USGS Spectral Library Version 7 Data

Metadata also available as - [Questions & Answers] - [Parseable text] - [XML]

Metadata:

Identification_Information:
Citation:
Citation_Information:
Originator: Raymond F. Kokaly
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Originator: Gregg A. Swayze
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Originator: Rhonda L. Driscoll
Originator: Anna J. Klein
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Originator: Raymond F. Kokaly
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Description:

Abstract:

This data release provides the U.S. Geological Survey (USGS) Spectral Library Version 7 and all related documents. The library contains spectra measured with laboratory, field, and airborne spectrometers. The instruments used cover wavelengths from the ultraviolet to the far infrared (0.2 to 200 microns). Laboratory samples of specific minerals, plants, chemical compounds, and man-made materials were measured. In many cases, samples were purified, so that unique spectral features of a material can be related to its chemical structure. These spectro-chemical links are important for interpreting remotely sensed data collected in the field or from an aircraft or spacecraft. This library also contains physically-constructed as well as mathematically-computed mixtures. Measurements of rocks, soils, and natural mixtures of minerals have also been made with laboratory and field spectrometers. Spectra of plant components and vegetation plots, comprising many plant types and species with varying backgrounds, are also in this library. Measurements by airborne spectrometers are included for forested vegetation plots, in which the trees are too tall for measurement by a field spectrometer.

The related U.S. Geological Survey Data Series publication, "USGS Spectral Library Version 7", describes the instruments used, metadata descriptions of spectra and samples, and possible artifacts in the spectral measurements (Kokaly and others, 2017).

Four different spectrometer types were used to measure spectra in the library: (1) Beckman™ 5270 covering the spectral range 0.2 to 3 µm, (2) standard, high resolution (hi-res), and high-resolution Next Generation (hi-resNG) models of ASD field portable spectrometers covering the range from 0.35 to 2.5 µm, (3) Nicolet™ Fourier Transform Infra-Red (FTIR) interferometer spectrometers covering the range from about 1.12 to 216 µm, and (4) the NASA Airborne Visible/Infra-Red Imaging Spectrometer AVIRIS, covering the range 0.37 to 2.5 µm.

Two fundamental spectrometer characteristics significant for interpreting and utilizing spectral measurements are sampling position (the wavelength position of each spectrometer channel) and bandpass (a parameter describing the wavelength interval over which each channel in a spectrometer is sensitive). Bandpass is typically reported as the Full Width at Half Maximum (FWHM) response at each channel (in wavelength units, for example nm or micron). The linked publication (Kokaly and others, 2017), includes a comparison plot of the various spectrometers used to measure the data in this release. Data for the sampling positions and the bandpass values (for each channel in the spectrometers) are included in this data release. These data are in the SPECPR files, as separate data records, and in the American Standard Code for Information Interchange (ASCII) text files, as separate files for wavelength and bandpass.

Spectra are provided in files of ASCII text format (files with a .txt file extension). In the ASCII files, deleted channels (bad bands) are indicated by a value of -1.23e34. Metadata descriptions of samples, field areas, spectral measurements, and results from supporting material analyses – such as XRD – are provided in HyperText Markup Language HTML formatted ASCII text files (files with .html file extension). In addition, Graphics Interchange Format (GIF) images of plots of spectra are provided. For each spectrum a plot with wavelength in microns on the x-axis is provided. For spectra measured on the Nicolet spectrometer, an additional GIF image with wavenumber on the x-axis is provided.

Data are also provided in SPECtrum Processing Routines (SPECPR) format (Clark, 1993) which packages spectra and associated metadata descriptions into a single file (see the linked publication, Kokaly and others, 2017, for additional details on the SPECPR format and freely-available software than can be used to read files in SPECPR format).

The data measured on the source spectrometers are denoted by the "splib07a" tag in filenames. In addition to providing the original measurements, the spectra have been convolved and resampled to different spectrometer and multispectral sensor characteristics. The following list specifies the identifying tag for the measured and convolved libraries and gives brief descriptions of the sensors.

splib07a – this is the name of the SPECPR file containing the spectra measured on the Beckman, ASD, Nicolet and AVIRIS spectrometers. The data are provided with their original sampling positions (wavelengths) and bandpass values. The prefix "splib07a_" is at the beginning of the ASCII and GIF files pertaining to the measured spectra.

splib07b – this is the name of the SPECPR file containing a modified version of the original measurements. The results from using spectral convolution to convert measurements to other spectrometer characteristics can be improved by oversampling (increasing sample density). Thus, splib07b is an oversampled version of the library, computed using simple cubic-spline interpolation to produce spectra with fine sampling interval (therefore a higher number of channels) for Beckman and AVIRIS measurements. The spectra in this version of the library are the data used to create the convolved and resampled versions of the library. The prefix "splib07b_" is at the beginning of the ASCII and GIF files pertaining to the oversampled spectra.

s07_ASD – this is the name of the SPECPR file containing the spectral library measurements convolved to standard resolution ASD full range spectrometer characteristics. The standard reported wavelengths of the ASD spectrometers used by the USGS were used (2151 channels with wavelength positions starting at 350 nm and increasing in 1 nm increments). The bandpass values of each channel were determined by comparing measurements of reference materials made on ASD spectrometers in comparison to measurements made of the same materials on higher resolution spectrometers (the procedure is described in Kokaly, 2011, and discussed in Kokaly and Skidmore, 2015, and Kokaly and others, 2017). The prefix "s07ASD_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV95 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 1995 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV95_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV96 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 1996 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV96_" is at the beginning of the ASCII, and GIF files.

s07_AV97 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 1997 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV97_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV98 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 1998 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV98_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV99 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 1999 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV99_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV00 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2000 (wavelength

and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV00_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV01 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2001 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV01_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV05 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2005 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV05_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV06 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2006 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV06_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV09 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2009 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV09_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV10 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2010 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV10_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV11 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2011 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV11_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV12 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2012 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV12_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV13 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2013 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV13_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_AV14 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2014 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL). The prefix "s07_AV14_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_HY07 – this is the name of the SPECPR file containing the spectral library measurements convolved to Hyperspectral Mapper (HyMap) with spectral characteristics determined in the year 2007 (wavelength and bandpass values for the 124 channels provided with HyMap data by HyVista Corp). The wavelength and bandpass values were validated by comparing measurements of reference materials made using the HyMap 2007 imaging spectrometer to measurements of the same materials made on higher resolution laboratory spectrometers (the procedure is described in Kokaly (2011) and discussed in Kokaly and others (2013). The prefix "s07_HY07_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_HY14 – this is the name of the SPECPR file containing the spectral library measurements convolved to Hyperspectral Mapper (HyMap) with spectral characteristics determined in the year 2014 (wavelength and bandpass values for the 126 channels provided with HyMap data by HyVista Corp). The wavelength and bandpass values were validated by comparing measurements of reference materials made using the HyMap 2014 imaging spectrometer to measurements of the same materials made on higher resolution laboratory spectrometers (the procedure is described in Kokaly (2011) and discussed in Kokaly and others (2013). The prefix "s07_HY14_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07HYPRN - this is the name of the SPECPR file containing the spectral library measurements convolved to the Hyperion imaging spectrometer. The oversampled spectra in splib07b were convolved to Hyperion's average spectral characteristics (accessed January 10, 2017, at https://eo1.usgs.gov/sensors/hyperioncoverage). The prefix "s07HYPRN_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_VIMS – this is the name of the SPECPR file containing the spectral library measurements convolved to the Cassini spacecraft's Visual and Infrared Mapping Spectrometer (VIMS) with spectral characteristics determined by Clark and others (2016), wavelength and bandpass values for the 352 channels. The prefix "s07_VIMS_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07CRSMg – convolved to the global mapping mode of the Mars Reconnaissance Orbiter spacecraft's Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) with spectral characteristics determined by Murchie and others (2009), wavelength and bandpass values for the 72 channels. The prefix "s07CRSMg_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07CRSMj – convolved to the targeted mode (joined visible and infrared sensors) of the Mars Reconnaissance Orbiter spacecraft's Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) with spectral characteristics determined by Murchie and others (2009), wavelength and bandpass values for the 489 channels. The prefix "s07CRSMj_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_M3t – convolved to the target mode of the Moon Mineralogy Mapper spectrometer with spectral characteristics determined by Green and others (2011), wavelength and bandpass values for the 256 channels. The prefix "s07_M3t_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07ASTER – the library in SPECPR format, resampled to response functions of Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER). The spectral response functions for this sensor's nine bands covering the visible through shortwave infrared wavelengths came from NASA (ASTER instrument characteristics accessed January 3, 2017, at https://asterweb.jpl.nasa.gov/content/01_mission/03_instrument/archive/vnir.txt and https://asterweb.jpl.nasa.gov/content/01_mission/03_instrument/archive/swir.txt). The prefix "s07ASTER_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07LSAT8 – the library in SPECPR format, resampled to response functions of Landsat-8 Operational Land Imager (OLI). The spectral response functions for this sensor's seven bands covering the visible through shortwave infrared wavelengths came from spectral libraries included as part of the ENVI 5.3 software release. The ENVI data were compared to values of the pre-launch sensor response functions (Barsi and others, 2014; spreadsheet with values was accessed December 27, 2016, at http://landsat.gsfc.nasa.gov/?p=5779) and found to be identical. The prefix "s07LSAT8_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07SNTL2 – the library in SPECPR format, resampled to response functions of Sentinel-2 Multispectral Instrument (MSI). The spectral response functions for this sensor's 13 bands covering

the visible through shortwave infrared wavelengths came from the European Space Agency (ESA, 2015). The prefix "s07SNTL2_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

s07_WV3 – the library in SPECPR format, resampled to response functions of WorldView3 (WV3). The spectral response functions for this sensor's 16 bands covering the visible through shortwave infrared wavelengths came from DigitalGlobe (2016). The prefix "s07_WV3_" is at the beginning of the ASCII and GIF files pertaining to this spectrometer.

Alternative SPECPR files containing only the spectra (and not the metadata) with consistent data record numbering from spectrometer to spectrometer are included in the folder "alternativeSPECPR". The SPECPR files mentioned previously contain the resampled spectra along with their associated metadata descriptions. The filenames of these alternative SPECPR files are similar to those listed previously, except all characters are in lowercase.

The spectra in the data release are organized in these chapters:

Chapter M = Minerals

Chapter S = Soils (including rocks and mineral mixtures)

Chapter C = Coatings

Chapter L = Liquids (including mixtures of liquids, water and other volatiles, and frozen volatiles)

Chapter O = Organics (including biochemical constituents of plants and chemical compounds)

Chapter A = Artificial (manmade materials, including construction materials, fabrics, manufactured chemicals, processed materials, paint pigments, plastics, and materials introduced into the environment by human activity)

Chapter V = Vegetation (including biological materials, plant components such as leaves, flowers, and bark, vegetated areas having more than one species present, lichens, biological soil crusts, and mixtures with vegetation)

Chapter M includes native elements and minerals from arsenate, borate, carbonate, halide, hydroxide, nitrate, oxide, phosphate, silicate (cyclosilicate, inosilicate, phyllosilicate, nesosilicate, sorosilicate, and tectosilicate), sulfate, and sulfide classes are represented. The chapter also contains compositional end- and intermediate-members for the olivine, garnet, scapolite, montmorillonite, muscovite, jarosite, and alunite solid-solution series. We have included representative spectra of kerogen, ammonium-bearing minerals, Lanthanide element oxides, desert varnish coatings, kaolinite crystallinity series, kaolinite-smectite series, zeolite series, and an extensive evaporite series. In some cases, a number of spectra span a compositional solid-solution series or a grain-size series or both.

Some samples were not easily placed into a specific chapter. For example, pure minerals are often difficult to find, or it may be difficult to process the sample to purify the mineral. Such a sample could be considered a mixture. Some samples of this type were put in the minerals chapter (Chapter 1: M) because they have spectral features that are representative of one mineral in the sample. The mixture chapter (Chapter 2: S) contains spectra of multiphase samples used for identifying and mapping mixtures. Usually, the materials in these mixtures have overlapping absorption features in their spectra. The samples in the coatings chapter (Chapter 3: C) are also mixtures. However, the mineral coatings on the surfaces of the rock samples may be optically thick and obscure the spectral signatures of the underlying minerals. Frozen water, in the form of snow and ice, is included in Chapter 4: L.

Organic compounds are a vast category with great chemical diversity. We have added more than 200 organic compounds to a new chapter in this release of the library (Chapter 5: O). The additions are focused on compounds of smaller molecular weight that form the functional groups for larger molecules. Major groups represented include alkanes, alkenes, alkynes, aromatic hydrocarbons based on the benzene ring, and amino acids. Many of these compounds are known by multiple names because of different naming conventions and use of the common name before systematic naming conventions were created. We endeavored to use the name that was in most common use in the spectrum titles. The sample description has the Chemical Abstract Services Registry Number. The metadata descriptions also list the various names that have been applied to a particular chemical. Biochemical constituents of plants are also in this chapter of the library. Spectra of major components of plants, including lignin, cellulose, amylose, and starch, and less abundant components, including many plant phenolics, were added.

Terrestrial remote sensing may be used in urban areas covered by manmade materials, so the library includes spectra of plastics, roofing materials, processed wood, paint, and other artificial materials (Chapter 6: A). Also in this chapter are materials that might be considered natural, for example oil and vermiculite insulation; however, they are present in the environment because of human activity or they have been altered or concentrated during a manufacturing process. In the data release, spectra of oil residues from the British Petroleum (BP) Deepwater Horizon spill (DWH) have been added. Materials that we use to process spectra and monitor the performance of our spectrometers have been added, specifically, Spectralon and mylar plastic.

The spectra in the vegetation chapter (Chapter 7: V) are representative of areas in which we have conducted research and for which we have published results, including: grasslands, semiarid shrublands, biological soil crusts, temperate evergreen forests, California chaparral, and coastal wetlands. The spectra span a range of measurement scales, from laboratory spectra of leaves, stems, flowers, and other plant components to remotely-sensed spectra of vegetated areas of mixed species. Because the SPECPR database file format has a limitation of 40 characters for spectrum titles, scientific names of organisms are rarely used in spectrum titles. Instead, scientific names are specified in the metadata descriptions of spectra. Spectra of leaves or a plant of a single species are often listed by a generic common name of the plant (for example, “manzanita” to represent *Arctostaphylos viscida* Parry). Field and AVIRIS spectra of mixed vegetation areas (plant communities) are sometimes listed by the common name of the dominant species (for example, lodgepole pine), by biome (such as grassland or shrubland), or by a land-use term (such as rangeland). In some cases, the title contains the biome name and the dominant species indicated by symbols comprising the genus and species of the dominant plant, for example, “Marsh_SPAL80%...” in the title describing a coastal wetland area where the most abundant species is *Spartina alterniflora* Loisel. with 80 percent (%) cover.

Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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Purpose:
The samples and spectra collected in this library were assembled for the purpose of using spectroscopy and remote sensing for identification and mapping of materials.

Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 19800101
Ending_Date: 20160825

Currentness_Reference: publication date

Status:
Progress: Complete
Maintenance_and_Update_Frequency: Irregular

Spatial_Domain:

Bounding_Coordinates:
West_Bounding_Coordinate: -180.0
East_Bounding_Coordinate: 180.0
North_Bounding_Coordinate: 90.0
South_Bounding_Coordinate: -90.0

Keywords:
Theme:
Theme_Keyword_Thesaurus: USGS Thesaurus
Theme_Keyword: remote sensing
Theme_Keyword: visible light imaging
Theme_Keyword: infrared imaging
Theme_Keyword: hyperspectral imaging
Theme_Keyword: multispectral imaging
Theme_Keyword: AVIRIS
Theme_Keyword: mineralogy
Theme_Keyword: vegetation
Theme_Keyword: chemical analysis

Theme:
Theme_Keyword_Thesaurus: ISO 19115 Topic Categories
Theme_Keyword: geoscientificInformation
Theme_Keyword: biota
Theme_Keyword: environment
Theme_Keyword: imageryBaseMapsEarthCover

Theme:
Theme_Keyword_Thesaurus: None
Theme_Keyword: spectroscopy
Theme_Keyword: spectral analysis
Theme_Keyword: reflectance spectra
Theme_Keyword: imaging spectroscopy
Theme_Keyword: Crustal Geophysics and Geochemistry Science Center
Theme_Keyword: CGGSC
Theme_Keyword: Central Minerals and Environmental Resources Science Center
Theme_Keyword: CMERSC
Theme_Keyword: Mineral Resources Program
Theme_Keyword: MRP

Place:
Place_Keyword_Thesaurus: Common Geographic Areas
Place_Keyword: Africa
Place_Keyword: Asia
Place_Keyword: Australia
Place_Keyword: Europe
Place_Keyword: North America
Place_Keyword: South America

Access_Constraints: none
Use_Constraints:
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Data_Set_Credit:
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Data_Quality_Information:
Attribute_Accuracy:
Attribute_Accuracy_Report: No formal attribute accuracy tests were conducted

Logical_Consistency_Report: No formal logical accuracy tests were conducted
Completeness_Report:
Data set is considered complete for the information presented, as described in the abstract. Users are advised to read the rest of the metadata record carefully for additional details.

Positional_Accuracy:
Horizontal_Positional_Accuracy:
Horizontal_Positional_Accuracy_Report: No formal positional accuracy tests were conducted

Vertical_Positional_Accuracy:
Vertical_Positional_Accuracy_Report: No formal positional accuracy tests were conducted

Lineage:
Source_Information:
Source_Citation:
Citation_Information:
Originator:
Clark, R.N., Swayze, G.A., Wise, R., Livo, E., Hoefen, T., Kokaly, R., Sutley, S.J.

Publication_Date: 2007
Title: USGS Digital Spectral Library splib06a
Geospatial_Data_Presentation_Form: tabular digital data
Publication_Information:
Publication_Place: Denver, CO
Publisher: U.S. Geological Survey

Online_Linkage: https://pubs.er.usgs.gov/publication/ds231

Type_of_Source_Media: spectra
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 19800101
Ending_Date: 20060913

Source_Currentness_Reference: Publication_date

Source_Citation_Abbreviation: splib06a
Source_Contribution: Spectra and metadata

Process_Step:
Process_Description:
Spectra were measured using these previously mentioned spectrometers (Beckman, Nicolet, ASD, and AVIRIS) over the time period from 1980 to 2016. These measurements were conducted in field and laboratory settings. Data were converted to absolute reflectance, relative reflectance, and transmission, dependent on the sample (see the linked publication, Kokaly and others, 2017, and consult the information in the HTML-formatted description for each sample). A number of spectra were collected using the AVIRIS airborne imaging spectrometer. Further processing was done to convolve the spectra to the characteristics of other spectrometers and broadband sensors channels. These convolved versions of spectra have also been provided in this data release. The full procedures have been documented and described in the linked publication Kokaly and others (2017) (https://doi.org/10.3133/ds1035).

Process_Date: 20160926

Spatial_Data_Organization_Information:
Indirect_Spatial_Reference:
Spectral data were measured for samples collected across the globe.

Entity_and_Attribute_Information:
Detailed_Description:
Entity_Type:
Entity_Type_Label: folderid_materialname_sampleid_otherinformation.txt
Entity_Type_Definition:
Text file containing spectral data values for each sample. The naming convention for this group of files is the combination of the folder identifier, material name, sample identifier, and other additional information. The folder identifiers are listed in the metadata abstract. The material name indicates the specific mineral, vegetation, organic compound or other material that was measured. The sample identifier is a unique letter/number code for the sample or site. The other information includes letter codes indicating the spectrometer utilized, spectrometer settings, and measurement type (for an explanation of these codes, see Kokaly and others, 2017).

Entity_Type_Definition_Source: U.S. Geological Survey

Attribute:
Attribute_Label: No_Label
Attribute_Definition:
Data value (reflectance or transmission) for each channel in the spectrometer. NOTE: Data for the wavelength sampling positions and the bandpass values (for each channel in the spectrometers) are included in this data release and are provided as separate ASCII files for wavelength and bandpass.

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain:
Data value (reflectance or transmission) for each channel in the spectrometer. NOTE: Data for the wavelength sampling positions and the bandpass values (for each channel in the spectrometers) are included in this data release and are provided as separate ASCII files for wavelength and bandpass.

Detailed_Description:
Entity_Type:
Entity_Type_Label: materialname_sampleid_otherinformation.html
Entity_Type_Definition:

Metadata describing spectra. The naming convention for this group of files is the combination of the material name, sample identifier, and other additional information.The material name indicates the specific mineral, vegetation, organic compound or other material that was measured. The sample identifier is a unique letter/number code for the sample or site. The other information includes letter codes indicating the spectrometer utilized, spectrometer settings, and measurement type (for an explanation of these codes, see Kokaly and others, 2017).

Entity_Type_Definition_Source: U.S. Geological Survey

Attribute:
Attribute_Label: TITLE
Attribute_Definition: Short description of sample material including sample id number
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Descriptive title of material including sample id

Attribute:
Attribute_Label: DOCUMENTATION_FORMAT
Attribute_Definition: Categorical documentation format type
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: MINERAL
Enumerated_Domain_Value_Definition: Mineral documentation
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: ELEMENT
Enumerated_Domain_Value_Definition: Element documentation
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: MIXTURE
Enumerated_Domain_Value_Definition: Mixture documentation
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Man_Made
Enumerated_Domain_Value_Definition: Man-made documentation
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: VOLATILE
Enumerated_Domain_Value_Definition: Volatile documentation
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: PLANT
Enumerated_Domain_Value_Definition: Plant documentation
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute:
Attribute_Label: SAMPLE_ID
Attribute_Definition:
A string of alphanumeric characters that serve as the sample identifier.

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Sample identifier

Attribute:
Attribute_Label: MATERIAL_TYPE, ELEMENT_TYPE, MINERAL_TYPE, PLANT_TYPE
Attribute_Definition:
A description of the general class of material, minerals in the mixture, element, or a general mineral type to which the mineral is associated based on its chemistry. Klein and Hurlbut (1999) was used as a reference for defining the mineral type. Additionally, a description of the general class or classes of vegetation.

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: General type of material, elelement, mixture, or mineral.

Attribute:
Attribute_Label: MIXTURE_TYPE
Attribute_Definition: A description of the minerals in the mixture.
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Areal
Enumerated_Domain_Value_Definition: Areal type of mixture
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Coating
Enumerated_Domain_Value_Definition: Coating type of mixture
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Intimate
Enumerated_Domain_Value_Definition: Intimate type of mixture
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Molecular
Enumerated_Domain_Value_Definition: Molecular type of mixture
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute:
Attribute_Label: MATERIAL, ELEMENT, MINERAL, PLANT
Attribute_Definition: A description of the material.
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain:
General description of material, element, mixture, common name(s) of the vegetation measured, or mineral names according to recognized references. For additional details see Kokaly and others (2017) (http://dx.doi.org/10.5066/YYYY).

Attribute:
Attribute_Label: LATIN_NAME
Attribute_Definition:
The latin name(s) (genus and species) of the vegetation measured.

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Vegetation latin name.

Attribute:
Attribute_Label: FORMULA
Attribute_Definition: Chemical formula
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Chemical formula

Attribute:
Attribute_Label: FORMULA_HTML
Attribute_Definition:
Chemical formula in html-format for proper display of subscripts.

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: HTML-format chemical formula

Attribute:
Attribute_Label: COLLECTION_LOCALITY
Attribute_Definition: Place name of sample collection site. [May be blank]
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Collection site place name; may be blank.

Attribute:
Attribute_Label: COLLECTION_LATITUDE
Attribute_Definition:
Latitude in degrees and decimal minutes (N or S), if applicable and noted. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Collection site latitude; may be blank.

Attribute:
Attribute_Label: COLLECTION_LONGITUDE
Attribute_Definition:
Longitude in degrees and decimal minutes (W or E), if applicable and noted. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Collection site longitude; may be blank.

Attribute:
Attribute_Label: DATUM
Attribute_Definition:
Reference spheroid model, if applicable and noted. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Spheroid model; may be blank.

Attribute:
Attribute_Label: ORIGINAL_DONOR
Attribute_Definition:
Name of person that collected the sample, name of institution that provided the sample for measurement, or name of company from which the sample was purchased. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:

Unrepresentable_Domain: Source of sample; may be blank.

Attribute:
Attribute_Label: CURRENT_SAMPLE_LOCATION
Attribute_Definition: Current location where the sample is stored. [May be blank]
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Current location of sample; may be blank.

Attribute:
Attribute_Label: ULTIMATE_SAMPLE_LOCATION
Attribute_Definition:
Anticipated location where the sample will be archived after measurement. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Final location of sample; may be blank.

Attribute:
Attribute_Label: SAMPLE_DESCRIPTION
Attribute_Definition:
Description of the sample, measurement procedure, spectral features, and other information related to the sample and its measured spectrum and impurities in the sample. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Description of sample amd measurement details; may be blank.

Attribute:
Attribute_Label: IMAGE_OF_SAMPLE
Attribute_Definition:
HTML links to thumbnail and full size image of the sample. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: HTML links to sample image; may be blank.

Attribute:
Attribute_Label: XRD_ANALYSIS
Attribute_Definition:
Results and discussion of XRD analysis, if conducted. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: XRD analysis results; may be blank.

Attribute:
Attribute_Label: COMPOSITIONAL_ANALYSIS_TYPE
Attribute_Definition: Categorical list of compositional analysis type, if conducted.
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: None
Enumerated_Domain_Value_Definition: No compositional analysis
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: XRF
Enumerated_Domain_Value_Definition: X-ray fluorescence
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: EPMA
Enumerated_Domain_Value_Definition: Electron Probe MicroAnalysis
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: ICP (Trace)
Enumerated_Domain_Value_Definition: Inductively coupled plasma mass spectrometry (trace elements)
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: WChem
Enumerated_Domain_Value_Definition: Wet chemistry
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Other
Enumerated_Domain_Value_Definition: Other compositional analysis method
Enumerated_Domain_Value_Definition_Source: U.S. Geological Survey

Attribute:
Attribute_Label: COMPOSITION_DISCUSSION
Attribute_Definition:
Additional details about the results of compositional analyses. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Additional compositional analysis details; may be blank.

Attribute:
Attribute_Label: MICROSCOPIC_EXAMINATION
Attribute_Definition:
Observations about the sample under the microscope. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Microscopic observations; may be blank.

Attribute:
Attribute_Label: TRACE_ELEMENT_ANALYSIS
Attribute_Definition: Results of trace element analysis. [May be blank]
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Trace element analysis results; may be blank.

Attribute:
Attribute_Label: TRACE_ELEMENT_DISCUSSION
Attribute_Definition: Discussion of trace element analysis. [May be blank]
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Additional trace element analysis details; may be blank.

Attribute:
Attribute_Label: SPECTROSCOPIC_DISCUSSION
Attribute_Definition:

Observations about the spectral features in the measured sample including those features attributable to the material or impurities in the sample. [May be blank]

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Spectroscopic observations; may be blank.

Attribute:
Attribute_Label: SPECTRAL_PURITY
Attribute_Definition:
A categorical value rating the purity of the spectrum. A purity rating is given for as many as four spectral ranges, dependent on which were measured. For additional details see Kokaly and others (2017).

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain: Spectral purity rating; may be blank.

Detailed_Description:
Entity_Type:
Entity_Type_Label: folderid_materialname_sampleid_otherinformation.gif
Entity_Type_Definition:
GIF images showing plots of spectral data versus wavelength. For spectra measured on the Nicolet spectrometer, an additional GIF image with wavenumber on the x-axis is provided. The naming convention for this group of files is the combination of the folder identifier, material name, sample identifier, and other additional information. The folder identifiers are listed in the metadata abstract. The material name indicates the specific mineral, vegetation, organic compound or other material that was measured. The sample identifier is a unique letter/number code for the sample or site. The other information includes letter codes indicating the spectrometer utilized, spectrometer settings, and measurement type (for an explanation of these codes, see Kokaly and others, 2017). NOTE: Separate plots of the wavelength sampling positions for each channel and bandpass valued versus wavelength are included in this data release as separate GIF files (for each spectrometer).

Entity_Type_Definition_Source: U.S. Geological Survey

Attribute:
Attribute_Label: digital image
Attribute_Definition: Graphical interface format (GIF).
Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain:
Graphical interface format (GIF). NOTE: Separate plots of the wavelength sampling positions for each channel and bandpass valued versus wavelength are included in this data release as separate GIF files (for each spectrometer).

Detailed_Description:
Entity_Type:
Entity_Type_Label: SPECPR files
Entity_Type_Definition:
Binary digital files (for example, splib07a, splib07b, s07_ASD, s07_AV96, s07ASTER, and others) containing spectra and associated metadata in SPECPR format (Clark, 1993)

Entity_Type_Definition_Source: U.S. Geological Survey

Attribute:
Attribute_Label:
Binary digital file containing spectra and associated metadata in SPECPR format

Attribute_Definition:

NOTE: Data for the sampling positions and the bandpass values (for each channel in the spectrometers) are included in this data release (stored in the SPECPR files as separate data records). In addition to providing the original measurements, the spectra have been convolved and resampled to different spectrometer and multispectral sensor characteristics. The following list specifies the filenames for the measured and convolved libraries and gives brief descriptions of the sensors.

splib07a – this is the name of the SPECPR file containing the spectra measured on the Beckman, ASD, Nicolet and AVIRIS spectrometers. The data are provided with their original sampling positions (wavelengths) and bandpass values.

splib07b – this is the name of the SPECPR file containing a modified version of the original measurements. The results from using spectral convolution to convert measurements to other spectrometer characteristics can be improved by oversampling (increasing sample density). Thus, splib07b is an oversampled version of the library, computed using simple cubic-spline interpolation to produce spectra with fine sampling interval (therefore a higher number of channels) for Beckman and AVIRIS measurements. The spectra in this version of the library are the data used to create the convolved and resampled versions of the library.

s07_ASD – this is the name of the SPECPR file containing the spectral library measurements convolved to standard resolution ASD full range spectrometer characteristics. The standard reported wavelengths of the ASD spectrometers used by the USGS were used (2151 channels with wavelength positions starting at 350 nm and increasing in 1 nm increments). The bandpass values of each channel were determined by comparing measurements of reference materials made on ASD spectrometers in comparison to measurements made of the same materials on higher resolution spectrometers (the procedure is described in Kokaly, 2011, and discussed in Kokaly and Skidmore, 2015, and Kokaly and others, 2017).

s07_AV95 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 1995 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV96 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 1996 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV97 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 1997 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV98 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 1998 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV99 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 1999 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV00 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2000

(wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV01 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2001 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV05 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2005 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV06 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2006 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV09 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2009 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV10 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2010 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV11 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2011 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV12 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2012 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV13 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2013 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_AV14 – this is the name of the SPECPR file containing the spectral library measurements convolved to AVIRIS-Classic with spectral characteristics determined in the year 2014 (wavelength and bandpass values for the 224 channels provided with AVIRIS data by NASA/JPL).

s07_HY07 – this is the name of the SPECPR file containing the spectral library measurements convolved to Hyperspectral Mapper (HyMap) with spectral characteristics determined in the year 2007 (wavelength and bandpass values for the 124 channels provided with HyMap data by HyVista Corp). The wavelength and bandpass values were validated by comparing measurements of reference materials made using the HyMap 2007 imaging spectrometer to measurements of the same materials made on higher resolution laboratory spectrometers (the procedure is described in Kokaly (2011) and discussed in Kokaly and others (2013).

s07_HY14 – this is the name of the SPECPR file containing the spectral library measurements convolved to Hyperspectral Mapper (HyMap) with spectral characteristics determined in the year 2014 (wavelength and bandpass values for the 126 channels provided with HyMap data by HyVista Corp). The wavelength and bandpass values were validated by comparing measurements of reference materials made using the HyMap 2014 imaging spectrometer to measurements of the same materials made on higher resolution laboratory spectrometers (the procedure is described in Kokaly (2011) and discussed in Kokaly and others (2013).

s07HYPRN - this is the name of the SPECPR file containing the spectral library measurements convolved to the Hyperion imaging spectrometer. The oversampled spectra in splib07b were convolved to Hyperion's average spectral characteristics (accessed January 10, 2017, at https://eo1.usgs.gov/sensors/hyperioncoverage).

s07_VIMS – this is the name of the SPECPR file containing the spectral library measurements convolved to the Cassini spacecraft's Visual and Infrared Mapping Spectrometer (VIMS) with spectral characteristics determined by Clark and others (2016), wavelength and bandpass values for the 352 channels.

s07CRSMg – convolved to the global mapping mode of the Mars Reconnaissance Orbiter spacecraft's Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) with spectral characteristics determined by Murchie and others (2009), wavelength and bandpass values for the 72 channels.

s07CRSMj – convolved to the targeted mode (joined visible and infrared sensors) of the Mars Reconnaissance Orbiter spacecraft's Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) with spectral characteristics determined by Murchie and others (2009), wavelength and bandpass values for the 489 channels.

s07_M3t – convolved to the target mode of the Moon Mineralogy Mapper spectrometer with spectral characteristics determined by Green and others (2011), wavelength and bandpass values for the 256 channels.

s07ASTER – the library in SPECPR format, resampled to response functions of Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER). The spectral response functions for this sensor's nine bands covering the visible through shortwave infrared wavelengths came from NASA (ASTER instrument characteristics accessed January 3, 2017, at https://asterweb.jpl.nasa.gov/content/01_mission/03_instrument/archive/vnir.txt and https://asterweb.jpl.nasa.gov/content/01_mission/03_instrument/archive/swir.txt).

s07LSAT8 – the library in SPECPR format, resampled to response functions of Landsat-8 Operational Land Imager (OLI). The spectral response functions for this sensor's seven bands covering the visible through shortwave infrared wavelengths came from spectral libraries included as part of the ENVI 5.3 software release. The ENVI data were compared to values of the pre-launch sensor response functions (Barsi and others, 2014; spreadsheet with values was accessed December 27, 2016, at http://landsat.gsfc.nasa.gov/?p=5779) and found to be identical.

s07SNTL2 – the library in SPECPR format, resampled to response functions of Sentinel-2 Multispectral Instrument (MSI). The spectral response functions for this sensor's 13 bands covering the visible through shortwave infrared wavelengths came from the European Space Agency (ESA, 2015).

s07_WV3 – the library in SPECPR format, resampled to response functions of WorldView3 (WV3). The spectral response functions for this sensor's 16 bands covering the visible through shortwave infrared wavelengths came from DigitalGlobe (2016).

Alternative SPECPR files containing only the spectra (and not the metadata) with consistent data record numbering from spectrometer to spectrometer are included in the folder "alternativeSPECPR". The SPECPR files mentioned previously contain the resampled spectra along with their associated metadata descriptions. The filenames of these alternative SPECPR files are similar to those listed previously, except all characters are in lowercase.

Attribute_Definition_Source: U.S. Geological Survey
Attribute_Domain_Values:
Unrepresentable_Domain:
Full set of spectra and metadata for samples in the library. NOTE: Data for the sampling positions and the bandpass values (for each channel in the spectrometers) are included in this data release. These data are in the SPECPR files, as separate data records.

Distribution_Information:
Distributor:
Contact_Information:
Contact_Person_Primary:
Contact_Person: U.S. Geological Survey – ScienceBase
Contact_Organization: U.S. Geological Survey – ScienceBase

Contact_Address:
Address_Type: mailing and physical
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City: Denver
State_or_Province: CO
Postal_Code: 80225
Country: USA

Contact_Voice_Telephone: 1-888-275-8747
Contact_Electronic_Mail_Address: sciencebase@usgs.gov

Distribution_Liability:
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Metadata_Reference_Information:
Metadata_Date: 20170131
Metadata_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Raymond F. Kokaly
Contact_Organization: U.S. Geological Survey

Contact_Position: Research Geophysicist
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State_or_Province: CO
Postal_Code: 80225
Country: USA

Contact_Voice_Telephone: 720-352-7414
Contact_Electronic_Mail_Address: raymond@usgs.gov

Metadata_Standard_Name: Content Standard for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998

Generated by mp version 2.9.40 on Sat Mar 18 21:12:30 2017