MAPPING OF OPHIOLITIC MELANGES OF THE WADI GHADIR AREA, NUBIAN SHIELD OF EGYPT USING A LINEAR MIXING MODEL APPLIED TO LANDSAT THEMATIC MAPPER DATA; [1]B. Rivard, [1]R.E. Arvidson, [1]M. Sultan, and [2]B. El Kaliouby. [1]McDonnell Center for the Space Sciences, Department of Earth and Planetary Sciences, Washington University, St.Louis, MO, 63130.
[2]Ain Shams University, Cairo, Egypt.

Data to be acquired by the Visible and Infrared Mapping Spectrometer on Mars Observer, CRAF, and Lunar Geoscience Orbiter, and by the Near Infrared Mapping Spectrometer on Galileo will enable detailed mapping of values related to mineralogy and physical properties. Further, the data may allow estimates to be made of spectral endmember components at the subpixel level. In this study we pursue use of Landsat thematic mapper data to generate a melange map in the hyperarid Eastern Desert of Egypt using a linear sub-pixel mixing procedure. The objectives were to: (A) evaluate the validity of the linear sub-pixel mixing model in a setting where ground truth data can be acquired; (B) to generate spectral component maps for a geologic setting where regional mapping is precluded because of fine-scale lithologic heterogeneity; and (C) to apply results to a regional-scale tectonic problem. A linear mixing approach was selected because field observations of the melange suggest that the rock components are mainly juxtaposed and rarely overlap.

The Wadi Ghadir area (Lat. 24°43'-24°49', Long. 34°45'-35°00') of the central Eastern Desert (CED) of Egypt contains the first recognized ophiolitic melange in the Nubian shield. The melange is composed of fragments derived mainly from ophiolitic sheets, greywacke, siltstone, and mudstone units and granitic rocks [1]. The melanges are commonly interpreted to be allochtonous with respect to underlying paragneisses and/or orthogneisses and to have been generated by gravity sliding and/or thrusting and emplaced by SE-NW directed thrusting [2]. The melanges would have been transported over distances of 300-500 kilometers [3]. However, recent analyses of Landsat thematic mapper data combined with field observations in Saudi Arabia and Egypt suggest that the Egyptian melange may have been generated by shear associated with the Najd transcurrent fault system [4, 5].

An improved understanding of the spatial distribution of the melange components in relation to Najd-related structures would help decide between the two models postulated above. Landsat thematic mapper band 1 through 7 data were thus used, along with a subpixel linear mixing model [6], to generate the necessary detailed maps. The six radiance factor values (bands 1, 2, 3, 4, 5, 7) for each pixel (30m across) were estimated by a least squares fit to the following four endmember melange components: serpentines, granitoids, talc-carbonate rich (?) unit, and rocks rich in Fe-bearing aluminosilicates (e.g., gabbros and pillow basalts). Endmember spectra were obtained from digital data for localities with known homogeneous outcrops.

Three conclusions have resulted from this preliminary study: (A) the serpentinite, granitoid and mafic component map predicted from the least squares fits correlate well with known outcrops reported for the Wadi Ghadir and surrounding areas. In addition, numerous subpixel exposures of these endmembers too small to have been mapped in the field are predicted from the mixing analysis. These areas will be checked in the field; (B) structural interpretations of the component maps in the Wadi Ghadir area show a series of WNW to NW trending brittle and ductile faults with a sinistral sense of motion. These are known characteristics of the Najd system observed in Saudi Arabia [7]. In addition, there appears to be systematic variations in the size and shape of competent outcrops within the melange with increasing distance from the inferred faults. Thus, if the fault deformation is Najd related, as seems to be suggested from the trends and sense of displacement of the

faults, then a model for the genesis of the ophiolitic melange involving a component of Najd deformation would be favored for the Wadi Ghadir area; (C) The serpentinite map shows high values in regions that have been mapped as schists-mudstones-greywackes. These observations imply that ophiolitic melanges may be more extensive than mapped if widely reported schist-mudstone-greywacke units elsewhere are similar to those of the Wadi Ghadir area [3].

REFERENCES

[1] El-Bayoumi, R.M. (1984) Pan African crustal evolution in the Arabian-Nubian shield, King Abdulaziz University, Faculty of Earth Sciences, Bulletin, 6, 113-126.
[2] Shackleton, R.M., et al. (1980) Nature, 285, 472-474.
[3] Ries, A.C., (1983) J. Geol. Soc. London, 140, 75-95.
[4] Sultan, M., and R.E. Arvidson, (1987) Geological Society of America abstracts with Program; 19, 859.
[5] Sultan, M., et al. (1988) In prep. To be submitted to Tectonics.
[6] Johnson, P.E., et al. (1983) J. Geophys. Res.,88, 3557-3561.
[7] Davis, F.B. (1984) J. Geol., 82, 37-53.