.26	.488	1.70		2.14	
.40	.180	.84	.395	1.28	.487	1.72		2.16	
.42	.191	.86	.391	1.30	.486	1.74		2.18	
.44	.205	.88	.387	1.32		1.76		2.20	
.46	.216	.90	.388	1.34		1.78		2.22	
.48	.231	.92	.390	1.36		1.80		2.24	
.50	.249	.94	.392	1.38		1.82		2.26	
.52	.265	.96	.397	1.40		1.84		2.28	
.54	.285	.98	.407	1.42		1.86		2.30	
.56	.301	1.00	.425	1.44		1.88		2.32	
.58	.315	1.02	.453	1.46		1.90		2.34	
.60	.328	1.04	.473	1.48		1.92		2.36	
.62	.346	1.06	.482	1.50		1.94		2.38	
.64	.358	1.08	.477	1.52		1.96		2.40	
.66	.370	1.10	.467	1.54		1.98		2.42	
.68	.385	1.12	.455	1.56		2.00		2.44	
.70	.403	1.14	.446	1.58		2.02		2.46	
.72	.4[illegible]7	1.16	.447	1.60		2.04		2.48	

NO.155 - SHINGLES



λ	R	λ	R	λ	R	λ	R	λ	R
.30	.141	.74	.285	1.18	.392	1.62		2.06	
.32	.119	.76	.278	1.20	.409	1.64		2.08	
.34	.100	.78	.269	1.22	.420	1.66		2.10	
.36	.093	.80	.262	1.24	.428	1.68		2.12	
.38	.105	.82	.257	1.26	.434	1.70		2.14	
.40	.138	.84	.254	1.28	.438	1.72		2.16	
.42	.177	.86	.254	1.30		1.74		2.18	
.44	.209	.88	.253	1.32		1.76		2.20	
.46	.220	.90	.252	1.34		1.78		2.22	
.48	.226	.92	.252	1.36		1.80		2.24	
.50	.226	.94	.252	1.38		1.82		2.26	
.52	.224	.96	.250	1.40		1.84		2.28	
.54	.221	.98	.250	1.42		1.86		2.30	
.56	.219	1.00	.252	1.44		1.88		2.32	
.58	.215	1.02	.257	1.46		1.90		2.34	
.60	.215	1.04	.266	1.48		1.92		2.36	
.62	.218	1.06	.280	1.50		1.94		2.38	
.64	.224	1.08	.296	1.52		1.96		2.40	
.66	.237	1.10	.315	1.54		1.98		2.42	
.68	.259	1.12	.334	1.56		2.00		2.44	
.70	.275	1.14	.352	1.58		2.02		2.46	
.72	.285	1.16	.375	1.60		2.04		2.48	

NO.156 - ARTIFICIAL TURF



λ	R	λ	R	λ	R	λ	R	λ	R
.30		.48	.073	.66	.051	.84	.084	1.02	
.31		.49	.092	.67	.060	.85	.083	1.03	
.32		.50	.114	.68	.069	.86	.083	1.04	
.33		.51	.133	.69	.075	.87	.083	1.05	
.34		.52	.154	.70	.078	.88	.083	1.06	
.35		.53	.174	.71	.080	.89	.083	1.07	
.36		.54	.192	.72	.082	.90		1.08	
.37		.55	.204	.73	.083	.91		1.09	
.38		.56	.206	.74	.082	.92		1.10	
.39		.57	.198	.75	.083	.93		1.11	
.40	.027	.58	.174	.76	.083	.94		1.12	
.41	.030	.59	.138	.77	.082	.95		1.13	
.42	.033	.60	.108	.78	.083	.96		1.14	
.43	.035	.61	.087	.79	.082	.97		1.15	
.44	.040	.62	.073	.80	.082	.98		1.16	
.45	.045	.63	.061	.81	.083	.99		1.17	
.46	.050	.64	.053	.82	.083	1.00		1.18	
.47	.057	.65	.049	.83	.083	1.01		1.19	