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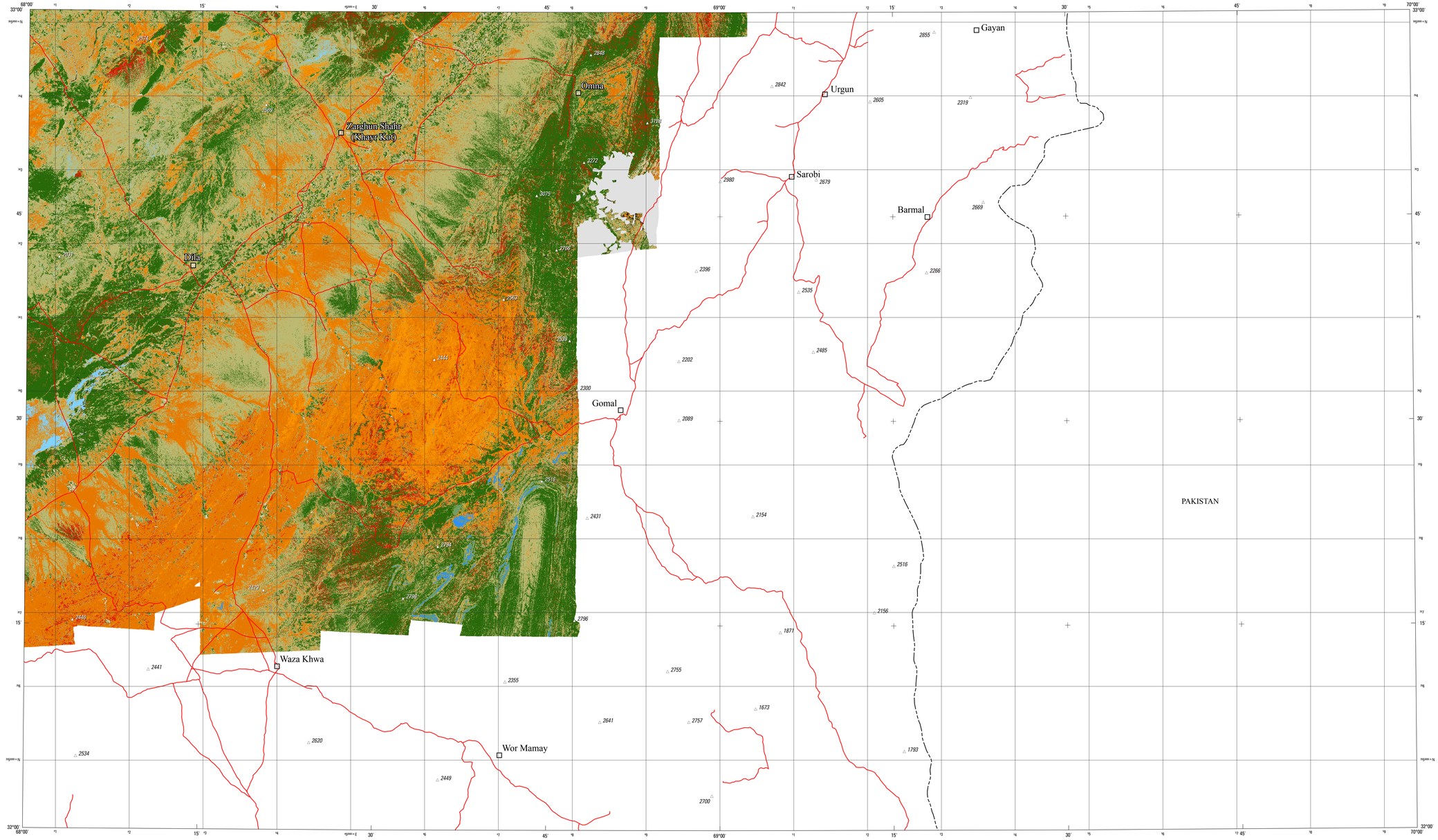

Cultural data from digital files from Afghanistan Information Management Service (http://www.aims.org.af)

Projection: Universal Transverse Mercator, Zone 42, WGS 1984 Datum

SCALE 1:250 000

5 0 5 10 15 20 25 30 35 40 KILOMETERS

5 0 5 10 15 20 MILES

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HYPERSPECTRAL SURFACE MATERIALS MAP OF QUADRANGLE 3268, KHAYR KOT (521) AND URGUN (522) QUADRANGLES, AFGHANISTAN, SHOWING CARBONATES, PHYLLOSILICATES, SULFATES, ALTERED MINERALS, AND OTHER MATERIALS

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

- Calcite, abundant (1)
- Calcite (3,314,290)
- Calcite and muscovite/clay (34,588)
- Calcite and clay/muscovite (4,696,616)
- Carbonate and clay/muscovite (3,887)
- Carbonate, iron-bearing (1,279)
- Dolomite (124)
- Dolomite and clay/muscovite (91)
- Epidote or chlorite (531,259)
- Muscovite (651,741)
- Illite (3,000,121)
- Kaolinite (alunite, pyrophyllite, or dickite may be present) (21)
- Kaolinite (109)
- Kaolinite and muscovite/clay/carbonate (31,217)
- Montmorillonite (63,548)
- Alunite (0)
- Alunite and kaolinite (0)
- Pyrophyllite (alunite or kaolinite may be present) (0)
- Jarosite (3)
- Buddingtonite (2)
- Serpentine (211)
- Serpentine, or dolomite and calcite (67)
- Tremolite or talc (0)
- Hydrated silica (19)
- Gypsum (0)
- Green vegetation (127,752)
- Dry vegetation (27,774)
- Snow and ice (0)
- Cloud or cloud shadow (167,157)
- Water (234)
- Wet soils (48)

OTHER SYMBOLS

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

- Not classified (12,218)
- No data
- Road, improved or unimproved
- 3725 Peak; elevation in meters
- City, town, or village
- International boundary

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

Flown at an altitude of 50,000 feet (15,240 meters (m)), the HyMap™ 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 classification differences may be present between adjacent flight lines.

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

REFERENCES CITED

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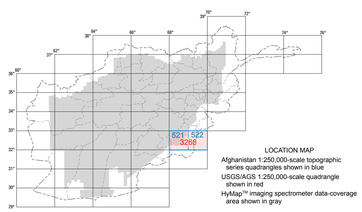
Figure 1.—Provinces and selected cities, towns, and villages in the map area. Topography is shown as shaded relief.



LOCATION MAP
Afghanistan 1:250,000-scale topographic series quadrangles shown in blue
USGS/AGS 1:250,000-scale quadrangle shown in red
HyMap™ imaging spectrometer data-coverage area shown in gray