yrophyllite (alunite or kaolinite

may be present) (0)

Tremolite or talc (4,077)

Green vegetation (1,763,166)

Cloud or cloud shadow (1,145,474)

Dry vegetation (99,076)

3725 Peak; elevation in meters

☐ City, town, or village

EXPLANATION OF MATERIAL CLASSES [Materials are listed based on quality of match with reference spectra; class may contain one or more minerals

or material types with the most likely option listed first. Number in parentheses indicates pixel count. Material

OTHER SYMBOLS [Not all symbols shown may be present on this map]

DATA SUMMARY This map shows the spatial distribution of selected carbonates, phyllosilicates, sulfates, altered minerals, and other materials derived from analysis of airborne HyMap™ imaging spectrometer (hyperspectral) data of Afghanistan collected in late 2007 (Kokaly and others, 2008). This map is one in a series of U.S. Geological Survey/Afghanistan Geological Survey quadrangle maps covering Afghanistan and is a subset of the version 2 map of the entire country showing carbonates, phyllosilicates, sulfates, altered minerals, and other materials (Kokaly and others, 2013). This version 2 map improved mineral mapping from the previously published version (Kokaly and others, 2011) by refining the classification procedures, especially in areas having wet soils. The version 2 map more accurately represents the mineral distributions and contains modifications to the material class

Flown at an altitude of 50,000 feet (15,240 meters (m)), the HyMapTM imaging spectrometer measured reflected sunlight in 128 channels, covering wavelengths between 0.4 and 2.5 µm. The data were georeferenced,

atmospherically corrected and converted to apparent surface reflectance, empirically adjusted using ground-based reflectance measurements, and combined into a mosaic with 23-m pixel spacing. Variations in water vapor and

dust content of the atmosphere, in solar angle, and in surface elevation complicated correction; therefore, some

The reflectance spectrum of each pixel of HyMap™ imaging spectrometer data was compared to the reference

materials in a spectral library of minerals, vegetation, water, and other materials (Clark and others, 2007). Minerals occurring abundantly at the surface and those having unique spectral features were easily detected and discrimi-

nated. Minerals having slightly different compositions but similar spectral features were less easily discriminated; thus, some map classes consist of several minerals having similar spectra, such as "Epidote or chlorite." A designation of "Not classified" was assigned to the pixel when there was no match with reference spectra. Further

REFERENCES CITED Clark, R.N., Swayze, G.A., Wise, R.A., Livo, K.E., Hoefen, T.M., Kokaly, R.F., and Sutley, S.J., 2007, USGS

Kokaly, R.F., King, T.V.V., and Hoefen, T.M., 2013, Surface mineral maps of Afghanistan derived from

Kokaly, R.F., King, T.V.V., Hoefen, T.M., Dudek, K.B., and Livo, K.E., 2011, Surface materials map of Afghanistan; carbonates, phyllosilicates, sulfates, altered minerals, and other materials: U.S. Geological

Kokaly, R.F., King, T.V.V., and Livo, K.E., 2008, Airborne hyperspectral survey of Afghanistan 2007; flight

line planning and HyMap™ data collection: U.S. Geological Survey Open-File Report 2008–1235, 14 p.

Figure 1.—Provinces and selected cities, towns, and villages in the map

area. Topography is shown as shaded relief.

information regarding the processing procedures is presented in Kokaly and others (2011, 2013).

HyMap™ imaging spectrometer data, version 2: U.S. Geological Survey Data Series 787.

names, as well as an additional mineral classification (Carbonate and clay/muscovite).

classification differences may be present between adjacent flight lines.

digital spectral library splib06a: U.S. Geological Survey Data Series 231.

Survey Scientific Investigations Map 3152–A, one sheet, scale 1:1,100,000.

classes that have small areal extent may not be visible at the publication scale of this map]

lcite, abundant (1,976)

Calcite and muscovite/clay (352,954)

Calcite and clay/muscovite (64,396)

Carbonate, iron-bearing (611)

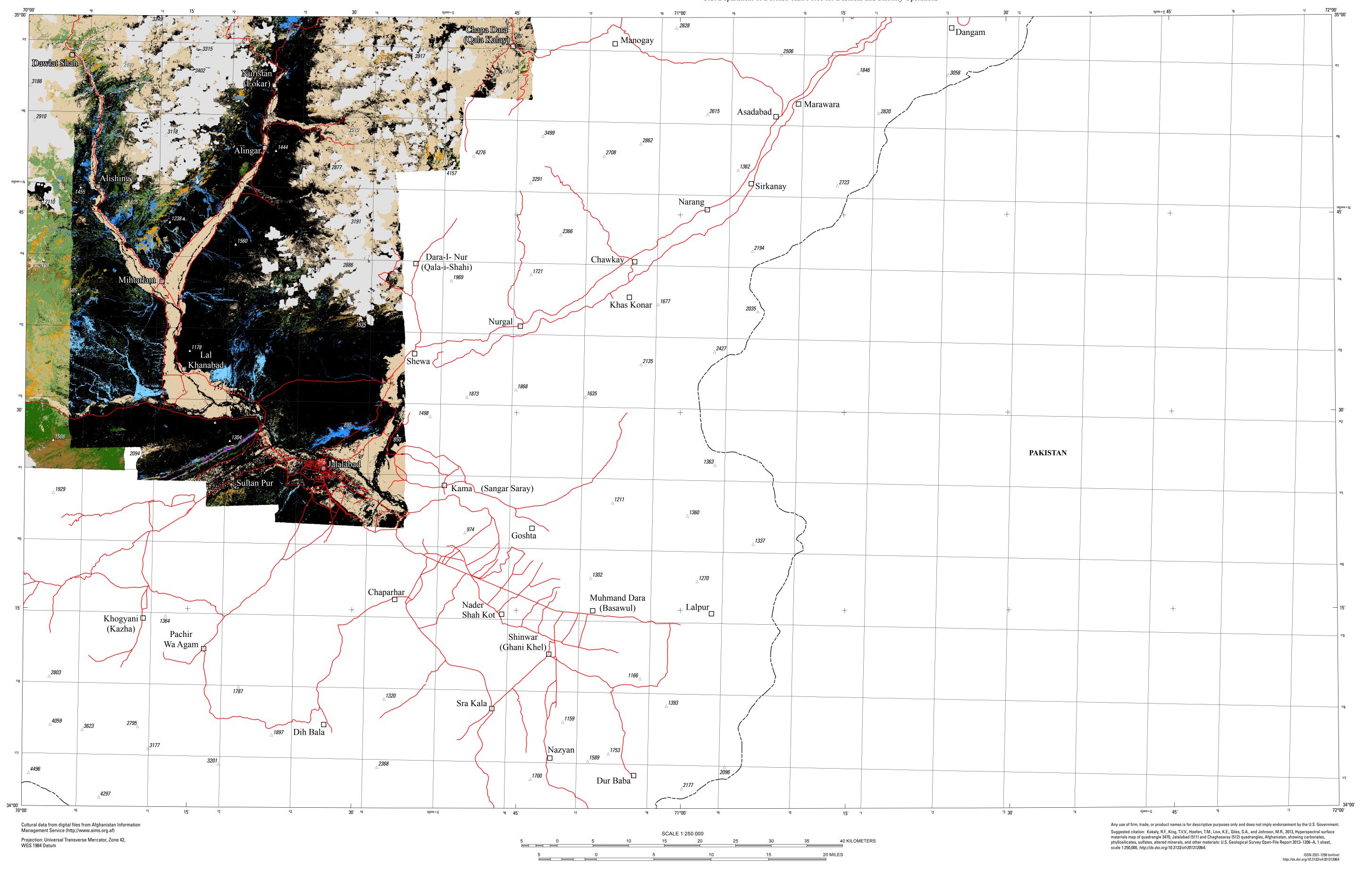
pidote or chlorite (3,066)

Kaolinite (alunite, pyrophyllite, oi

dickite may be present) (147)

Carbonate and clay/muscovite (9,931)

omite and clay/muscovite (1,016)



HYPERSPECTRAL SURFACE MATERIALS MAP OF QUADRANGLE 3470, JALALABAD (511) AND CHAGHASARAY (512) QUADRANGLES, AFGHANISTAN, SHOWING CARBONATES, PHYLLOSILICATES, SULFATES, ALTERED MINERALS, AND OTHER MATERIALS







Afghanistan 1:250,000-scale topographic series quadrangles shown in blue USGS/AGS 1:250,000-scale quadrangle

HyMap™ imaging spectrometer data-coverage